

# Milestone M31 (M5.3)

QA/QC measures in the pilot  
activities defined

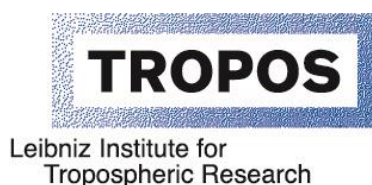


**RI-URBANS**

**Research Infrastructures Services Reinforcing Air  
Quality Monitoring Capacities in European Urban &  
Industrial Areas (GA n. 101036245)**

**By**

**TROPOS & INOE**



***27<sup>th</sup> July 2022***

### Milestone M31 (M5.3): QA/QC measures in the pilot activities defined

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<b>Milestone</b>	M31 (M5.3)
<b>Lead beneficiary</b>	TROPOS
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## 1. About this document

This document describes quality assurance/quality control (QA/QC) measures for RI-URBANS pilots (RI-URBANS, Research Infrastructures Services Reinforcing Air Quality Monitoring Capacities in European Urban & Industrial Areas, Horizon-2020 GD project #101036245). Task 5.2 in the RI-URBANS project is the “establishment of the measurement quality framework supporting RI-URBANS services”. This task supports implementation of QA/QC measures in the pilot studies (WP4) in close connection with pilot study leaders and the ACTRIS Topic Centres.

This is a public document, available in the RI-URBANS website (<https://riurbans.eu/work-package-5/#milestones-wp5>), will be distributed to all RI-URBANS partners for their use and submitted to European Commission as an RI-URBANS milestone M31 (M5.3).

## 2. QA/QC measures in RI-URBANS pilot studies

The procedure to define the QA/QC measures started with a joined remote meeting between pilot study and ACTRIS Topic Centre representatives. During that meeting it was agreed that:

- a) an instrument survey should be generated, in order to provide the ACTRIS Topic Centres with the information on the number and type of instruments operated in the RI-URBANS pilots and thus to be considered by the ACTRIS Topic Centres, and
- b) a document providing information on where to find respective QA/QC measure recommendations, documents, links, and web pages should be generated, in order to provide this information to the pilot studies and to define the QA/QC measures.

Both documents, briefly described below, were generated and were provided to the pilot studies and the ACTRIS Topic Centres. The pilot studies confirmed that they got the information on the QA/QC measures, read it and understood which QA/QC measures should be undertaken in the pilots. The complete documentation for the QA is available at the website of the **ACTRIS Central Facility – CAIS-ECAC**: European Center for Aerosol Calibration & Characterization.

<https://www.actris-ecac.eu/measurement-guidelines.html>

These documents are openly accessible with no restrictions.

### 2.1 Instrument survey

The instrument survey was set-up as an Excel file to be filled in by all pilot studies. An example of the information requested and provided is shown in Table 1. The file also provides a statistics sheet where the ACTRIS Topic Centres get the summarized information for individual or all pilot studies and thus can easily estimate the amount of work to them.

Table 1. Example of the information provided by the pilot studies.

Main contact:		nnicol@inoe.ro			
Instrument	QA/QC recommendations come from	Measured quantities / variables	Pilot	Location of the instrument	Instrument type
<i>free text</i>	<i>selection from drop-down list</i>	<i>free text</i>	<i>selection from drop-down list</i>	<i>selection from drop-down list</i>	<i>selection from drop-down list</i>
Multiwavelength Raman lidar	CARS	profiles of aerosol optical properties	Pilot 5: Pollution hotspots	At the usual fixed site	Lidar
Lunar photometer	CARS	column aerosol optical & microphysical properties	Pilot 5: Pollution hotspots	At the usual fixed site	Photometer
Ceiliometer 1	CARS	PBL height and cloud coverage	Pilot 5: Pollution hotspots	At the usual fixed site	Ceiliometer
Weather tower	Internal procedure	temperature, humidity, pressure, wind	Pilot 5: Pollution hotspots	At the usual fixed site	Meteorology
SMPS	ECAC/CAIS	PM1 size distribution	Pilot 3: Urban fine scale mapping including innovative modelling, monitoring, and crowdsourcing	At the usual fixed site	MPSS
ACSM	ECAC/CAIS	mass concentration Org, SO <sub>4</sub> , NO <sub>3</sub> , NH <sub>4</sub> , Cl	Pilot 1: Near-real time aerosol source apportionment of carbonaceous aerosols	At the usual fixed site	ACSM
Aethalometer	ECAC/CAIS	mass concentrationBC	Pilot 1: Near-real time aerosol source apportionment of carbonaceous aerosols	At the usual fixed site	Absorption Photometer
PM counter	Internal procedure	PM1, PM2.5, PM10	Pilot 5: Pollution hotspots	At the usual fixed site	OPSS
UV scanning depolarization lidar	CARS	source mapping, profiles of aerosol optical parameters	Pilot 5: Pollution hotspots	At a temporary site	Lidar
Ceiliometer 2	CCRES	PBL height and cloud coverage	Pilot 5: Pollution hotspots	At a temporary site	Ceiliometer
Wind lidar	CCRES	radial wind speed	Pilot 5: Pollution hotspots	At a temporary site	Wind lidar
PM counter	Internal procedure	PM10, PM2.5, PM1	Pilot 5: Pollution hotspots	At a temporary site	OPSS
Gas monitors	Internal procedure	concentration CO, NO <sub>x</sub> , O <sub>3</sub> , SO <sub>2</sub>	Pilot 5: Pollution hotspots	At a temporary site	Automatic gas monitors
Weather station	Internal procedure	temperature, humidity, pressure, wind	Pilot 5: Pollution hotspots	At a temporary site	Meteorology
Nano-particle counter	Internal procedure	number, surface, volume concentration, UFP mass range PM0.3	Pilot 3: Urban fine scale mapping including innovative modelling, monitoring, and crowdsourcing	Mobile	Naneos Partector
Mobile particle counter	Internal procedure	mass concentration of PM10, PM2.5, PM1	Pilot 3: Urban fine scale mapping including innovative modelling, monitoring, and crowdsourcing	Mobile	OPSS

## 2.2 QA/QC information sources

Measurements in the air quality pilot studies in RI-URBANS are related to four of the six ACTRIS components, namely, *in situ* aerosol and reactive trace gas measurements as well as aerosol and cloud remote sensing. Consequently, for each of these four fields QA/QC measures were defined and provided as described in the following.

