



Intercomparison of Integrating Nephelometers Project No.: IN-2017-2-2

Basic Information:

Location of the quality assurance: TROPOS, lab 121

Date: 24 September, 2017

Principal Investigator	Home Institution	Participant	Instrument
A. Eija	Finnish Meteorological Institute, FMI	J. Backmann	Nephelometer, TSI model 3563, SN 1061

1. Intercomparison summary

Status on arrival: Device could not be started immediately, due to a loose contact of analog and digital PCB.

Noise: The one minute instrumental noise (single standard deviation) was less than 0.18 for total scattering and less than 0.18 for backscattering. The noise level conforms to the expected noise.

Span check: The span check before instrument inspection revealed, that the instrument was properly calibrated with a deviation of 6.5% at 700 nm and less than 2% for the other channels. The values for backscattering differs significantly with large negative values, similar to the results from the zero checks.

Comparison to a reference instrument:

Before inspection: Comparison to the reference nephelometer (Aurora 4000, SN 14-1408) showed that scattering coefficients agreed with values from the reference instrument. The poor results for backscattering fit into the results from zero and span check.

After inspection and calibration: Comparison to the reference instrument showed that the blue and green channels agreed within 1% for total scattering. The red channel shows little higher deviation of 10%. For backscattering the deviations are 11%, 10% and 12%, respectively. Deviations for total scattering are in the acceptable range. For backscattering the results are slightly high.

Inspection: The flocked paper was clean. The shutter for backscattering was dirty and cleaned with distilled water. The red PMT is somewhat loose.

Recommendations: The issue of loose contact of the analog and digital PCB should be monitored.

Overall assessment: The instrument meets the requirements.

2. Details

Instrument noise.						
The noise is determined by the standard deviation of a time series of 4 times 30 minutes with a temporal resolution of 1 minute. Test aerosol was filtered room air.						
	total scattering in Mm^{-1}			backscattering in Mm^{-1}		
Wavelength in nm	450	550	700	450	550	700
Zero check (average in Mm^{-1})	0.03	0.00	-0.02	-17.73	-9.51	-16.05
Noise (standard deviation)	0.18	0.11	0.11	0.05	0.01	0.13

Span check

Percentage deviation to theoretical value. A positive number means that the instrument measure too high values.

	total scattering			backscattering		
Wavelength [nm]	450	550	700	450	550	700
before recalibration (as instrument arrived) deviation [%]	1.6	0.1	6.5	-179.9	-195.5	-511.6

Comparison to reference instrument before inspection

Reference nephelometer: Aurora4000 (SN 14-1408)

Test aerosol: ambient air

Measurements were done before inspection and recalibration.

(*) See span check results. Scattering coefficients were interpolated to the wavelengths of the reference nephelometer.

	total scattering			backscattering		
Wavelength in nm	450	525 ^(*)	635 ^(*)	450	525 ^(*)	635 ^(*)
slope	1.03	1.05	1.02	0.02	0.01	0.06
R ²	0.982	0.985	0.976	0.044	0.073	0.180

Comparison to reference instrument after inspection

Reference nephelometer: Aurora4000 (SN 14-1408)

Test aerosol: ammonium sulphate

Measurements were done after inspection and recalibration.

(*) See span check results. Scattering coefficients were interpolated to the wavelengths of the reference nephelometer.

	total scattering			backscattering		
Wavelength in nm	450	525 ^(*)	635 ^(*)	450	525 ^(*)	635 ^(*)
slope	0.99	0.99	0.90	0.89	0.90	0.88
R ²	0.997	0.999	0.999	0.981	0.995	0.984