
# Intercomparison of integrating nephelometers Project No.: IN-2020-1-3

Basic informations:

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|---|---|
| Location of the quality assurance: | TROPOS, Lab 121 |
| Date: | 27 January - 31 January 2020 |

| Principal Investigator | Home Institution | Participant | Instrument |
|---|---|---|---|
| C. Di Biagio | LISA | C. Di Biagio | 1041 |

## 1 Intercomparison summary

### Status on arrival

No issues due to transportation or other damages.

### Zerocheck

The noise level of the instrument is out of the normal range. The average noise ($1\sigma$) for the all wavelengths was less eqal $0.55\,\mathrm{Mm}^{-1}$ for full scattering and $0.37\,\mathrm{Mm}^{-1}$ for backscattering. The background level was acceptable with deviations of less equal $0.47\,\mathrm{Mm}^{-1}$ for full scattering and $0.41\,\mathrm{Mm}^{-1}$ for backscattering.

### Spancheck

The span check was inacceptable with deviations of less equal 13.1 %.

## Inspection

The measuring cell and the light trap was contaminated with dust. The measuring cell and the light trap was completely cleaned. A recalibrations was not performed.

## Comparison to reference nephelometer

### Before inspection and recalibration

The results from intercomparisson to reference device were barely acceptable with deviations in the range of $-1.8\,\%$ to $8.6\,\%$.

### After inspection and recalibration

The results from intercomparisson to reference device were acceptable with deviations in the range of $-3.7\,\%$ to $5.6\,\%$.

## Recommendations

No recommendations.

## Overall assessment

The instrument meets the requirements.

# 2 Details

## Configuration parameters

## Zerocheck

Table 1: Noise parameters of nephelometer (SN 1041) measured with filtered air.

| Wavelength [nm] | total scattering mean [$Mm^{-1}$] | total scattering std.dev. [$Mm^{-1}$] | backscattering mean [$Mm^{-1}$] | backscattering std.dev. [$Mm^{-1}$] |
|---|---|---|---|---|
| 450 | -0.12 | 0.55 | 0.41 | 0.37 |
| 530 | 0.47 | 0.26 | 0.02 | 0.16 |
| 700 | 0.06 | 0.31 | 0.27 | 0.23 |

## Spancheck

Table 2: Percentage deviation of measured values from nephelometer (SN 1041) to theoretical values for CO2

| Wavelength [nm] | total scattering deviation [%] | backscattering deviation [%] |
|---|---|---|
| 450 | 4.5 | 0 |
| 530 | 7.6 | -2.7 |
| 700 | 3.9 | -13.1 |

## Comparison to reference nephelometer before inspection and recalibration

Table 3: Comparison of nephelometer (SN 1041) to reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

| Wavelength [nm] | total scattering slope | total scattering R2 | backscattering slope | backscattering R2 |
|---|---|---|---|---|
| 450 | 1.04 | 1 | 0.982 | 0.997 |
| 525 | 1.076 | 1 | 1.041 | 0.998 |
| 635 | 1.032 | 0.999 | 1.086 | 0.997 |

