

Intercomparison of Integrating Nephelometers and Extinction monitors

Project No.: IN-2015-1-5

Basic Information:

Location of the quality assurance: TROPOS, lab 121

Date: 26 July, 2016

Principal Investigator	Home Institution	Participant	Instrument
Jean Sciare	The Cyprus Institute	Michael Pikridas	TSI model 3563, S/N 1082

1. Intercomparison summary

Status on arrival: Instrument very dirty.

Noise: The noise was up to 1 Mm^{-1} because of the dirty cell on arrival. After cleaning the cell the noise was in the acceptable range.

Span check: Span check using CO₂ showed that the instrument measured too high values in the green channel by 6 to 8 % for total and back scattering, respectively, an 9% for backscattering in red.

Inspection: Temperature and pressure sensors were ok. The cell was cleaned. The black flocked paper was ok. The light trap was very dirty (note that the light trap can not be seen without opening the cell).

Comparison to other Nephelometer: Comparison to the average of other Nephelometers after maintenance showed that deviations were less than 3.5%, except for the red channel for total scattering with deviations of about 6%.

Other observation: The blacked flocked paper was rather clean while the mirror in the light trap was very dirty. Inspection of the cell through the inlet might not be sufficient.

Recommendations: Recalibrate instrument after back transportation and check performance/clean/recalibrate after strong dust storms.

Overall assessment: The instrument meets the requirements after cleaning and recalibration.

2. Details

Table: Noise checks for 30 minutes duration before cleaning

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			backscattering		
Wavelength in nm	450	550	700	450	550	700
Zero check (average in Mm^{-1})	0.067	-2.353	0.074	-0.027	0.400	0.114
Noise (standard deviation)	0.290	0.707	0.215	0.217	1.060	0.196

Table: Noise checks for 30 minutes duration after cleaning

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			backscattering		
Wavelength in nm	450	550	700	450	550	700
Zero check (average in Mm^{-1})	0.469	0.342	0.059	0.154	0.075	0.086
Noise (standard deviation)	0.391	0.155	0.172	0.301	0.095	0.142

Table: Span check before recalibration, deviation to theoretical value

	total scattering			backscattering		
Wavelength in nm	450	550	700	450	550	700
deviation in %	1.62	6.31	1.85	3.79	6.98	9.82

Table: Span check after recalibration, deviation to theoretical value						
	total scattering			backscattering		
Wavelength in nm	450	550	700	450	550	700
deviation in %	1.8	1.7	5.2	3.6	1.7	1.0

Table: Percentage deviation to an average of four TSI nephelometers of model 3563 as arrived to Leipzig.						
	total scattering			backscattering		
Wavelength in nm	450	550	700	450	550	700
Deviation [%]	-2.6	-0.6	-4.3	-4.5	-2.4	-1.8
R ²	0.987	0.987	0.987	0.982	0.983	0.983

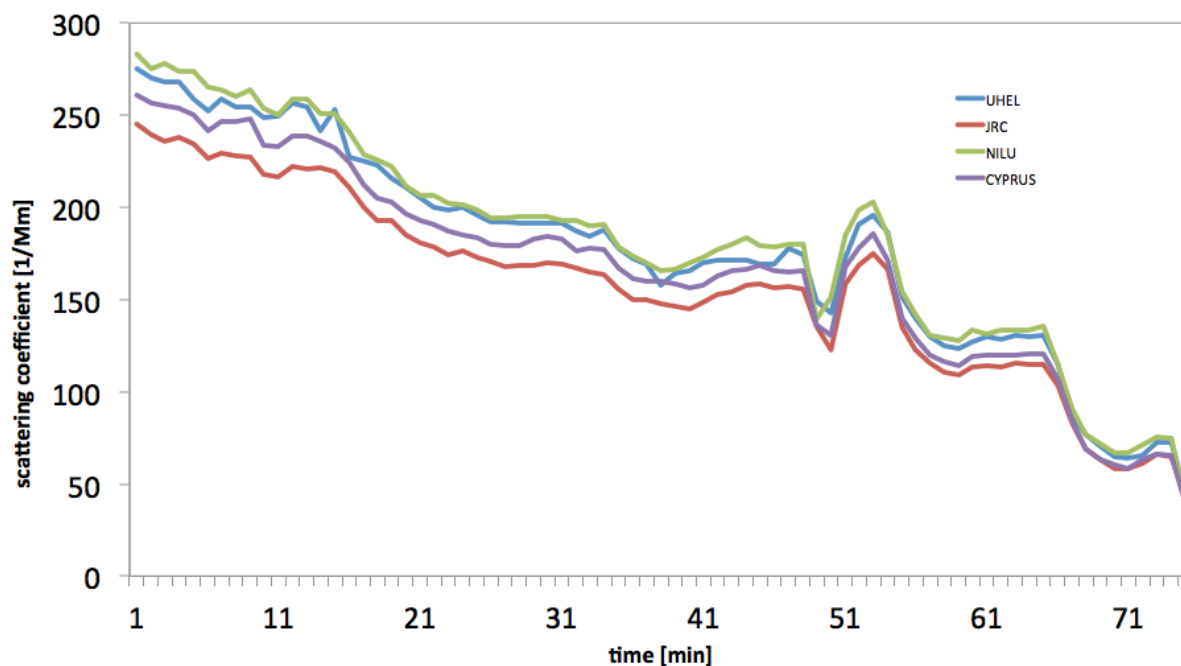


Figure 1: Comparison of four TSI nephelometers as arrived to at workshop. Shown are values for total scattering at 550 nm.

Table: Percentage deviation to an average of four TSI nephelometers model 3563 after inspection and CO₂ calibrations.

	total scattering			backscattering		
Wavelength in nm	450	550	700	450	550	700
Deviation [%]	-3.3	-0.7	-6.7	-4.7	-1.3	-1.1
R ²	0.988	0.990	0.983	0.983	0.989	0.970