



Leibniz Institute for
Tropospheric Research



World Calibration Centre
for Aerosol Physics

Intercomparison of Integrating Nephelometers Project No.: IN-2016-2-3

Basic Information:

Location of the quality assurance: TROPOS

Delivery Date: 2 August, 2017

Principal Investigator	Home Institution	Participant	Instrument
Sebastien Conil	ANDRA	Sebastien Conil	Nephelometer, Aurora3000 with external pump SN 12-0489

1. Intercomparison summary

Status on arrival: Instrument was cleaned before workshop. Therefore, the instrument was considered as un-calibrated.

Noise: The one minute instrumental noise (single standard deviation) was between 0.2 and 0.3 Mm^{-1} .

Span check:

The initial span check does not reflect the instrument status, since the instrument was cleaned before workshop. Span check using CO_2 after inspection and recalibration showed that the instrument deviated just by 2% from the theoretical values.

Comparison to a reference instrument:

Before inspection: Not done because of invalid calibration

After inspection and calibration: Comparison with ammonium sulfate to the reference instrument showed that for total scattering the blue channels (total- and

back scattering) were higher by up to 7%. The green and red channels agreed to the reference instrument by about 3% or less. For ambient air values for blue total scattering channel were lower by 7%.

Changing sensitivity of the blue channels, especially for total scattering, can not be explained.

Inspection: Cell was little dirty (no significant). Furthermore, scratches probably from cleaning were found.

Recommendations: The calibration of the blue channel should be checked regularly.

Overall assessment: The instrument meets the requirements. A statement to the instrument status prior to workshop can not be made. Data of the blue channels could have a higher uncertainty of $\pm 7\%$.

2. Details

Instrument noise.

The noise is determined by the standard deviation of a time series of 120 minutes with a temporal resolution of 1 minute. Test aerosol was filtered room air.

Initial zero check not meaningful since instrument arrived un-calibrated and without a valid zero.

	total scattering in Mm^{-1}			backscattering in Mm^{-1}		
Wavelength in nm	450	550	700	450	550	700
Zero check (average in Mm^{-1})	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Noise (standard deviation)	0.24	0.20	0.32	0.22	0.20	0.20

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 [%] <i>note: instrument is considered to be un-calibrated</i>	1.5%	3.0%	13.8%	-3.2%	-5.0%	-40.6%
after recalibration	0.9%	-0.9%	2.1%	1.3%	-1.1%	1.7%

deviation [%]						
---------------	--	--	--	--	--	--

Comparison to reference instrument after inspection						
Reference nephelometer: Aurora4000 (SN 14-1408)						
Test aerosol: ammonium sulphate						
	total scattering			backscattering		
Wavelength in nm	450	525	635	450	525	635
slope	1.074	1.033	0.989	1.060	1.014	0.982
R ²	0.968	0.964	0.968	0.950	0.934	0.923

Comparison to reference instrument after inspection						
Reference nephelometer: Aurora4000 (SN 14-1408)						
Test aerosol: ambient air						
(*) Low values for R ² because the concentration did not vary much over time.						
	total scattering			backscattering		
Wavelength in nm	450	525	635	450	525	635
slope	0.93±0.01	0.97±0.01	0.99±0.01	0.97±0.02	1.01±0.03	0.92±0.03
R ²	0.875	0.775	0.715	0.193	0.169	0.054