



## Intercomparison of integrating nephelometers

### Project: IN-2022-3-1

Location of the quality assurance: TROPOS, Lab 108  
Date: 2022-09-19 – 2022-09-22

Principal Investigator	Institution	Participant	Instrument SN
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### Intercomparison summary

#### Status on arrival

No issues due to transportation or other damages.

#### Inspection

The measuring cell was clean. The device has passed the leak check. Due to the exceptionally good performance the instrument was not recalibrated.

#### Zerocheck

The noise level of the instrument is in the normal range. The average noise ( $1\sigma$ ) was less equal  $0.12 \text{ Mm}^{-1}$  for 5 minute average. The background level was acceptable with deviations of less equal  $0.45 \text{ Mm}^{-1}$ .

#### Spancheck

The span check was acceptable with deviations of less equal 3.8 %.

## Comparison to reference nephelometer

The results from intercomparison to reference device were acceptable with deviations in the range of -4.5 % to +1 %.

## Recommendations

No recommendations.

## Overall assessment

The instrument meets the ACTRIS and GAW requirements.

### Details:

#### Zerocheck:

	Mean	Std. Deviation
sca450	0.4511	0.88576
sca525	0.0938	0.71946
sca635	-0.0507	0.80595
bsca450	0.1411	0.60843
bsca525	0.0296	0.55712
bsca635	0.1159	0.57386

Table 1: Noise parameters of nephelometer measured with filtered air.

#### Spancheck:

	Mean	Std. Deviation	Deviation from nominal value
sca450	45.2369 ± 0.13327	1.19940	+2.3%
sca525	24.6421 ± 0.09319	.83870	+3.3%
sca635	11.5738 ± 0.10707	.96362	+3.8%

Table 2: Deviation of measured values from nephelometer to theoretical values for CO<sub>2</sub>.

## Comparison to reference nephelometer

### Model Summary and Parameter Estimates

Dependent Variable: sca 450nm 212397 [1/Mm]

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.995	85304.325	1	435	.000	1.547	.966

The independent variable is sca 450nm Reference [1/Mm].

