



Intercomparison of integrating nephelometers Project No.: IN-2018-3-3

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	70933005

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 (1σ) for the all wavelengths was less equal 0.41 Mm^{-1} for full scattering and 0.3 Mm^{-1} for backscattering. The background level was unacceptable with deviations of less equal 9.82 Mm^{-1} for full scattering and 4.67 Mm^{-1} for backscattering.

Spancheck

The span check was unacceptable with deviations of less equal 33.4%.

Inspection

The instrument was clean without any contamination.

Comparison to reference nephelometer

Before inspection and recalibration

The deviations of intercomparisson to reference device were unacceptable with deviations in the range of -9.3% to -2.4% .

After inspection and recalibration

The results from intercomparisson to reference device were barely acceptable with deviations in the range of -7.4% to -0.6% .

Recommendations

No recommendations.

Overall assessment

The instrument meets the requirements.

2 Details

Configuration parameters

Nephelometer Configuration Data					
Analog Output Range:		Zero V	Full Scale		
Relative Humidity ->		0	100		
Barometric Pressure ->		0	1200		
Sample Temperature ->		0	400		
Scattering ->		7	2 (Offset=1.00000E-7)		
Channel	Type		Channel	Type	
0	9 (Relative Humidity)		5	5 (Red sp)	
1	1 (Barometric Pressure)		6	6 (Blue bsp)	
2	2 (Sample Temperature)		7	7 (Green bsp)	
3	3 (Blue sp)		8	8 (Red bsp)	
4	4 (Green sp)				
Calibration Points:		Low Bits	Low Value	High Bits	High Value
Relative Humidity ->		266	113	596	754
Barometric Pressure->		15359	1266	54544	9850
Sample Temperature ->		0	0	38715	2958
Inlet Temperature ->		0	0	38730	2958
Calibration Constants:		K1	K2	K3	K4
Blue ->		20000	2.620E-3	2.789E-5	5.260E-1
Green->		20000	2.801E-3	1.226E-5	5.140E-1
Red ->		20000	1.649E-3	4.605E-6	5.080E-1
Data Delimiter:		Comma			
Calibration Label:		8:17 AM August 01, 2018 Zae SN. 1048 AIR/C02 CAL.			
Backscatter Shutter Mode:		Enabled			
Autozero Baseline Measurement:		Manual Mode			
Lamp Power (Watts)		: 75			
Auxiliary BNC Output (millivolts):		0			
Time for Averaging (sec.)		: 1			
Time to Blank Valve (sec.)		: 30			
Time between Autozeros (sec.)		: 21600			
Time for AutoZero Measurement (sec.):		300			
PMT Voltage:					
Blue = 1100					
Green = 1075					
Red = 1100					
Zero Baseline Values:		Total Scatter	BackScatter	Rayleigh Scatter	
Blue ->		2.925E-5	1.507E-5	1.721E-5	
Green ->		1.503E-5	7.682E-6	7.540E-6	

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Table 1: Noise parameters of TSI nephelometer (70933005) measured with filtered air.

Wavelength [nm]	total scattering		backscattering	
	mean	std.dev.	mean	std.dev.
	[Mm ⁻¹]	[Mm ⁻¹]	[Mm ⁻¹]	[Mm ⁻¹]
450	-9.82	0.41	-4.67	0.3
530	-4.18	0.23	-1.9	0.16
700	-1.75	0.14	-0.71	0.12

Spancheck

Table 2: Percentage deviation of measured values from TSI nephelometer (70933005) to theoretical values for CO₂

Wavelength [nm]	total scattering deviation [%]	backscattering deviation [%]
450	-24.8	-19.8
530	-26.9	-21.9
700	-33.4	-26.5

Comparison to reference nephelometer before inspection and recalibration

Table 3: Comparison of TSI nephelometer (70933005) 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	0.964	0.999	0.948	0.996
525	0.976	0.999	0.974	0.997
635	0.907	0.999	0.928	0.995

