# BAQUNIN and QA4EO

BAQUNIN TEAM and friends

**https://www.baqunin.eu/**

## QA4EO WPs

- **ACIX/CIMIX**: CBH+CF from Sky-Cameras and Lidar Data. *Brockmann, NASA-GSFC, Sapienza, Serco*
- **Lunar**: retrieval of trace gases and AOD from night-time (Lunar) PGN, AERONET and EUBREWNET measurements. ARPA VdA, LuftBlick, Sapienza, CNR-ISAC, Serco

## Scientific collaborations

- Impact of $NO_2$ concentrations on AOD retrieval quality, Institute for Environmental Research & Sustainable Development, NOA, Greece, *Ioannis Panagiotis Raptis*
- Sea Breeze and Urban air quality, University of Reading, UK, *Carlo Cafaro*
- Aerosol retrieval from Pandora Almucantar measurements, LuftBlick, Austria, *Axel Kreuter*
- Enhanced GRASP retrieval of aerosols using Lidar, AERONET and PGN data (DIVA style), CNR-ISMAR, Italy, *Gianluigi Liberti*
- Retrieval of $NO_2$ profiles from Pandora Sky Measurements, Virginia Polytechnic Institute and State University, USA, *Elena Spinei Lind*
- Retrieval of AOD from AERONET measurements using SKYNET-Europe processors, University of Valencia, Spain, Victor Estelles

# BAQUNIN instruments involved in QA4EO Work Packages

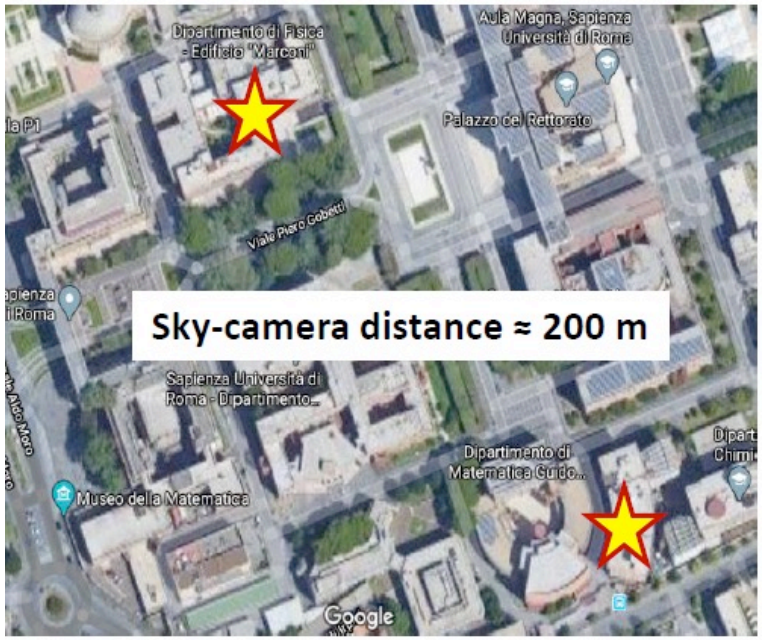
| Instrument | Site | Status | QA4EO WP |
|---|---|---|---|
| PANDORA #115 | CNR-ISAC | Maintenance | ***Lunar*** |
| PANDORA #117 | APL | Operational | ***Lunar*** |
| PANDORA #138 | CNR-IIA | Maintenance | ***Lunar*** |
| PYRANOMETER | APL | Operational | |
| SKY-CAMERA ESA | APL | Testing | ***Lunar*** |
| SKY-CAMERA #1 NASA | APL | Testing | ***ACIX/CMIX*** |
| SKY-CAMERA #2 NASA | APL | Testing | ***ACIX/CMIX*** |
| BREWER #067 | APL | Operational | ***Lunar*** |
| METEO-STATION Sap | APL | Operational | |
| MWL-LIDAR | APL | Operational | ***ACIX/CMIX + Lunar*** |
| MFRSR | APL | Testing | |
| SODAR | APL | Operational | |
| CIMEL | APL | Operational | |
| POM-PREDE 01 upgraded Lunar | APL+campaigns | Testing | ***Lunar*** |
| POM-PREDE 01 | APL | Operational | |
| POM-PREDE 02 Lunar | APL | To be procured | ***Lunar*** |
| MICROBAROMETER | APL | Operational | ***Lunar*** |
| AIR QUALITY STATION #1376 | APL | Testing | ***Lunar*** |
| AIR QUALITY STATION #1379 | APL | Testing | ***Lunar*** |
| WEBCAM Sard.Clim. | APL | Operational | |
| METEO-STATION Sard.Clim. | APL | Operational | |
| CEILOMETER (RAP) | APL | Testing | ***ACIX/CMIX + Lunar*** |
| CEILOMETER (SAP) | CNR-IIA | Maintenance | ***ACIX/CMIX + Lunar*** |

