



TNA User Report

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eurochamp2020@lisa.u-pec.fr

Project title	Participation to the IN-2020-1 instrument intercomparison workshop
Name of the accessed calibration center	WCCAP
Number of users in the project	two
Project objectives (max 100 words)	<p>The objective of the project was to participate in the Integrating Nephelometer Laboratory intercomparison and calibration workshop, that took place at ECAC facility in Leipzig on January 27-31-2020.</p> <p>We participated with a Neph_TSI_3563133901. This instrument was running at the Monte Cimone ACTRIS site, also Global stations of the GAW-WMO network, since February 2014 replacing an Ecotech M9001 1w nephelometer for the long term monitoring of the aerosol scattering coefficient. The intercomparison at the WCCAP, already performed on the Ecotech in the framework of ACTRIS-1, is crucial in order to assure the good quality of the data set.</p>
Description of work (max 100 words):	<p>During the intercomparison workshop for integrating Nephelometers, the measures of four instruments (two TSI 3563 Neph and two Ecotech Neph) were compared. They all derived the aerosol sample from the same mixing chamber, filled with different kind of particles (ambient aerosol, generated combustion aerosol and salts). All the Nephelometers were also cleaned and calibrated.</p>

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User status	

1 Physics; Chemistry, Earth Sciences & Environment; Engineering & Technology; Mathematics; Information & Communication Technologies; Material Sciences; Energy; Social sciences; Humanities.

2 UNI= University and Other Higher Education Organisation;
RES= Public Research Organisation (including international research organisations and private research organisations controlled by public authority);
SME= Small and Medium Enterprise;
PRV= Other Industrial and/or Profit Private Organisation;
OTH= Other type of organization.

3 UND= Undergraduate; PGR= Post graduate; PDOC= Post-doctoral researcher; RES= Researcher EXP= Engineer; ACA= Academic; TEC= Technician.

4 Reproduce the table for each user who accessed the infrastructure

New user	
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Trans-National Access (TNA) Scientific Report

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Please limit the report to max 5 pages, you can include tables and figures. Please make sure to address any comments made by the reviewers at the moment of the project evaluation (if applicable, in this case you were informed beforehand). Please do not alter the layout of the document and keep it in Word version. The report will be made available on the eurochamp.org website. Should any information be confidential or not be made public, please inform us accordingly (in this case it will only be accessible by the European Commission, the EUROCHAMP-2020 project partners, and the reviewers). Please include:

- Introduction and motivation
- Scientific objectives
- Reason for choosing the calibration facility
- Method and experimental set-up
- Data description
- Preliminary results and conclusions
- Outcome and future studies
- References

Instructions

Name of the PI: Angela Marinoni

Calibration center's name and location: WCCAP Leipzig

Campaign name and period: IN-2020-1 instrument intercomparison workshop

Introduction and motivation

The Monte Cimone ACTRIS site is one of the Global stations of the GAW-WMO which provides continuous measures of the main aerosol properties considered as representative for the Mediterranean basin.

The aerosol scattering coefficient is one of the main properties measured worldwide to assess the role of aerosol particles in the climate system. It is monitored at Monte Cimone since 2007 by means of integrating Nephelometers. Between 2007 and 2014 the Ecotech M9001 1w Nephelometer was used at the station then replaced by the Neph_TSI_3563133901 in February 2014. In order to assure the high quality of the data set of the station, it is very important to involve the instruments in inter-comparison workshops in Calibration Centers. While the Ecotech M9001 1w had been inter-compared at the WCCAP in the framework of ACTRIS-1, the TSI was not.

For this reasons it was decided to participate to the IN-2020-1 instrument inter-comparison workshop, that took place on January 27-31-2020 at WCCAP an ECAC facility in Leipzig. The Center was chosen because of The long term experience of its scientists in this kind of activity and the quality of its facilities.

Method and experimental set up

During the inter-comparison three models of integrating Nephelometer (two TSI Neph 3563 and one Ecotech AURORA 3000) have been compared to a reference instrument (an Aurora 4000). They have been placed in the same room with their inlet connected to the same mixing chamber, to analyze approximately the same sample of air.

