The Boundary-layer Air Quality-analysis Using Network of Instruments (BAQUNIN) Super-Site for Satellite Atmospheric Chemistry Products Validation

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3) EUMETSAT
4) CNR-ISAC
5) ARPA Valle d'Aosta, Saint-Christophe, Aosta
6) ESA/ESRIN

BAQUNIN Super-Site

Context: IDEAS+ support contract (ESA/ESRIN SPPA) and PANDONIA project (ESA)

Purpose: Joint instrumental suite for validating the satellite atmospheric composition and optical products (level 2), and for Planetary Boundary Layer (PBL) studies.

Super Site concept: Ground based active and passive remote sensing instruments are operating in synergy, offering quantitative and qualitative information for a wide range of atmospheric parameters for atmospheric chemistry (satellite) validation activities and Planetary Boundary Layer (PBL) studies

BAQUNIN Super-Site

BAQUNIN Super-Site Data

The atmospheric data acquired during BAQUNIN lifetime will be made available to the scientific community, and will contribute to the validation of the aerosol and tropospheric trace gases products produced by the Copernicus Sentinel-5p, Sentinel-4 and Sentinel-5 and by the ESA Third Party Missions (TPM), such as the Ozone Monitoring Instrument (OMI).

The list of the BAQUNIN Super Site instrumentation comprises:

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- **CIMEL** photometer
  H2O, AOD
  [340, 380, 440, 500, 675, 870, 1020] nm

  Aeronet Network
  http://aeronet.gsfc.nasa.gov/

The list of the BAQUNIN Super Site instrumentation comprises:

- **CIMEL** photometer
- **PANDORA 2S** Spectrometer

  [290 - 900] nm

  O_3, NO_2

  (Other trace gases, H_2O, AOD)

PANDORA 2S #115

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- **CIMEL** photometer
- **PANDORA 2S** Spectrometers

  [290 - 900] nm

  O_3, NO_2

  (Other trace gases, H_2O, AOD)

Pandonia Network

http://www.pandonia.net

PANDORA 2S #117

The list of the BAQUNIN Super Site instrumentation comprises:

- **CIMEL** photometer
- **PANDORA 2S** Spectrometers
- **POM 01 L PREDE** sun-sky radiometer

  [340, 400, 500, 675, 870, 940, 1020] nm

  Aeorosols:

  Optical depth

  Angstrom coefficient

  Volume size distribution

  Asymmetry factor

  Refractive index

  (Column amount of H2O)

  Euroskyrad network

  http://www.euroskyrad.net/

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- **PANDORA 2S** Spectrometers
- **POM 01 L PREDE** sun-sky radiometer
- **M**ulti **F**ilter **R**otating **S**hadow-band **R**adiometer

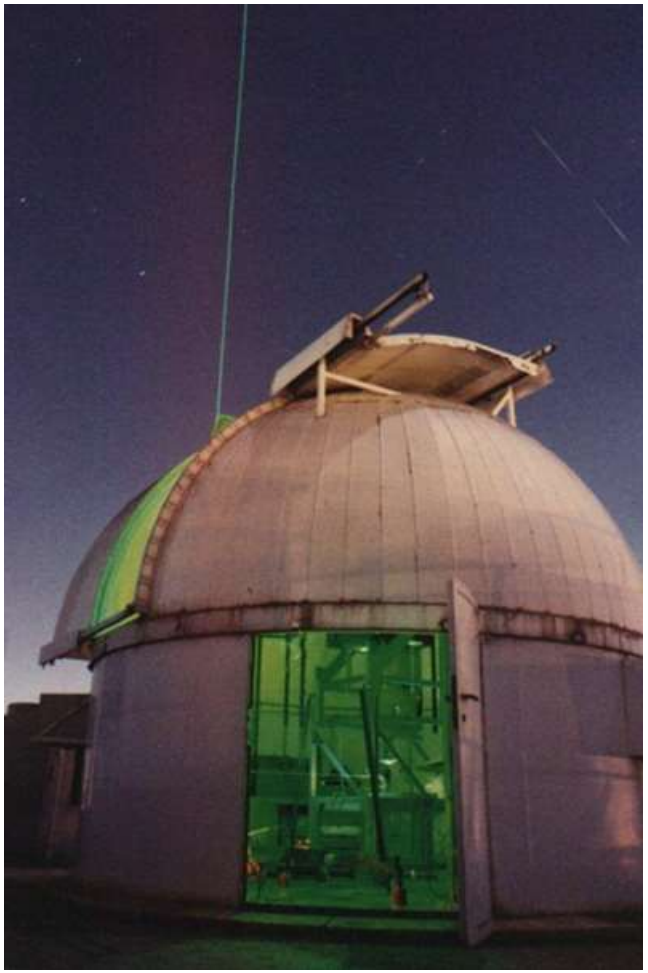
  AOD [496, 624, 670, 878] nm

  (O_3, H_2O)

  Integration time 1 min

The list of the BAQUNIN Super Site instrumentation comprises:

- **CIMEL** photometer
- **PANDORA 2S** Spectrometers
- **POM 01 L PREDE** sun-sky radiometer
- **MFRSR** radiometer
- **LIDAR**, Raman and elastic
  (total and parallel polarization)
  [355, 532, 1064] nm
  Day/night measurements
  Aerosol and H_2O profiles
  Top and bottom heights of clouds
  Vertical resolution 7.5 m
  Integration time ≥ 1 min



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- **MFRSR** radiometer
- **LIDAR**, Raman and elastic
- **SODAR**

  Day/night measurements

  Wind speed and direction profiles in PBL

  Vertical resolution 1.5 m

  Integration time ≥ 1 sec

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- **CIMEL** photometer
- **PANDORA 2S** Spectrometers
- **POM 01 L PREDE** sun-sky radiometer
- **MFRSR** radiometer
- **LIDAR**, Raman and elastic
- **SODAR**
- **BREWER** spectrophotometer

