TROPOS
Leibniz Institute for
Tropospheric Research

ECAC
European Center for Aerosol Calibration

WCCAP
World Calibration Centre
for Aerosol Physics

Intercomparison of Integrating Nephelometers
Project No.: IN-2016-2-6

Basic Information:

Location of the quality assurance: TROPOS

Delivery Date: 1 August, 2017

Principal Investigator	Home Institution	Participant	Instrument
Mar Sorribas Panero	National Institute for Aerospace Technology (INTA)	n.a.	Nephelometer, TSI model 3563, SN 70513053

1. Intercomparison summary

Status on arrival: No issues due to transportation or other damages.

Noise: The one minute instrumental noise (single standard deviation) was 0.42 for total scattering at wavelength 450 nm and less then 0.29 for the other wavelength and backscattering. The noise level conforms to the expected noise.

Span check:
The span check before instrument inspection showed, that the instrument was on average measuring still too low values. The values are between -3.9 and -5.7% for the blue and green channels and between about -7% for the red channels.
After inspection, the span check values were in the valid range.
It was requested to do a span check when back at the station. The span error was on average 0.79% (Information Mar Sorribas Panero), and a new calibration was not necessary.

Comparison to a reference instrument:
> Before inspection: Comparison to reference nephelometer (Aurora 4000, SN 14-1408) showed that scattering coefficients were about 8% lower for total scattering and 12% lower for backscattering. These results are consistent with a span check showing.
> After inspection and calibration: Comparison to the reference instrument showed that for total scattering the blue and green channels are higher by 4% and the red channel is lower than 3%. Also the backscattering channels agreed better within 4% to the reference instrument.

Inspection: Bright shining particles were found in inlet and large flocky particles are found in the cell and light trap. Instrument was fully cleaned and recalibrated afterwards.

Recommendations: It was recommended to do a span check at the station after transportation. The span check was done and the instrument passed the test.

Overall assessment: The instrument meets the requirements.

2. Details

Instrument noise.						
The noise is determined by the standard deviation of a time series of 145 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})	0.175	0.181	-0.164	0.094	0.028	-0.027
Noise (standard deviation)	0.412	0.242	0.019	0.288	0.172	0.020

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 [%]	-5.7	-4.0	-7.4	-3.9	-4.5	-6.9
after recalibration	2.2	2.7	1.8	3.5	3.4	5.6

deviation [%]						

Comparison to reference instrument before inspection
Reference nephelometer: Aurora4000 (SN 14-1408)
Test aerosol: ambient air
Measurements were done before inspection and recalibration.
[*]Scattering coefficients were interpolated to the wavelengths of the reference nephelometer.

	total scattering			backscattering		
Wavelength in nm	450	525[*]	635[*]	450	525[*]	635[*]
slope	0.925	0.955	0.926	0.868	0.856	0.918
R^2	0.977	0.978	0.973	0.826	0.865	0.82

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	1.037	1.039	0.969	0.998	0.96	1.012
R^2	0.997	0.998	0.996	0.996	0.991	0.978