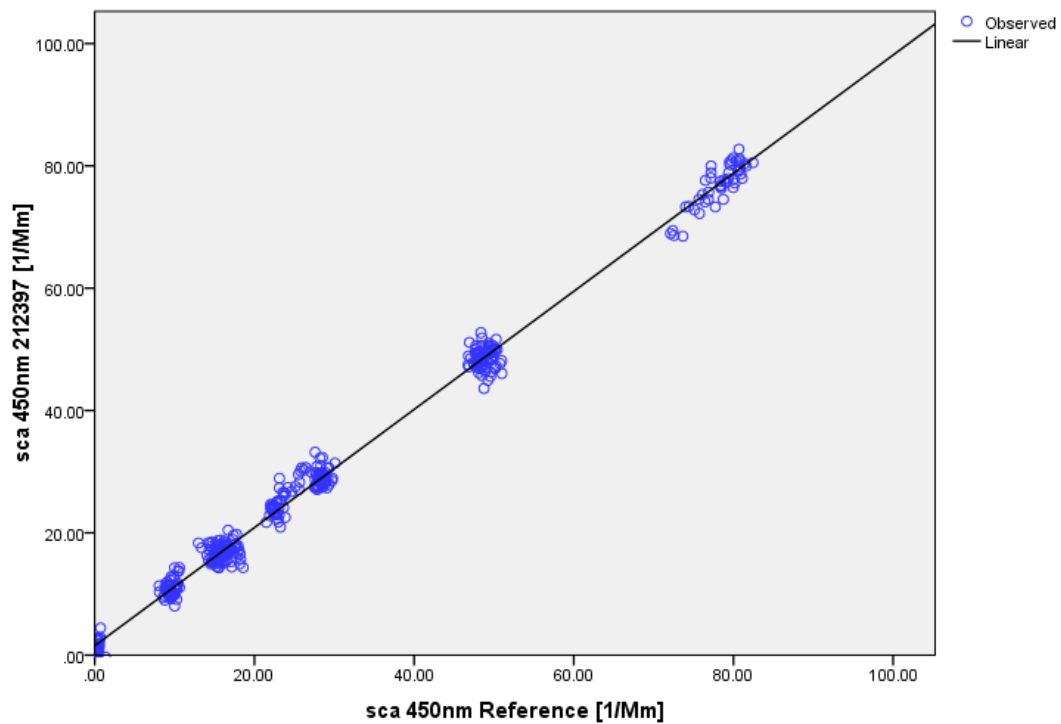


Fig 1: Correlation of 1 minute average measurements by the candidate instrument for blue scattering coefficient with the WCCAP reference. Testaerosol was ammonium sulfate.

Fit function is  $y=0.966x + 1.547$ .

### Model Summary and Parameter Estimates

Dependent Variable: sca 525nm 212397 [1/Mm]

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.996	98853.096	1	435	.000	.643	1.014

The independent variable is sca 525nm Reference [1/Mm].

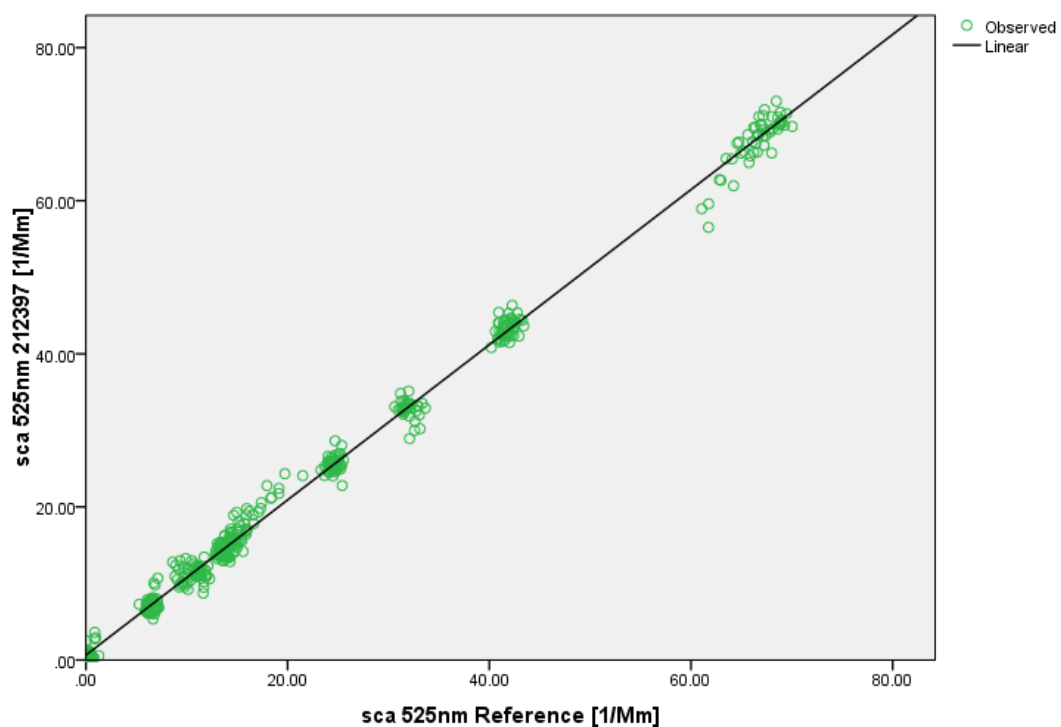


Fig 2: Correlation of 1 minute average measurements by the candidate instrument for green scattering coefficient with the WCCAP reference. Testaerosol was ammonium sulfate.

Fit function is  $y=1.014x + 0.643$ .