### 2.2.1 In situ Aerosol Measurements

The responsible Topic Centre for the *in situ* aerosol measurements in ACTRIS is the Centre for Aerosol *In Situ* Measurements - European Centre for Aerosol Calibration and Characterization ([CAIS/ECAC](#)). Measurement guidelines for *in situ* aerosol measurements have been already defined by CAIS/ECAC and are provide to the pilot studies via the [ECAC web page](#). For mobile *in situ* aerosol measurements the guidelines are not defined yet and thus for the pilot studies it is recommended to follow the guidelines provided in the CAIS/ECAC publication:

Alas, H.D.C., Weinhold, K., Costabile, F., Di Ianni, A., Müller, T., Pfeifer, S., Di Liberto, L., Turner, J. R., and Wiedensohler, A. *Methodology for high-quality mobile measurement with focus on black carbon and particle mass concentrations*. Atmos. Meas. Tech., 12, 4697–4712, <https://doi.org/10.5194/amt-12-4697-2019>, 2019.

Part of the proposed QA/QC measures is that the *in situ* aerosol instruments used in a RI-URBANS pilot study are ideally calibrated at CAIS/ECAC before and after the pilot study. If this is not possible, for whatever reason, instruments should be regularly calibrated vs. a reference instrument at the sites. For OC & EC off-line analyses it is recommended to participate in inter-laboratory comparisons at JRC, Ispra. It is the responsibility of the operators at the pilot sites to conduct measurement quality measures and data quality should be checked using the near-real-time (NRT) data tool. The data shall be finally sent to

the *in situ* aerosol ACTRIS Data Centre Unit at NILU, Norway, where they will be flagged and automatically processed from level 1b to 2b.

### 2.2.2 *In Situ Trace Gas Measurements*

The responsible Topic Centre for the *in situ* reactive trace gas measurements in ACTRIS is the Centre for Reactive Trace Gases *In Situ* Measurements ([CiGAS](#)). Also for the reactive trace gases measurements guidelines are provided on the ACTRIS web page under [https://www.actris.eu/sites/default/files/Documents/ACTRIS-2/Deliverables/WP3\\_D3.17\\_M42.pdf](https://www.actris.eu/sites/default/files/Documents/ACTRIS-2/Deliverables/WP3_D3.17_M42.pdf).

Proposed QA/QC measures for the pilots are on-site calibration, and calibration standard information and schedule should be provided to CiGAS. Measurement quality has to be checked at site by the pilot studies. Data quality of the VOC measurements can be also checked by the pilot studies using the CiGAS check tool for VOC data (@VOC@, contact [stefan.reimann@empa.ch](mailto:stefan.reimann@empa.ch) for access and support) while running the campaigns. These data shall be ideally discussed during the annual CiGAS workshop on ACTRIS VOC data.

### 2.2.3 *Aerosol Remote Sensing*

The responsible Topical Centre for the aerosol remote sensing measurements in ACTRIS is the Centre for Aerosol Remote Sensing ([CARS](#)). Measurement guidelines for the aerosol remote sensing measurements are provided under: <https://intranet.actris.eu/index.php/s/9gsJLFjCcT3tSKN>.

Because of the size and complexity of lidar systems, CARS recommended for RI-URBANS no direct comparison with a reference lidar at CARS as measurement guideline, but instead that pilots provide QA/QC test data to be checked by CARS. Additionally, sample test data will be run through the Single Calculus Chain at the responsible ACTRIS Data Centre Unit for aerosol remote sensing data, ARES-DC at CNR, Italy. Thus, measurement and data quality will be checked through the built-in pre-processing modules of the Single Calculus Chain (automatic) at ARES-DC, but an additional final inspection by the pilot study operator is needed.

### 2.2.4 *Cloud Remote Sensing*

The responsible Topic Centre for the cloud remote sensing in ACTRIS is the Centre for Cloud Remote Sensing ([CCRES](#)). Although clouds are not a direct subject of investigation with respect to air quality, the atmospheric boundary layer heights, obtained by ceilometers, is and this parameter falls into the responsibility of CCRES. Measurement guidelines are again provided via the [ACTRIS web page](#).

As for the lidar systems, no direct comparison with reference instruments is recommended in RI-URBANS for the ceilometer measurements, but the pilots provide test data to be checked by CCRES. Doppler lidar scan schedules shall be confirmed with the cloud remote sensing Data Centre Unit CLU-DC at FMI, Finland. Measurement and data quality check (automatic) will be both performed by CLU-DC.

### **2.3 Future work**

The work started here will continue and eventually feed into the Deliverable D38 (D5.4) “Guidelines and training on AQ tools (source apportionment, mobile measurements, low cost sensors, citizen science) to be provided to Air Quality Monitoring Networks (AQMNs) at the end of this project.