

# Instrument Inter-Comparison Report

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Instrument	
Type	Aurora 3000
Serial Number	09-0867
Institution	
Contact	

Instrument inter-comparison	
Organization	Leibniz Institute for Tropospheric Research (TROPOS) World Calibration Centre for Aerosol Physics (WCCAP)
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Workshop, etc.	WCCAP-2015-6, 23-28 Nov. 2015

Report	
Status	<input type="checkbox"/> preliminary <input checked="" type="checkbox"/> final
Date	

## 1. Instrument inter-comparison summary

### Status on arrival:

**Noise:** The noise of the instrument is low with values of  $0.28 \text{ Mm}^{-1}$  for total scattering in the blue. The other channels show values smaller than  $0.2 \text{ Mm}^{-1}$ .

**Span check:** Span check with  $\text{CO}_2$  showed that the instrument measures too high values by more than 6% for total scattering in the blue and red channel. Deviations in the other channels were small.

**Inspection:** The cell was clean. Temperature, pressure and humidity sensors are ok.

**Comparison to other Nephelometer:** The instrument showed significant deviations when compared to TSI nephelometers and to an Aurora 4000. For total scattering in blue the instrument showed 8 and 14% too high values, respectively. For total scattering in the green the instrument agreed to the TSI and the Aurora 4000 nephelometer. For all other channels, the instrument was significantly too low with deviations of up to -18%. Span check results can not explain the observed differences.

**Other observation:** Calibration of the instrument failed! The problem could be a failure in the auto zero function. After auto zero measurement measurements with an external particle filter gave values of -7.9, -10.6 and -13.8  $\text{Mm}^{-1}$  for total scattering. Probably the fail function in the internal zero procedure prevents a stable calibration.

**Recommendations:** Check instrument for leaks and internal pumps for autozero.

**Overall assessment:** The instrument does not meet the requirements.

## 2. Technical checks

<b>Table: Noise checks for 50 minutes duration.</b>						
The noise is determined by the standard deviation of a time series of 30 minutes with a temporal resolution of 1 minute. Test aerosol was filtered room air.						
	total scattering in $\text{Mm}^{-1}$			backscattering in $\text{Mm}^{-1}$		
Wavelength in nm	450	525	635	450	525	635
Zero check (average in $\text{Mm}^{-1}$ )	-1.854	-0.311	-1.210	-0.449	-0.224	-0.291
<b>Noise</b> (standard deviation)	0.272	0.171	0.197	0.089	0.055	0.010

<b>Table: Span check, deviation to theoretical value</b>						
	total scattering			backscattering		
Wavelength in nm	450	525	635	450	525	635
deviation in %	6.1	0.0	6.6	4.5	3.3	2.3

## 3. Comparison to other Nephelometers of before inspection and calibration

<b>Table: Comparison to an average of in total four TSI nephelometers model 3563. Scattering coefficients were corrected for truncation. Values for the TSI nephelometer were adjusted using the Angström equation to match the wavelengths of the Aurora 3000.</b>						
	total scattering			backscattering		
Wavelength in nm	450	525	635	450	525	635

slope	1.141	1.032	0.776	0.842	0.856	0.819
intercept	1.752	-0.405	0.71	0.746	1.914	0.711
R <sup>2</sup>	0.991	0.991	0.985	0.976	0.973	0.947

**Table: Comparison to an Aurora 4000 reference Nephelometer. Scattering coefficients were corrected for truncation. The Aurora 4000 gave no reliable backscatter data.**

	total scattering			backscattering		
Wavelength in nm	450	525	635	450	525	635
slope	1.085	1.032	0.84	0.765	0.826	0.784
intercept	13.373	7.91	5.339	2.962	1.474	1.817
R <sup>2</sup>	0.918	0.921	0.906	0.765	0.797	0.725