### Model Summary and Parameter Estimates

Dependent Variable: sca 635nm 212397 [1/Mm]

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.996	100130.389	1	435	.000	.474	.982

The independent variable is sca 635nm Reference [1/Mm].

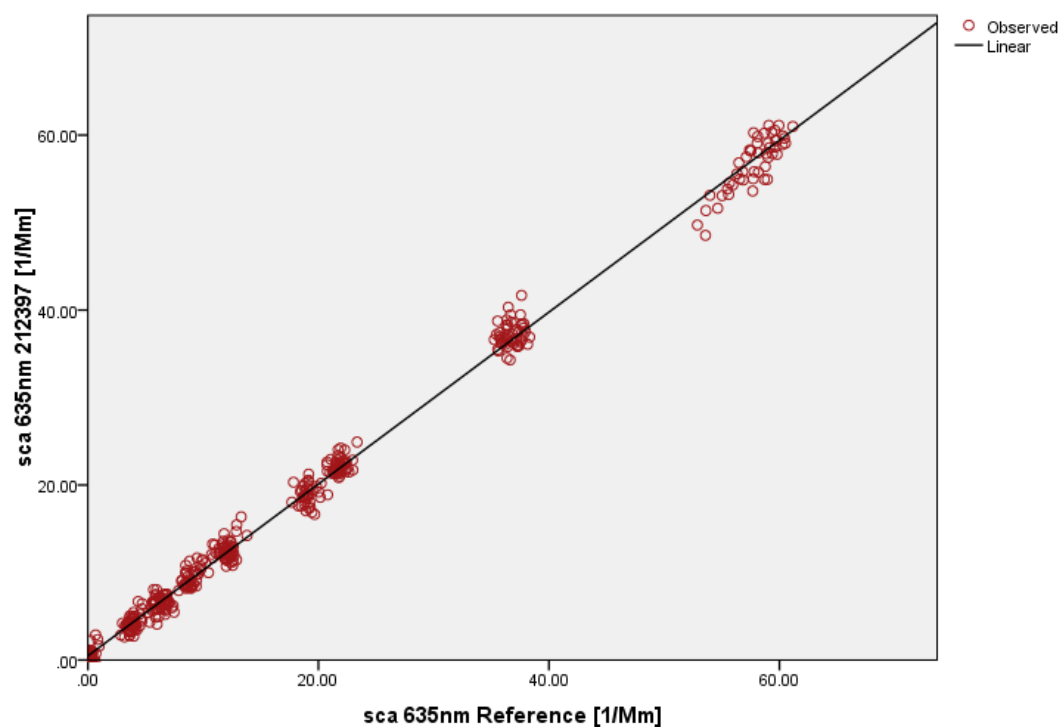


Fig 3: Correlation of 1 minute average measurements by the candidate instrument for red scattering coefficient with the WCCAP reference. Testaerosol was ammonium sulfate.  
Fit function is  $y=0.982x + 0.474$ .

### Model Summary and Parameter Estimates

Dependent Variable: bsca 450nm 212397 [1/Mm]

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.972	14873.973	1	435	.000	.446	.966

The independent variable is bsca 450nm Reference [1/Mm].