As a first step the performance of the instrument (noise level in normal conditions and scattering coefficient with respect to reference values) before calibration and inspection were evaluated. The noise was detected with filtered air sample (low span) and the scattering coefficients were measured for a sample of CO₂ as high span gas.

A preliminary comparison was made by inserting ammonium sulfate into the chamber, and then the instrument was inspected and cleaned. After the cleaning it was calibrated and after the inspection and calibration a final comparison with ammonium sulfate was made.

Results

The analysis of the noise before inspection and calibration is reported in table 1 for all the measuring wavelengths. The level was in the normal range with the greater values up to 0.42 Mm⁻¹ for full scattering and 0.31Mm⁻¹ for back-scattering. The background was instead unacceptable with deviations of up to 0.57 Mm⁻¹ for full scattering and 0.2 Mm⁻¹ for back-scattering.

Table 1: Noise parameters of nephelometer (SN 133901) measured with filtered air.

Wavelength [nm]	total scattering		backscattering	
	mean [Mm ⁻¹]	std.dev. [Mm ⁻¹]	mean [Mm ⁻¹]	std.dev. [Mm ⁻¹]
450	0.57	0.42	0.17	0.31
530	0.26	0.23	0.2	0.18
700	0.03	0.24	0.12	0.2

The span check with CO₂ as span gas is then reported in table 2. Deviations up to 13 % with respect to the theoretical ones are too high.

Table 2: Percentage deviation of measured values from nephelometer (SN 133901) to theoretical values for CO₂

Wavelength [nm]	total scattering	backscattering
	deviation [%]	deviation [%]
450	10.4	13.5
530	7.1	11.3
700	1.4	6.8

The first inter-comparison with the reference instrument and with ammonium sulfate as test aerosol, performed before the inspection and calibration, is summarized in figure 1 and table 3.

Table 3: Comparison of nephelometer (SN 133901) to reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength [nm]	total scattering		backscattering	
	slope	R2	slope	R2
450	0.966	1	1.125	0.998
525	0.975	1	1.137	0.998
635	0.941	0.999	1.152	0.998