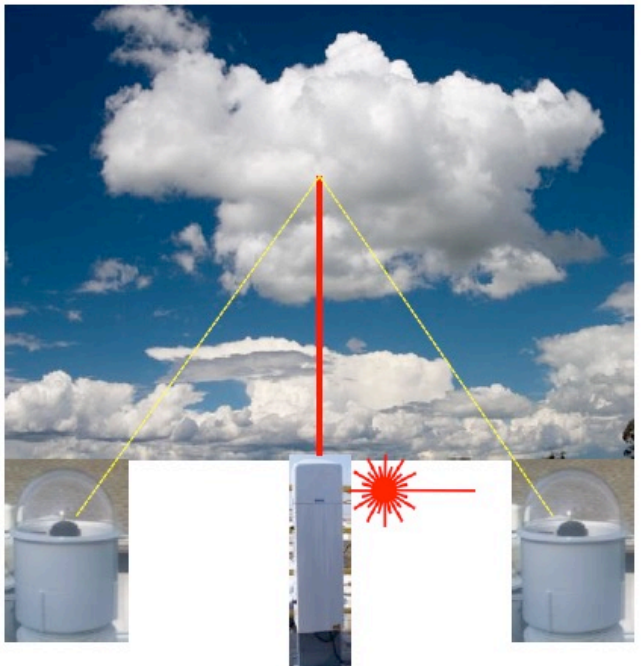
# QA4EO ACIX/CMIX WP

From last QA4EO WS (pre-pandemic) …

**Retrieval of cloud mask, cloud bottom height and, possibly, wind speed at cloud bottom using two sky-cameras and a ceilometer**

Sky-cameras will be installed on the roof of Marconi and Fermi building of Physics Department
Ceilometer will be installed and operated on the roof of Fermi building



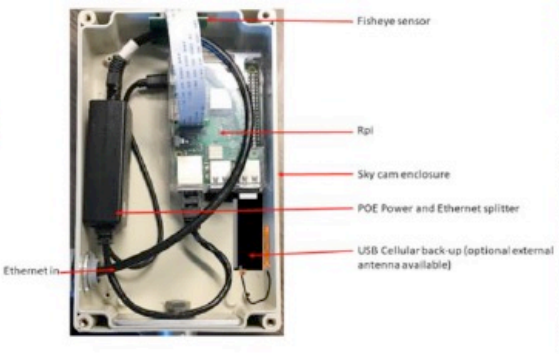
# QA4EO ACIX/CMIX WP

## Automatic Lidar - Raymetrics Aerosol Profiles (APL)


*Figure 1 System Overview*


*Figure 4 Enclosure*

## SkyCams – NASA-GSFC (APL)



# QA4EO ACIX/CMIX WP

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## Automatic Lidar - Raymetrics Aerosol Profiles (APL)


