



Intercomparison of integrating nephelometers Project No.: IN-2019-1-3

Basic informations:

Location of the quality assurance: TROPOS, Lab 121
Date: 3 June - 7 June 2019

Principal Investigator	Home Institution	Participant	Instrument
H. Servomaa	FMI	H. Servomaa	12-0717

1 Intercomparison summary

Status on arrival

No issues due to transportation or other damages.

Zerocheck

The noise level of the instrument is out of the normal range. The average noise (1σ) for the all wavelengths was less equal 0.89 Mm^{-1} for one minute averaging time. The background level was unacceptable with deviations of less equal 13.28 Mm^{-1} for all wavelengths.

Spancheck

The span check was unacceptable with deviations of less equal 204.5 %.

Inspection

The measuring cell and the shutter had white deposits and scratches which could not be removed. A full calibration was performed.

Comparison to reference nephelometer

Before inspection and recalibration

The deviations of intercomparisson to reference device were unacceptable with deviations in the range of -16.0% to 1.0% .

After inspection and recalibration

The results from intercomparisson to reference device were acceptable with deviations in the range of -2.9% to 6.4% .

Recommendations

No recommendations.

Overall assessment

The instrument meets the requirements.

2 Details

Configuration parameters

Zerocheck

Table 1: Noise parameters of nephelometer (SN 12-0717) measured with filtered air.

Wavelength [nm]	total scattering		backscattering	
	mean	std.dev.	mean	std.dev.
	[Mm ⁻¹]	[Mm ⁻¹]	[Mm ⁻¹]	[Mm ⁻¹]
450	-7.52	0.87	1.59	0.78
525	-13.28	0.89	0.03	0.71
635	-11.77	0.82	1.32	0.73

Spancheck

Table 2: Percentage deviation of measured values from nephelometer (SN 12-0717) to theoretical values for CO₂

Wavelength [nm]	total scattering	backscattering
	deviation [%]	deviation [%]
450	-116.5	-92.8
525	-154.9	-100.3
635	-204.5	-77.6

Comparison to reference nephelometer before inspection and recalibration

Table 3: Comparison of nephelometer (SN 12-0717) to reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength [nm]	total scattering slope	total scattering R2	backscattering slope	backscattering R2
450	0.84	0.999	0.86	0.994
525	0.867	0.998	1.01	0.985
635	0.935	0.998	0.913	0.984

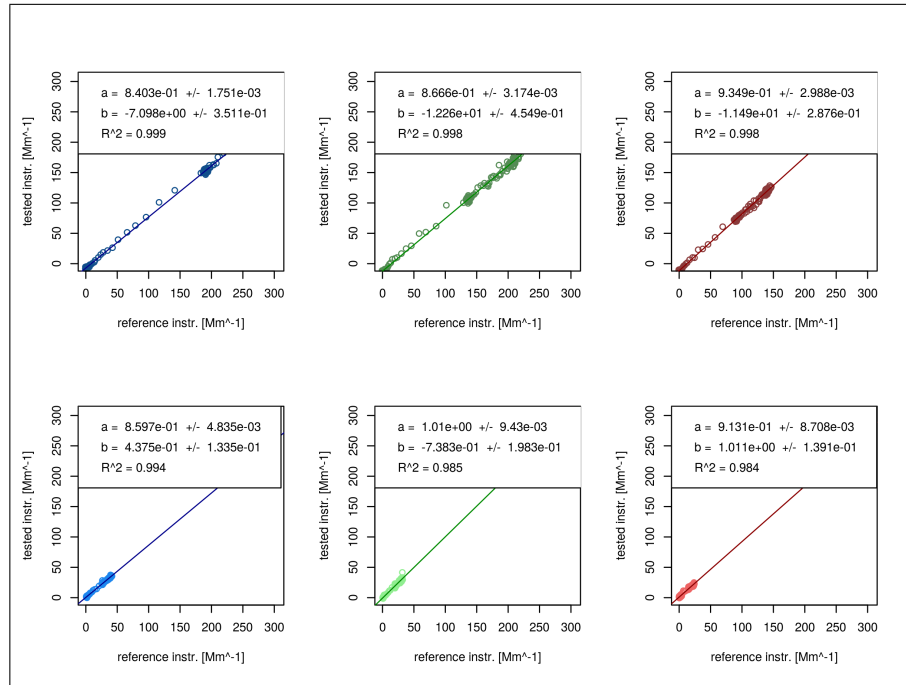


Figure 1: Correlation of scattering coefficients from nephelometer (SN 12-0717) and reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

Comparison to reference nephelometer after inspection and recalibration

Table 4: Comparison of nephelometer (SN 12-0717) to reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength [nm]	total scattering slope	total scattering R2	backscattering slope	backscattering R2
450	0.978	0.999	0.987	0.993
525	1.031	0.999	0.971	0.99
635	1.064	0.998	1.063	0.983

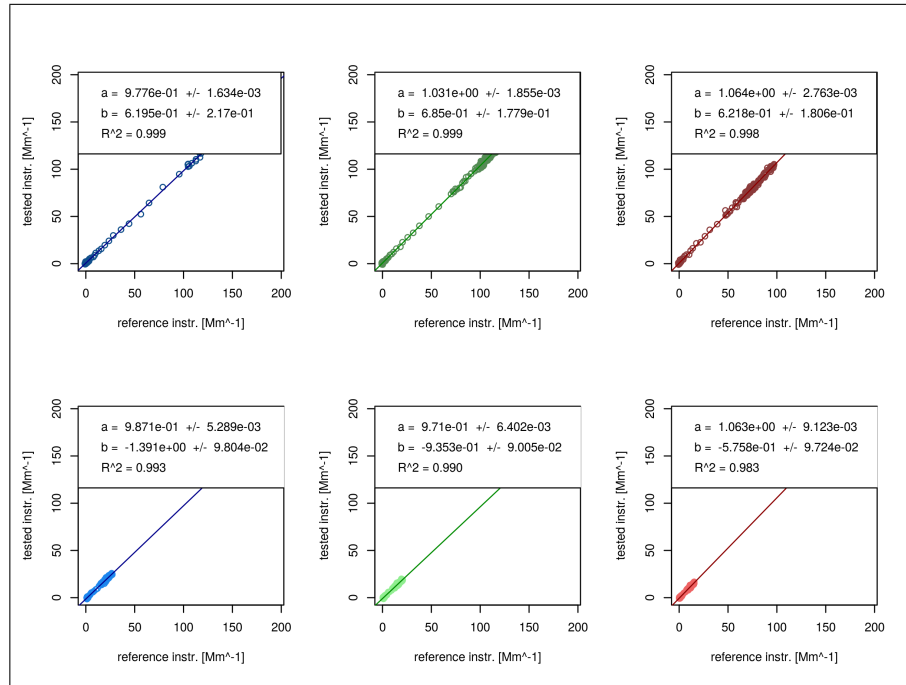


Figure 2: Correlation of scattering coefficients from nephelometer (SN 12-0717) and reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.