

# Intercomparison of integrating nephelometers Project No.: IN-2020-1-1

Basic informations:Location of the quality assurance:TROPOS, Lab 121Date:27 January - 31 January 2020

Principal Investi-	Home Institution	Participant	Instrument
gator			
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# 1 Intercomparison summary

## Status on arrival

No issues due to transportation or other damages.

## Zerocheck

The noise level of the instrument is in the normal range. The average noise  $(1\sigma)$  for the all wavelengths was less equal  $0.42 \,\mathrm{Mm^{-1}}$  for full scattering and  $0.31 \,\mathrm{Mm^{-1}}$  for backscattering. The background level was inacceptable with deviations of less equal  $0.57 \,\mathrm{Mm^{-1}}$  for full scattering and  $0.2 \,\mathrm{Mm^{-1}}$  for backscattering.

## Spancheck

The span check was inacceptable with deviations of less equal 13.5%.

#### Inspection

The device was heavily contaminated with a large number of insects. The device was cleaned and recalibrated.

#### Comparison to reference nephelometer

#### Before inspection and recalibration

The deviations of intercomparisson to reference device were inacceptable with deviations in the range of -5.9% to 15.2%.

#### After inspection and recalibration

The results from intercomparison to reference device were barely acceptable with deviations in the range of -6.5% to 8.3%.

#### Recommendations

No recommendations.

#### **Overall assessment**

The instrument meets the requirements.

## 2 Details

#### **Configuration parameters**

```
Analog Output-Rel. Humidity, 0, 100
Analog Output-Bar. Pressure, 0, 1200
Analog Output-Sample Temp., 0, 400
Analog Output-Sample Temp., 0, 400
Analog Output Channel 0, 9
Analog Output Channel 1, 1
Analog Output Channel 2, 2
Analog Output Channel 4, 4
Analog Output Channel 5, 5
Analog Output Channel 5, 5
Analog Output Channel 6, 6
Analog Output Channel 8, 8
Calibr. Pts-Rel. Humidity, 272, 113, 612, 754
Calibr. Pts-Rel. Humidity, 272, 113, 612, 754
Calibr. Pts-Rel. Humidity, 272, 113, 612, 754
Calibr. Pts-Sample Temp, 0, 0, 38866, 2978
Data Delimiter, 0
K Calibr. Const-Blue, 20000,1,319E-3,2,789E-5,5,230E-1
K Calibr. Const-Red, 20000,1,19E-4,4,605E-6,5,960E-1
Calibr. Label, Cimone July 17, 2018 AngelaDavide S/N 3563133901
BackScat Shutter Mode, 1
AutoZero Baseline Meas., 0
Lamp Power, 52
Averaging Time, 300
Blank Valve Time, 61
AutoZero Measurement, 300
PMT Voltage-Blue, 1000
PMT Voltage-Green, 1090
PMT Voltage-Red, 950
Aux. BNC Output, 0
Zero Baseline -Green, 1,562E-5,1,095E-5,9,269E-6
Zero Baseline-Green, 1,562E-5,1,095E-5,9,269E-6
Zero Baseline-Red,1,434E-5,4,070E-6,1,064E-5
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#### Zerocheck

Wavelength	total scattering		backscattering	
[nm]	mean	std.dev.	mean	$\operatorname{std.dev.}$
	$[\mathrm{Mm}^{-1}]$	$[\mathrm{Mm}^{-1}]$	$[\mathrm{Mm}^{-1}]$	$[\mathrm{Mm}^{-1}]$
450	0.57	0.42	0.17	0.31
530	0.26	0.23	0.2	0.18
700	0.03	0.24	0.12	0.2

Table 1: Noise parameters of nephelometer (SN 133901) measured with filtered air.

# Spancheck

Wavelength	total scattering	backscattering
[nm]	deviation	deviation
	[%]	[%]
450	10.4	13.5
530	7.1	11.3
700	1.4	6.8

Table 2: Percentage deviation of measured values from nephelometer (SN 133901) to theoretical values for CO2  $\,$ 

#### Comparison to reference nephelometer before inspection and recalibration

Table 3: Comparison of nephelometer (SN 133901) to reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength	total scattering		backscattering	
[nm]	slope	R2	slope	R2
450	0.966	1	1.125	0.998
525	0.975	1	1.137	0.998
635	0.941	0.999	1.152	0.998



Figure 1: Correlation of scattering coefficients from nephelometer (SN 133901) and reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

#### Comparison to reference nephelometer after inspection and recalibration

Table 4: Comparison of nephelometer (SN 133901) to reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength	total scattering		backscattering	
[nm]	slope	R2	slope	R2
450	0.954	0.999	0.985	0.983
525	0.968	0.999	1.072	0.988
635	0.935	0.998	1.083	0.974



Figure 2: Correlation of scattering coefficients from nephelometer (SN 133901) and reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.