Figure 1 System Overview

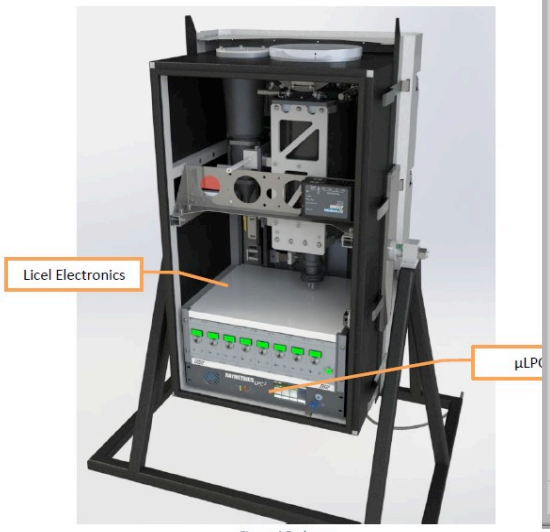
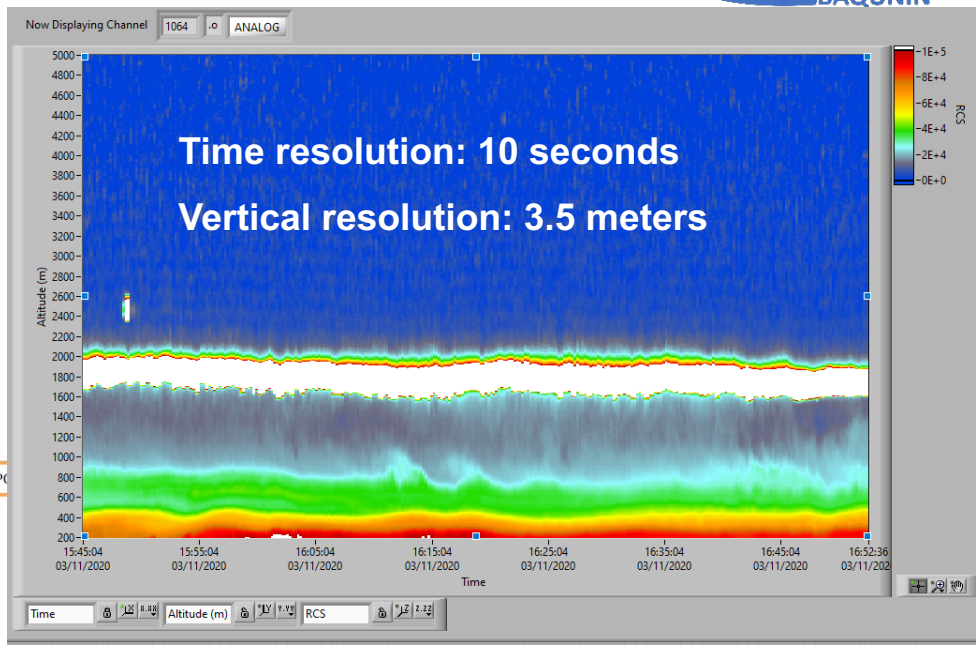



Figure 4 Enclosure

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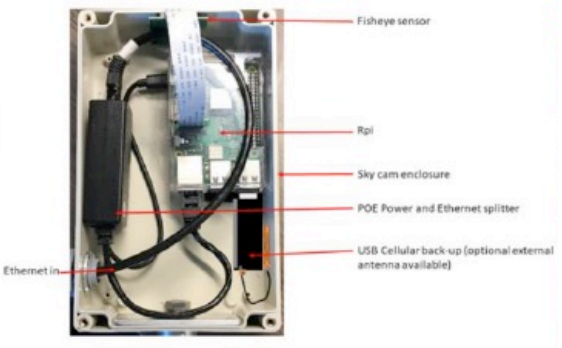

# QA4EO ACIX/CMIX WP

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## Automatic Lidar - Raymetrics Aerosol Profiles (APL)