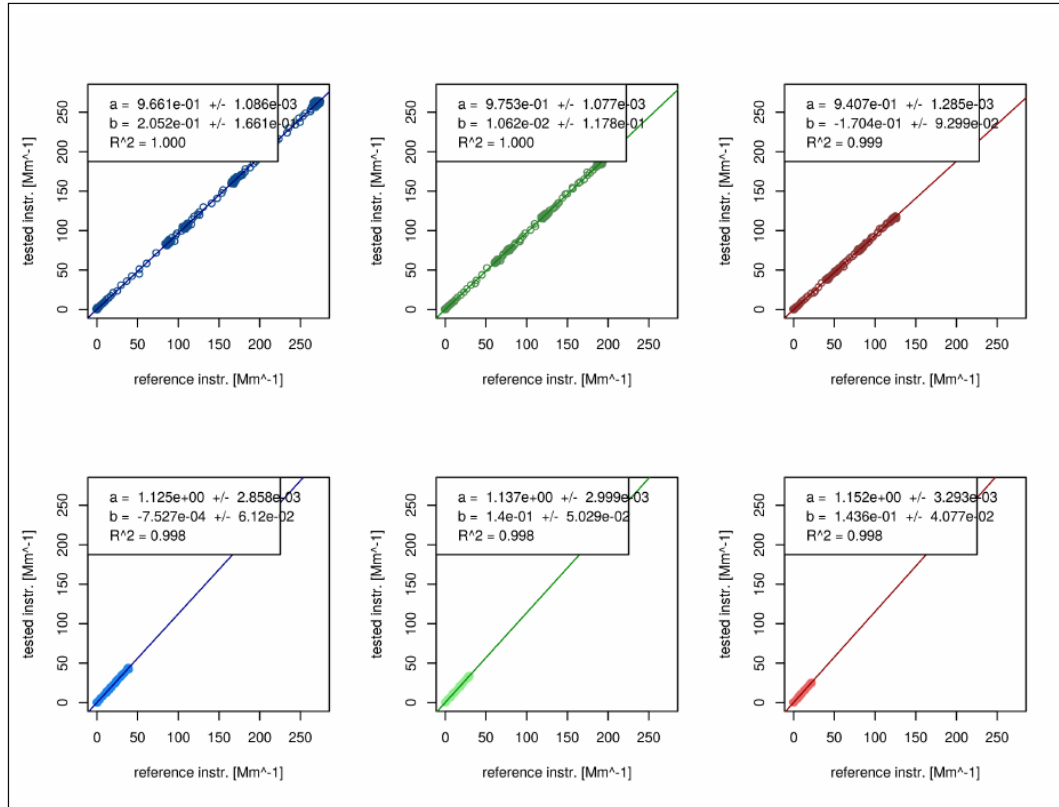


Figure 1: Correlation of scattering coefficients from nephelometer (SN 133901) and reference nephelometer Aurora4000 (SN 14-1408) before inspection and recalibration. Testaerosol is ammonium sulfate.

The ISAC nephelometer observations with respect to the reference device shows very high deviations, in the range of -5.9% to 15.2% .

The inspection revealed contamination because of presence of insects trapped in the instrument. It was thus cleaned and recalibrated.

The final comparison after inspection and calibration is in the end reported in the figure 2 and table 4. It gave better results, barely acceptable with deviations in the range of -6.5% to 8.3% .

Table 4: Comparison of nephelometer (SN 133901) to reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.

Wavelength [nm]	total scattering		backscattering	
	slope	R2	slope	R2
450	0.954	0.999	0.985	0.983
525	0.968	0.999	1.072	0.988
635	0.935	0.998	1.083	0.974

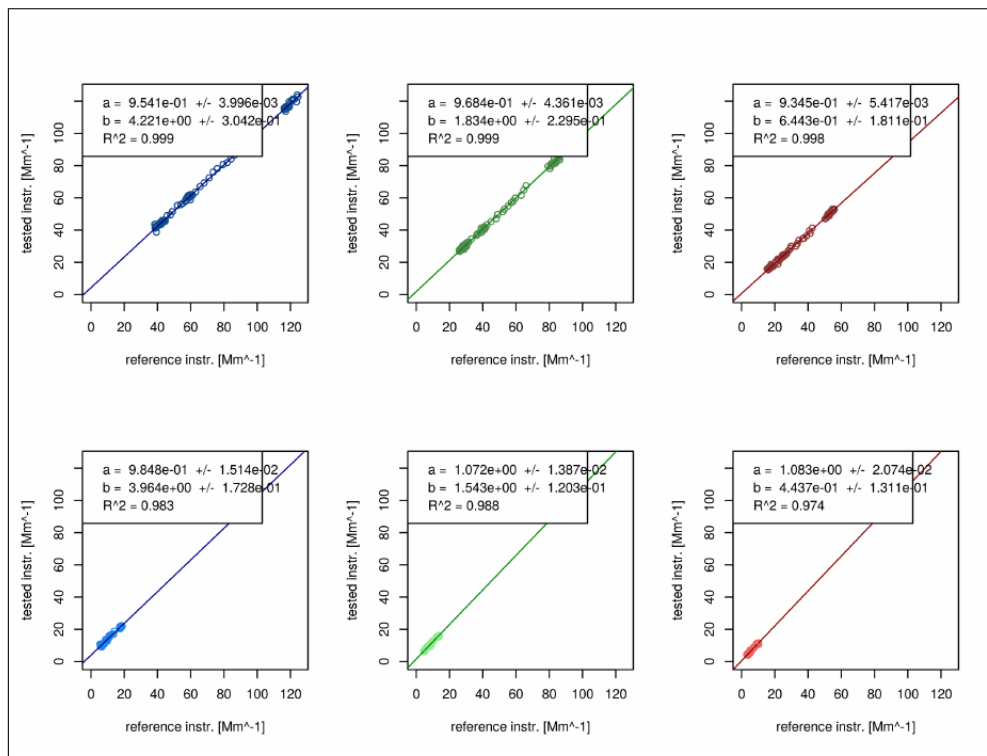


Figure 2: Correlation of scattering coefficients from nephelometer (SN 133901) and reference nephelometer Aurora4000 (SN 14-1408) after inspection and recalibration. Testaerosol is ammonium sulfate.

At the end of the workshop the overall assessment underline instrument data well comparable with the reference Nephelometer. The ISAC Neohelometer finally meets the quality standard requirements.