

# **EARLINET/ACTRIS NRT campaign during COVID-19 crisis**

## **Guidelines for participating stations**

### **Scope of the campaign:**

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This campaign is organized as part of the ACTRIS initiative for studying the changes in the atmosphere during the COVID-19 lockdown. Two types of data will be issued:

- **Near-real-time data**, partially quality-assured – to allow fast analysis of the status of the atmosphere. This data will be used to provide weekly reports to ACTRIS. No manual check by the PI is performed. No centralized QC on data products is performed. Quicklooks and reports will be made public, with no credentials. Data download will be password protected.
  - Timeframe: during the campaign
  - Responsible for the reports: WG on lidar data analysis
- **Re-analysis data**, fully quality-assured – to identify possible changes compared to similar periods in previous years. This data will be used to perform extended studies referring to the COVID-19 impact on the atmosphere. Manual check by the PI is performed. QC on data products performed in a centralized way. Data is published in the ACTRIS Data Portal.
  - Timeframe: after the campaign
  - Responsible for the study: representatives of the WG on lidar data analysis, in coordination with other ACTRIS groups

In parallel, the lidar community is invited to elaborate its own studies based on the re-analysis data. Several publications referring to the COVID-19 impact on the atmosphere will be coordinated by the WG on lidar data analysis.

### **Participants:**

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All lidar stations that are able to operate during the lockdown are invited to participate in the campaign. **In order to register to the campaign, please send a message to [Doina Nicolae](#) and [Lucia Mona](#) by 30 April 2020.** You will receive a link to input the necessary information about the setup of your station.

The stations should follow the general rules described in this document. However, exceptions can be made in particular cases. Please contact us if you have doubts or if we can help in any way.

### **Contacts:**

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- **Campaign:** [Doina Nicolae](#), [Lucia Mona](#)
- **QA tests:** [Volker Freudenthaler](#)
- **SCC configuration:** [Giuseppe D'Amico](#)

### **General documents storage:**

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Information about the campaign and related documents will be accessible via EARLINET's website starting on 30 April 2020: <https://www.earlinet.org/index.php?id=covid-19>.

## Campaign period:

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- **Preparation:** 26-30 April 2020
  - Preparation and check-up of the instrument
  - SCC configurations decided and reported
  - QA tests performed and submitted
  - (Test) measurements submitted to SCC
- **Pre-campaign:** 1-7 May 2020
  - Measurements submitted to SCC
  - Adjustments of the SCC configurations (if necessary)
- **Campaign:** 8-31 May 2020
  - Regular submission of measurements to SCC, fixed configuration

Note: In case no problems are identified during the preparation, a station can start the submission of the regular measurements already in the pre-campaign period.

## Measurement schedule:

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Lidar stations should perform measurements each day, as often as possible. **At minimum, the following time intervals must be covered:**

- **2h continuous measurements at noon**, after the full development of the PBL
- **2h continuous measurements at nighttime conditions**, allowing good Raman measurements

## Measurement setup:

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### Instrument QA

The instrument should be checked for alignment, stability and noise before the experiment. The settings of the instrument should be optimized as possible before the campaign (E.g. during the Preparation period).

The settings should remain unchanged during the campaign, to allow the use of the same SCC configurations.

### QA measurements

If possible, **a full set of QA tests** (telecover, Rayleigh-fit + dark-measurement, polarization calibration) **should be performed during the preparation period (26-30 April)**, and uploaded to your Sync+Share folder following the usual QA-procedures. **Please inform [Volker Freudenthaler](#) when the QA tests are ready to be checked.**

If you don't have a Sync+Share folder for your lidar yet, or if you forgot how to use it, please send an email to [Volker Freudenthaler](#). In case it is not possible to perform the QA-tests now, the most recent available set should be uploaded, or, if it is already there, indicated as currently valid. When it will be possible again (e.g. relaxation of the lock-down rules), the QA tests should be performed and uploaded as soon as possible in order to certify the current status of the lidar.

The QA tests will be used by CARS to check the status of the instrument (full overlap, dynamic range) and to calculate the polarisation calibration factor. In case you don't know the GHK-parameters of your polarisation channels, this could be a good time to get started; please contact [Volker Freudenthaler](#) in this regard.

The guidelines for QA tests, including the format of the submission data files are [enclosed](#).

**Dark measurements** of the analogue channels: If it is necessary to subtract the dark-measurement from the analogue signals, it must be performed immediately before or after each normal measurement - with sufficient averaging time in order to reduce the additional noise. If the dark-signals do not disturb the glued signals, the dark-measurement should be performed as often as possible in order to confirm that there is no disturbance. The most recent measurement should always be reported together with the datasets.

The **telecover** measurements should have sufficient averaging time, especially for the Raman channels, where the influence of the overlap is most important. We recommend at least 2 min per sector. In case of strong changes in the PBL, you can make several rounds N1, E2, S2, W1, N2, E2, ....., Wn, Nn+1 and store them in successive columns in the data file.

A **Rayleigh-fit** measurement is necessary to verify the far-range alignment of the laser, to assess the uncertainty of the Klett-reference value, and to check the background subtraction range. Therefore, the averaging time should be 1800 sec at least, and the averaging time must be reported in the header of the Rayleigh-fit file. This measurement is only necessary once if the lidar alignment is mechanically stable.

**The polarization calibration measurements** should be done as often as possible (ideally for every cycle the lidar is switched on) and reported together with the datasets following the SCC-procedure. As a Rayleigh-signal (without aerosol in some range) is necessary to calculate the molecular LDR using the retrieved polarization calibration factor, the measurements are ideally performed together with the Rayleigh-fit measurement. However, any "good" measurements with any aerosol-free range and sufficient averaging time is ok. The averaging time for the calibration measurements should be in the order of 5 min each.