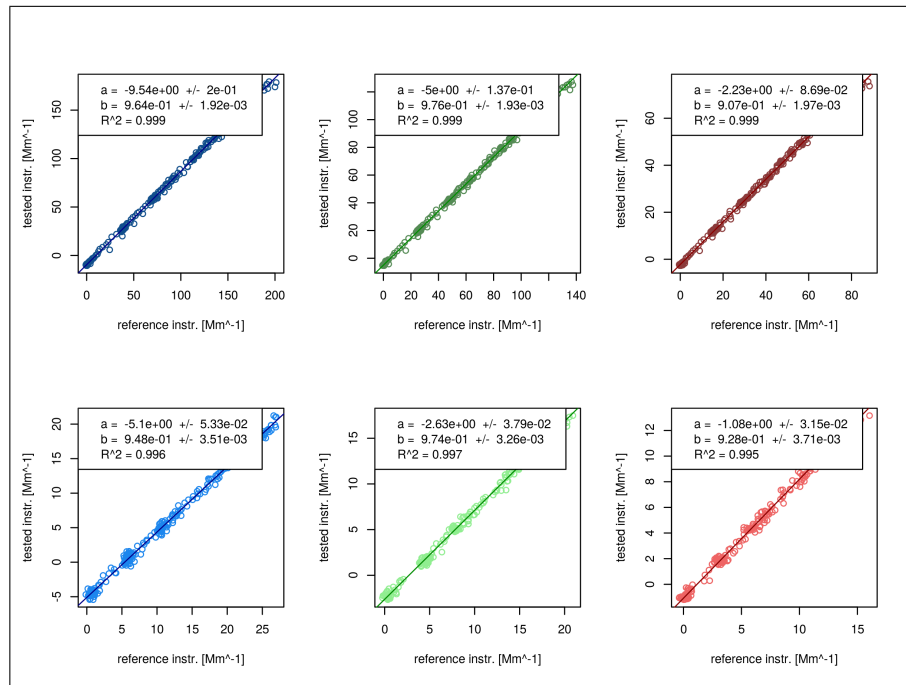


Figure 1: Correlation of scattering coefficients from TSI nephelometer (70933005) and reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

Comparison to reference nephelometer after inspection and recalibration

Table 4: Comparison of TSI nephelometer (70933005) to reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength [nm]	total scattering		backscattering	
	slope	R2	slope	R2
450	0.982	1	0.968	0.996
525	0.989	1	0.994	0.998
635	0.926	0.999	0.948	0.995

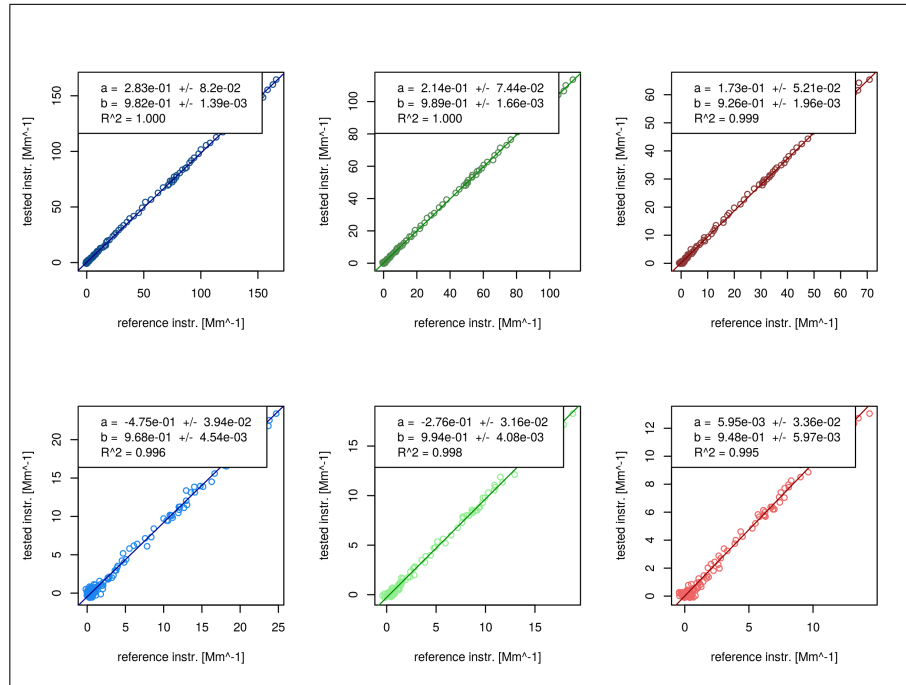


Figure 2: Correlation of scattering coefficients from TSI nephelometer (70933005) and reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.