Intercomparison of integrating nephelometers
Project: AP-2023-1-1

Location of the quality assurance: TROPOS, Lab 121
Date: 2023-01-16 – 2023-01-21

Principal Investigator	Institution	Participant	Type	SN
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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 (1σ) was less eqal 0.5 Mm^{-1} for 1 minute averaging time. The background level was acceptable with deviations of less equal 0.34 Mm^{-1}.

Spancheck

The span check was acceptable with deviations of less equal 4 %.

Inspection

The measuring chamber and shutter were contaminated and have been cleaned. The blower had a leak and was replaced. The device was not recalibrated.

Comparison to reference nephelometer

Before inspection and recalibration

The results from intercomparisson to reference device were inacceptable with deviations in the range of -18 % to -10.9 %.

After inspection and recalibration

The results from intercomparisson to reference device were inacceptable with deviations in the range of -16.3 % to -9.8 %.

Recommendations

Although the instrument has no more leaks and the span check was passed, the instrument shows a systematically too low value for aerosol (ammonium sulfate). Serial cross comparison with the reference instrument indicates probable systematic particle loss in the instrument. The reason for this could not be found.

Overall assessment

The instrument does not meet the requirement.

Details

Configuration parameters

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not available
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Zerocheck

Table 2: Noise parameters of nephelometer measured with filtered air.

	total scattering		backscattering	
Wavelength (nm)	Mean (1/Mm)	Std.dev. (1/Mm)	Mean (1/Mm)	Std.dev. (1/Mm)
450	0.34	0.50	0.17	0.39
550	0.22	0.23	0.11	0.17
700	0.09	0.24	0.09	0.23

Spancheck

Table 3: Percentage deviation of measured values from nephelometer to theoretical values for CO2.

	total scattering	backscattering
Wavelength (nm)	Dev. (%)	Dev. (%)
450	0.5	4.0
550	-3.3	-0.2
700	-3.5	1.1

Comparison to reference nephelometer before inspection and recalibration

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

Wavelength (nm)	total scattering		backscattering	
	Slope	R^2	Slope	R^2
450	0.857	0.994	0.891	0.974
525	0.842	0.996	0.878	0.985
635	0.820	0.992	0.855	0.953