#### **Data processing:**

For the purpose of this experiment, **the use of the SCC is mandatory**. Only data processed by the SCC will be used in this study.

#### **Data submission:**

Lidar data should be pushed to the SCC in **max. 12 h after the end of each measurement**. Datasets should be submitted in **packages of 2h profiles**.

The measurement ID should be set according the format: YYYYMMDDcccHHMM

*where YYYYMMDD HHMM is the start date time (UTC) and ccc is the SCC station code (for example 20200410pot1500)*

To allow data processing in NRT, the SCC calculation of the Rayleigh atmosphere should be configured to use the standard atmosphere (as no other of the current implemented options are available for all the

participant stations in NRT). As a consequence, the variable *Molecular\_Calc* (int the SCC raw input file) should be set to 0 (*Molecular\_Calc=0*).

Once the data from the stations are submitted to the SCC, the corresponding SCC optical products will be made available through a THREDDS server (see below) automatically. **No action from the PI is expected.**

Note: At a later stage (when CLOUDNET modeled data will be available for all stations), the entire dataset from the campaign will be re-processed centrally by the Data Centre (ARES (Aerosol remote SEnsing) unit to improve the molecular calculation. No action from the PI will be necessary .

### Configuration of the SCC

Each station should use max. 2 configurations (daytime and nighttime) **to not be changed during the campaign**. For lidars with polarization capabilities also a depolarization configuration should be used. **Please inform [Giuseppe D'Amico](#) when the configurations are ready to be checked.**

For the purpose of harmonizing the aerosol products, the SCC will run with the same general parameters for all products:

- **Elastic backscatter/Elastic backscatter and depolarization ratio**
  - min height: lidar full overlap height
  - max height: 15 km
  - detection limit:  $1e-7 \text{ m}^{-1}\text{sr}^{-1}$
  - preprocessing integration time: 3600 s
  - preprocessing vertical resolution: 60 m
  - low range and high range error thresholds: 50%
  - Elastic backscatter method: Klett
  - Backscatter calibration option: ID:25 5-15km, window: 500m, calibration value: 1.0
  - Error method: monte carlo
  - Monte Carlo iteration count: 30
  - Lidar ratio input method: fixed
  - Fixed Ir: climatological value at the station (35 ... 65 sr)
  - Fixed Ir error: climatological value at the station (10 ... 20 sr)
  - Min ratio for PLDR: 1.1
- **Raman backscatter/Raman backscatter and depolarization ratio**
  - min height: minimum reliable height for the elastic/Raman ratios
  - max height: 15 km
  - detection limit:  $1e-7 \text{ m}^{-1}\text{sr}^{-1}$
  - preprocessing integration time: 3600 s
  - preprocessing vertical resolution: 60 m
  - low range and high range error thresholds: 50%
  - Raman backscatter method: via backscatter ratio
  - Backscatter calibration option: ID:25 5-15km, window: 500m, calibration value: 1.0
  - Error method: error of the used method
  - Min ratio for PLDR: 1.1
- **Extinction only/lidar ratio**
  - min height: lidar full overlap height

- max height: 15 km
- detection limit:  $5e-6 \text{ m}^{-1}$
- preprocessing integration time: 3600 s
- preprocessing vertical resolution: 60 m
- low range and high range error thresholds: 50%
- Extinction method: non-weighted linear fit
- Error method: error of used method
- Angstrom: 1

The PI should make sure that these values are considered in the system configurations.

Note: CARS and ARES may adjust the configurations in order to optimize the retrievals. We recommend the PI to back-up initial configurations and the corresponding products.

#### Data products and availability:

The SCC products will be made available in NRT through the **THREDDS server**. These products will be accessible using the same credentials valid for the accessing the EARLINET database.

**Lidar quicklooks** available at: <https://quicklooks.earlinet.org/>

**Aerosol optical products** (<https://login.earlinet.org:8443/thredds/catalog/covid19/catalog.html>)

- Particle elastic backscatter profiles (daytime measurements)
- Raman backscatter and extinction profiles (nighttime measurements).
- Particle/volume depolarization ratio profiles (if applicable).

New credentials can be obtained by registering at <https://data.earlinet.org>.

At their convenience, the **PIs will be asked to check the re-analysis data** at their site and select the ones considered as reliable and upload on the EARLINET database. The availability of the re-analysis data will be announced by the organizers.

Additional “experimental data products” may be produced as agreed by the ACTRIS WG on data analysis, such as:

- Aerosol microphysical properties from collocated lidar-photometer measurements
- Aerosol layer parameters (boundaries, type)

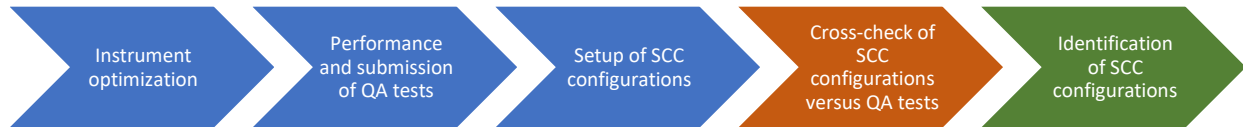
#### Responsibility chains

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##### Color codes:

	Lidar PI
	CARS
	ARES
	Working Group

#### Preparations (26-30 April 2020)



### Pre-campaign and Campaign (1-7-31 May 2020)



### Analysis (1-31 May 2020 and beyond)

To be defined by the Working Group on data analysis, in coordination with the ACTRIS WG on COVID19 lockdown.