Figure 1 System Overview


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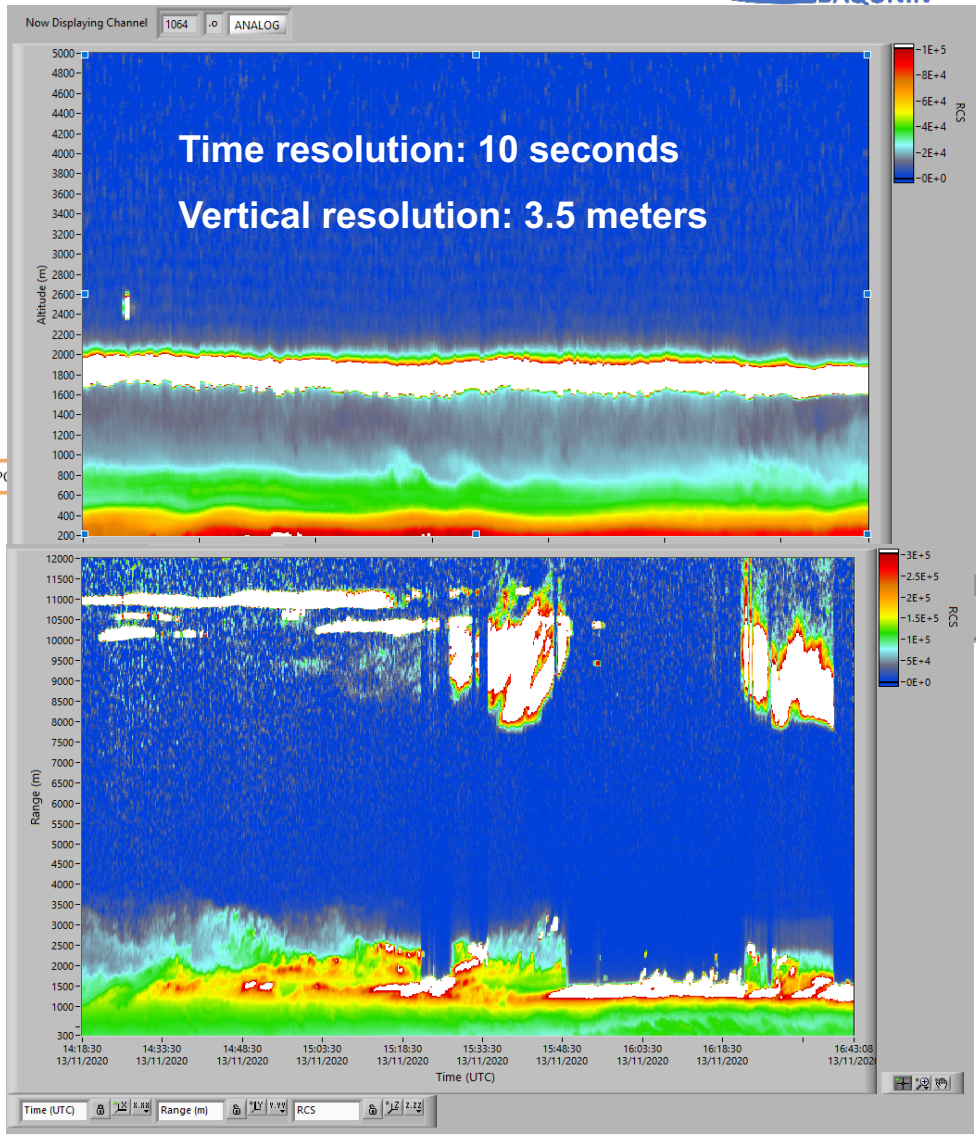


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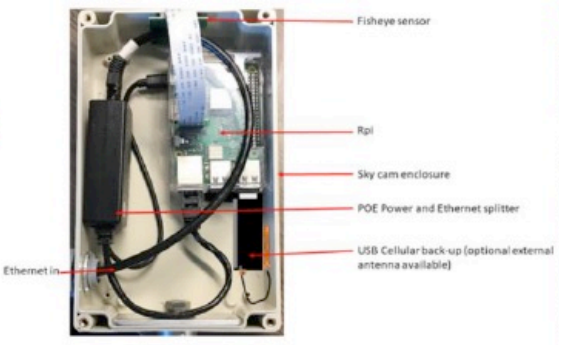


# QA4EO "Lunar" WP

Objectives:

- To develop retrieval techniques for the analysis of nocturnal (lunar) aerosol and trace gases loads using ground based photometer and spectrometer measurements
- To pre-operationally retrieve and disseminate nocturnal (lunar) aerosol and trace gases products
- To validate satellite products retrieved from nocturnal (eclipsed) orbit measurements (e.g. from TIR, Aeolus, EarthCare)
- To investigate the day-night transition of photo-chemically active species