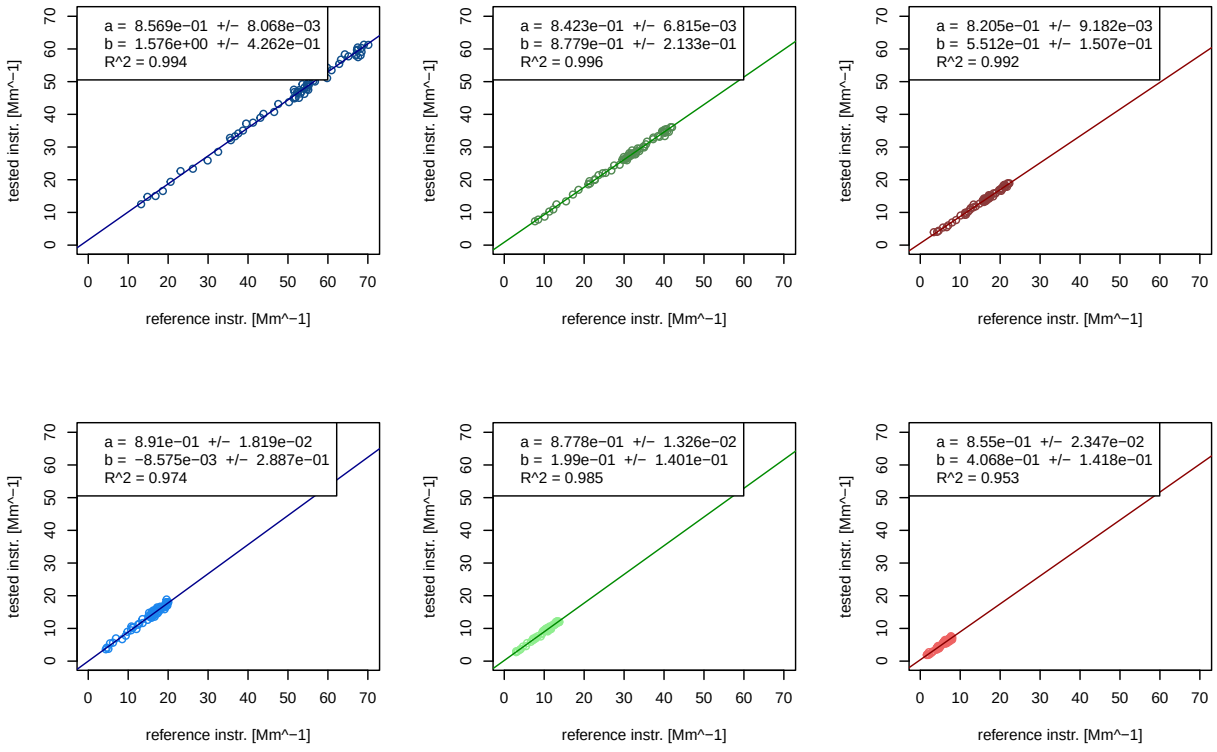

Figure 1: Correlation of scattering coefficients from nephelometer (SN 70919196) and reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

Comparison to reference nephelometer after inspection and recalibration

Table 5: Comparison of nephelometer to reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength (nm)	total scattering		backscattering	
	Slope	R^2	Slope	R^2
450	0.865	0.998	0.885	0.990
525	0.856	0.999	0.885	0.996
635	0.837	0.997	0.902	0.989

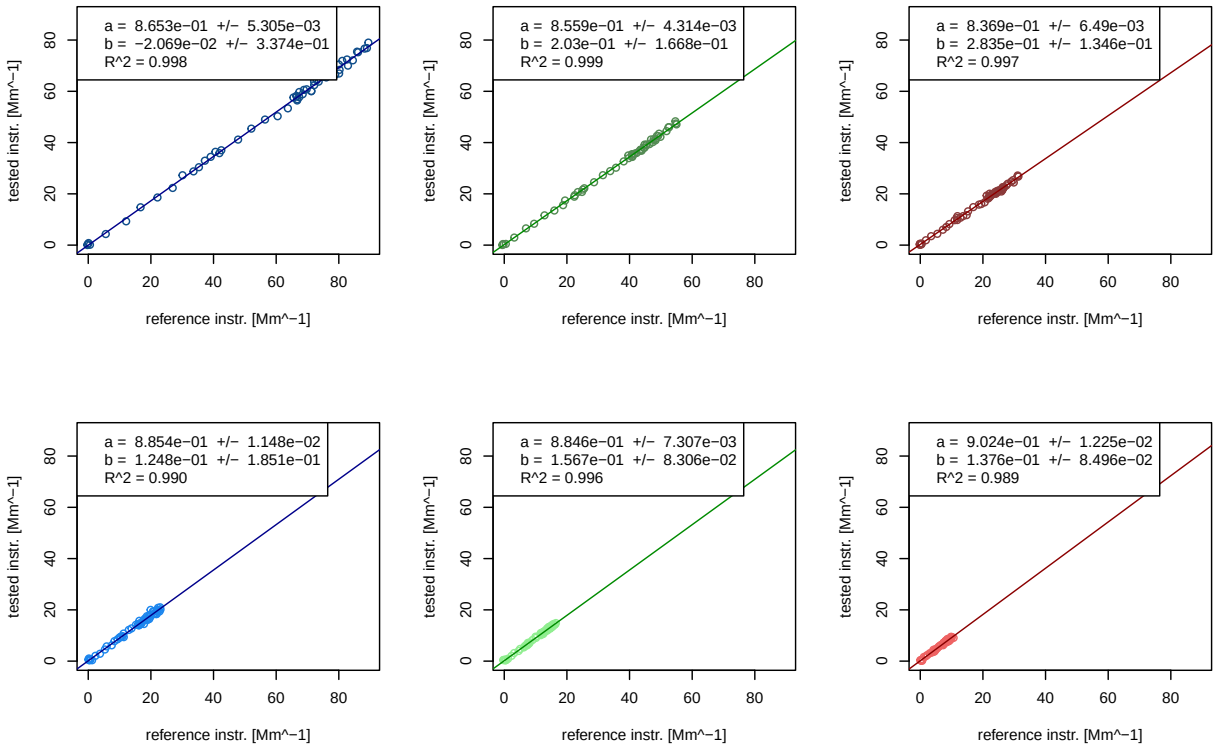

Figure 2: Correlation of scattering coefficients from nephelometer (SN 70919196) and reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.