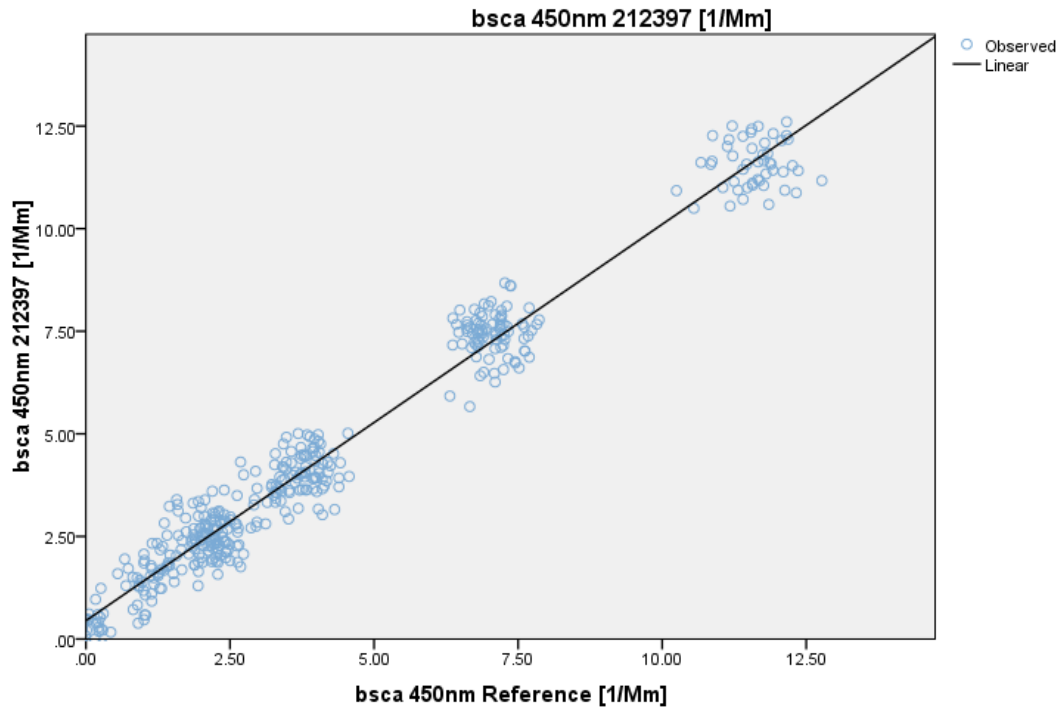


Fig 4: Correlation of 1 minute average measurements by the candidate instrument for blue backscattering coefficient with the WCCAP reference. Testaerosol was ammonium sulfate.  
Fit function is  $y = 0.966x + 0.446$ .

### Model Summary and Parameter Estimates

Dependent Variable: bsca 525nm 212397 [1/Mm]

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.975	16915.651	1	435	.000	.381	1.001

The independent variable is bsca 525nm Reference [1/Mm].