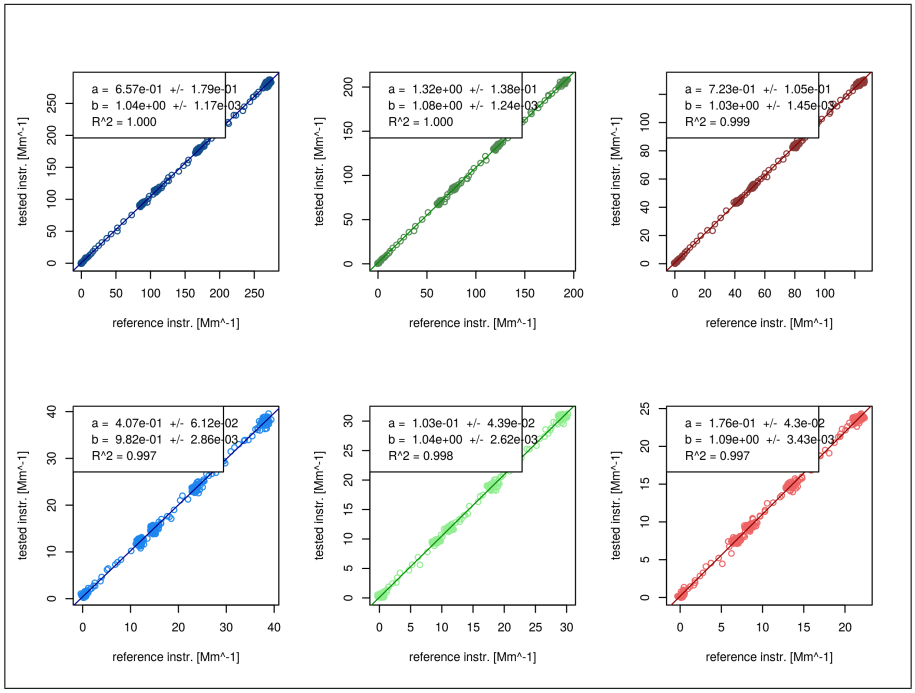


Figure 1: Correlation of scattering coefficients from nephelometer (SN 1041) and reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

## Comparison to reference nephelometer after inspection and recalibration

Table 4: Comparison of nephelometer (SN 1041) to reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.

| Wavelength [nm] | total scattering slope | total scattering R2 | backscattering slope | backscattering R2 |
|---|---|---|---|---|
| 450 | 1.02 | 0.999 | 0.963 | 0.996 |
| 525 | 1.056 | 0.999 | 1.024 | 0.997 |
| 635 | 1.015 | 0.999 | 1.056 | 0.994 |

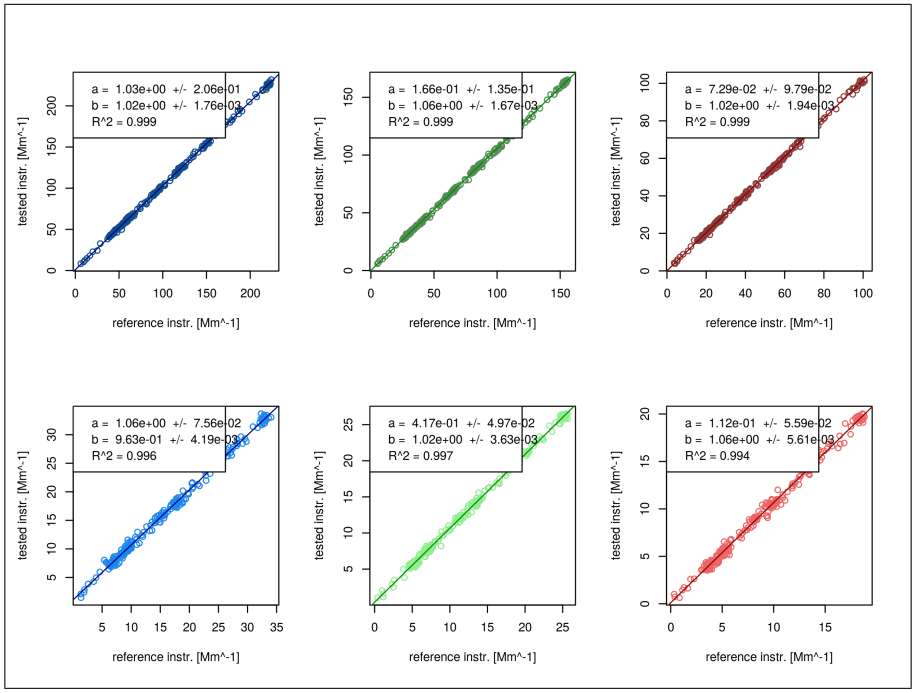


Figure 2: Correlation of scattering coefficients from nephelometer (SN 1041) and reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.