**Consortium:** Sapienza, Serco, CNR-ISAC, LuftBlick, ARPA Valle d'Aosta

**Task 1**: Instrumental set-up, operation/maintenance of lunar photometer (Lead: CNR-ISAC)

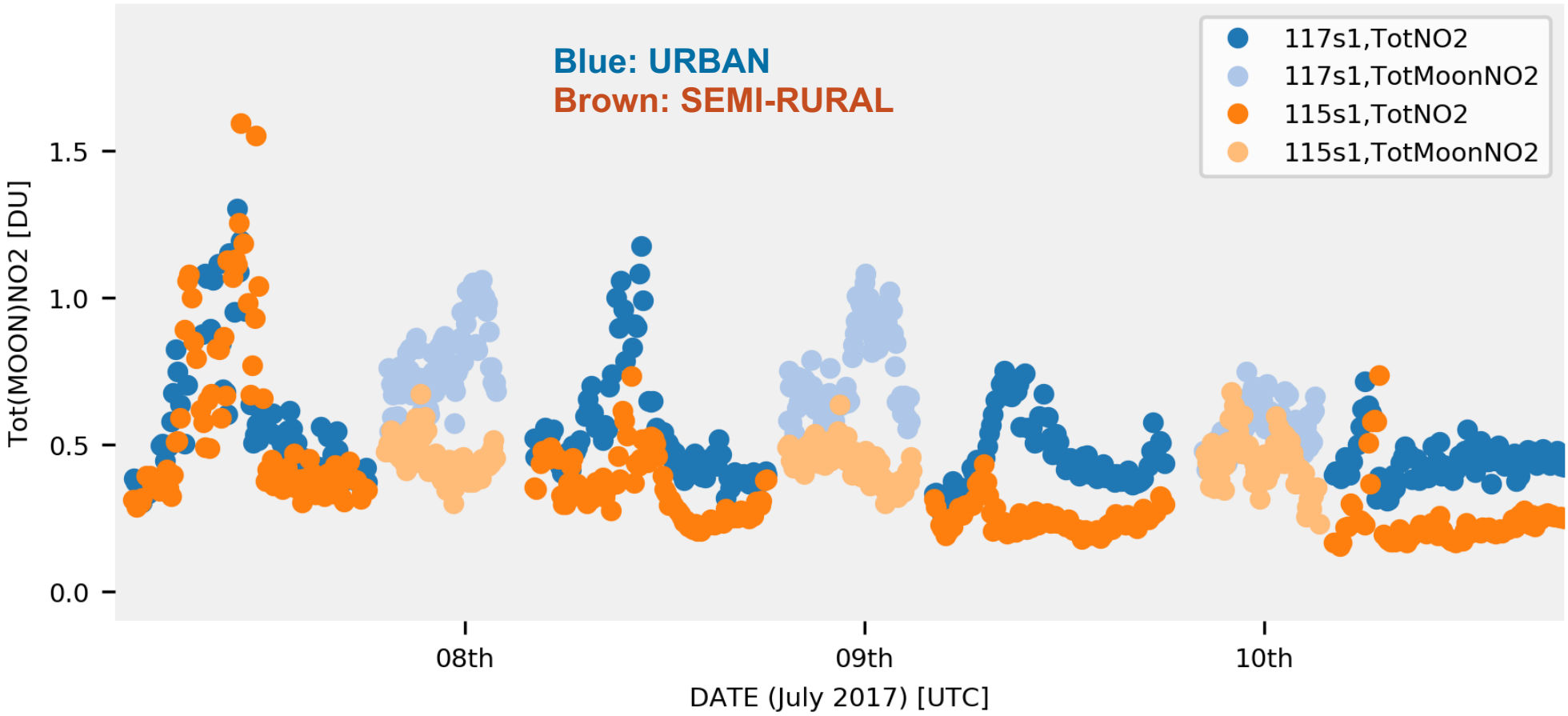
**Task 2**: Pandora lunar trace gas data production (Lead: LuftBlick)

**Task 3**: Brewer lunar trace gas and AOD data production (Lead: ARPA-Valle d'Aosta)

**Task 4**: Outreach (All)

# QA4EO "Lunar" WP

Example of DAY+NIGHT $NO_2$ Total Column from Pan#117 and Pan#115 from July 7th to July 11th 2017 (LuftBlick, test data)
Dark colours: Direct Sun (daytime)
Light colours: ***Moon*** (night-time)



# QA4EO "candidate" WP

## Impact of $NO_2$ total column on AERONET AOD 440nm retrieval

I.P. Raptis (NOA), S. Kazadzis (PMOD)

If not properly accounted for, $NO_2$ absorption in the 400-490 nm spectral region can introduce SIGNIFICANT OVERESTIAMATION of aerosol optical depth (AOD) from both Space and Ground based measurements.
**Impacted Aerosol Parameters**: AOD (440nm), Angstrom Exponent (UV-VIS)

AERONET baseline: OMI NO2 climatology
TROPOMI (S5p-Innovation) baseline: no correction!