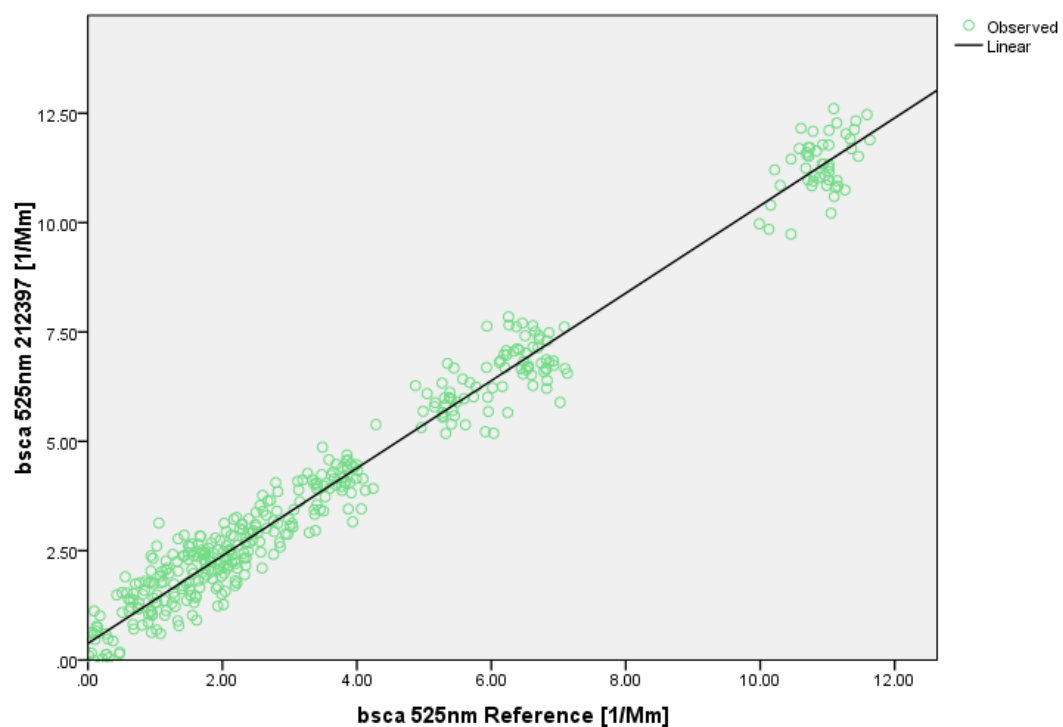


Fig 5: Correlation of 1 minute average measurements by the candidate instrument for green backscattering coefficient with the WCCAP reference. Testaerosol was ammonium sulfate.

Fit function is  $y=1.001x + 0.381$ .

### Model Summary and Parameter Estimates

Dependent Variable: bsca 635nm 212397 [1/Mm]

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.968	13246.490	1	435	.000	.203	1.045

The independent variable is bsca 635nm Reference [1/Mm].

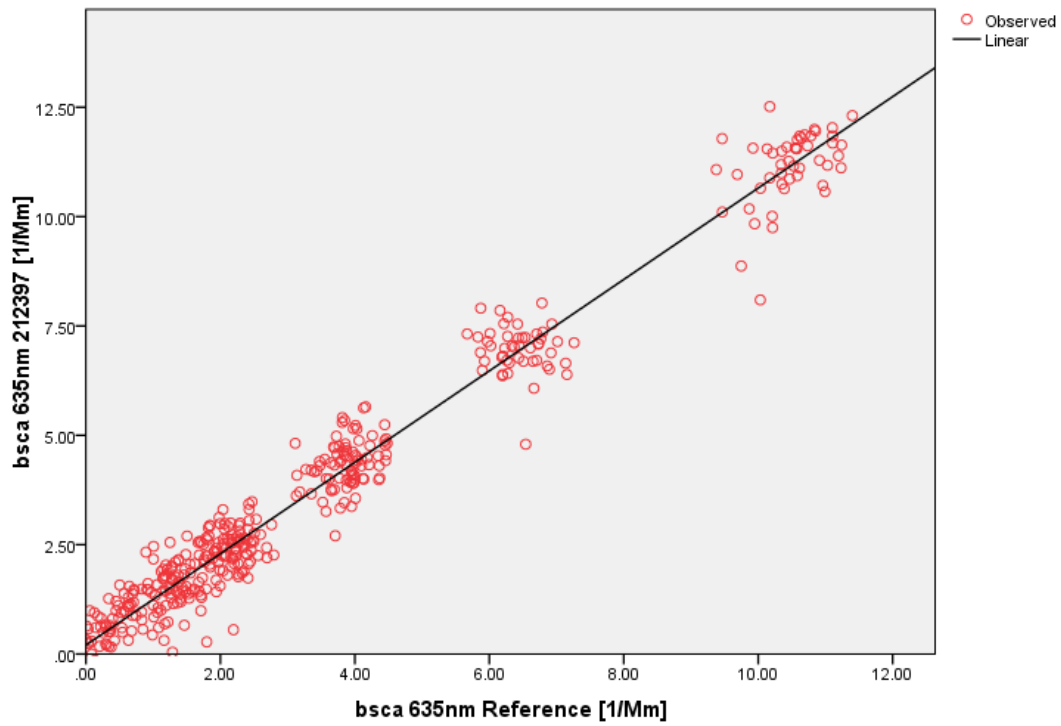


Fig 6: Correlation of 1 minute average measurements by the candidate instrument for green backscattering coefficient with the WCCAP reference. Testaerosol was ammonium sulfate.  
Fit function is  $y=1.045x + 0.203$ .