



Intercomparison of Integrating Nephelometers Project No.: IN-2017-3-3

Basic Information:

Location of the quality assurance: TROPOS, lab 121

Date: 15 October, 2017

| Principal Investigator | Home Institution | Participant | Instrument |
|------------------------|------------------|-------------|---|
| B. Briel | DWD | B. Briel | Nephelometer, TSI model 3563, SN 1032 |

1. Intercomparison summary

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

Noise: The one minute instrumental noise (single standard deviation) for total scattering was 0.80 (0.55 backscattering) for 450 nm and 0.75 (0.62 backscattering) for 700 nm. The values for the green channel are less equal 0.31. The noise level for the blue and the red channel is slightly higher than the expected noise.

Span check: The span check before instrument inspection show deviation for total scattering of -15.1% for the red channel and for the other channel values less equal 3.6%. The deviation for the backscattering are somewhat higher with values of 31.9% for the red and less equal 12.4% for the other channels.

Comparison to a reference instrument:

Before inspection: Comparison to the reference nephelometer (Aurora 4000, SN 14-1408) showed a deviation with values less equal 11% for the total scattering and less equal 18% for backscattering..

After inspection and calibration: The deviations for total scattering reduce to values less equal 7% and 11% for backscattering.

All deviations are in the acceptable range.

Inspection: The instrument was in clean and in a good condition.

Recommendations: No recommendations.

Overall assessment: The instrument meets the requirements.

2. Details

| Instrument noise | | | | | | |
|---|-------------------------------|------|-------|-----------------------------|------|-------|
| The noise is determined by the standard deviation of a time series of 120 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}) | -0.07 | 0.13 | -0.13 | 0.14 | 0.02 | -0.19 |
| Noise (standard deviation) | 0.80 | 0.31 | 0.75 | 0.55 | 0.21 | 0.62 |

| 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 [%] | -3.1 | -3.6 | -15.1 | -12.4 | -11.3 | -31.9 |

| Comparison to reference instrument before inspection | | | | | | |
|---|------------------|--------|--------|----------------|--------|--------|
| Reference nephelometer: Aurora4000 (SN 14-1408) | | | | | | |
| Test aerosol: ambient air | | | | | | |
| Measurements were done before 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 | 1.10 | 1.11 | 0.94 | 0.84 | 0.85 | 0.82 |
| R ² | 0.994 | 0.997 | 0.996 | 0.895 | 0.959 | 0.904 |

| 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 | 1.07 | 1.05 | 1.00 | 0.89 | 0.92 | 0.90 |
| R ² | 0.999 | 1.000 | 0.999 | 0.996 | 0.999 | 0.994 |