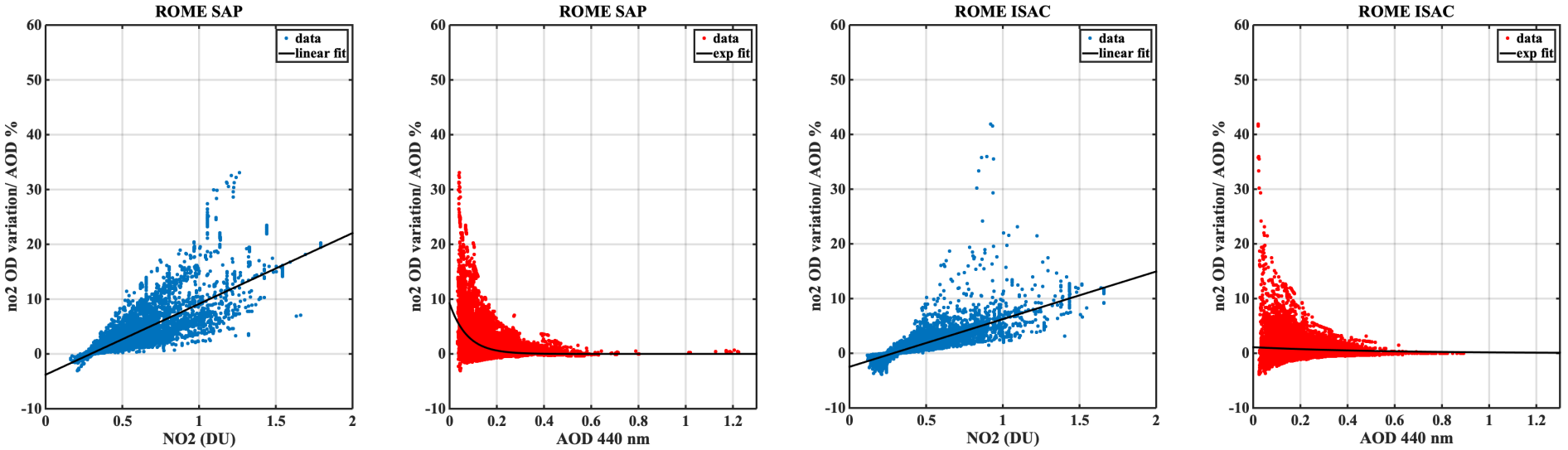
Using BAQUNIN PGN and AERONET data, NOA performed a sensitivity test:

- Level 1.5 AOD @440nm from APL and CNR-ISAC AERONET stations
- PGN $NO_2$ average of high quality data ±10 minute around AERONET measurement
- New AOD (AER_PGN) vs. original (AER_PGN)

Next slide: (AERONET-AER_PGN)/AERONET vs. PGN $NO_2$ (blue) and AERONET (red)

# QA4EO "candidate" WP

## Influence of $NO_2$ total column on AERONET AOD 440nm retrieval




Preliminary results show that, in **urban** environment (Rome), the OMI $NO_2$ climatology is not sufficiently accurate: AOD < 0.2 can be significantly overestimated depending on $NO_2$ load.

**Further studies are needed: new QA4EO WP?**

## Scientific articles submitted to peer journals

- Aerosol characteristics in urban environment and impact on UV index (AMT)
- VIEPI campaign (Sustainability)
- Impact of sea-breeze on urban aerosol and pollution (Urban Climate)
- Pandora NO2 reduction during Italian lockdown (AMT)

## Scientific articles in preparation

- Gas and aerosol properties during EMERGE flights
- AerLocus: regional analysis of air quality from different data sources
- SODAR characterisation and uncertainty assessment
- SODAR-PANDORA data analysis for urban NO2 fluxes estimation

**Post-doc (possibly during 2021): Mariela Lucía Aguilera Sammaritano,**
**Instituto de Altos Estudios Espaciales Mario Gulich/CONAE, Argentina**

Scientific objectives:

- Detection of smoke plumes over the city of Rome
- Analysis of transport of pollutants from near (close to the city) and far (trans-continental) ranges
- Impact of fire smoke plumes of Tropospheric and Urban Boundary Layer (UBL) air quality

# Thank you for your attention!

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