  O_3, NO_2

  EuBrewnet

  http://rbcce.aemet.es/eubrewnet

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- **POM 01 L PREDE** sun-sky radiometer
- **MFRSR** radiometer
- **LIDAR**, Raman and elastic
- **SODAR**
- **BREWER** spectrophotometer
- **PYRANOMETER** radiometer
  [290 -3000] nm

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- **POM 01 L PREDE** sun-sky radiometer
- **MFRSR** radiometer
- **LIDAR**, Raman and elastic
- **SODAR**
- **BREWER** spectrophotometer
- **PYRANOMETER** radiometer
- **YES** broad-band UV radiometer
  UV radiation
- **Meteorological** sensors
  Air temperature and relative humidity

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- **YES** broad-band UV radiometer
- **Meteorological** sensors

Rural

Urban

CIRAS (CNR Isac Rome Atmospheric Supersite) Tor Vergata

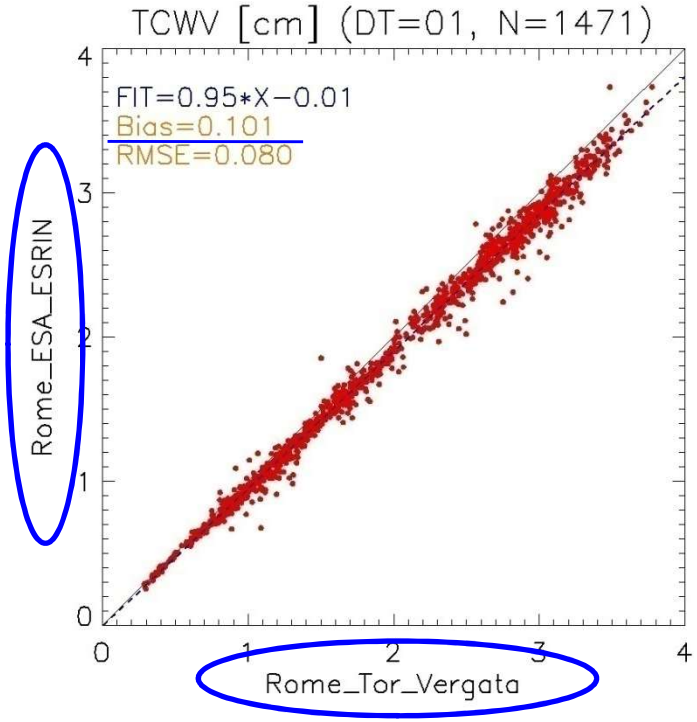
CIRAS website:
http://www.isac.cnr.it/it/infrastrutture/ciras-cnr-isac-rome-atmospheric-supersite

Water Vapor Total Column amount

CIMEL photometers

CIMEL data: http://aeronet.gsfc.nasa.gov/

Time lag ≤ 1 min



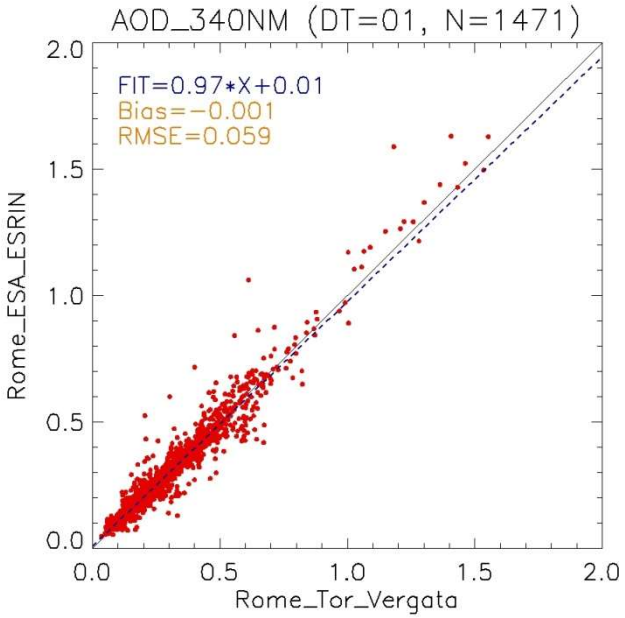
Location altitude:

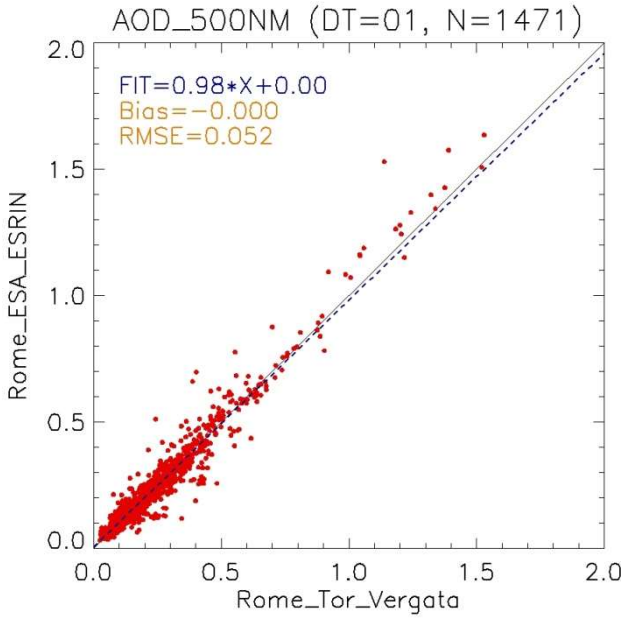
- ESA/ESRIN 200m
- CNR 130m

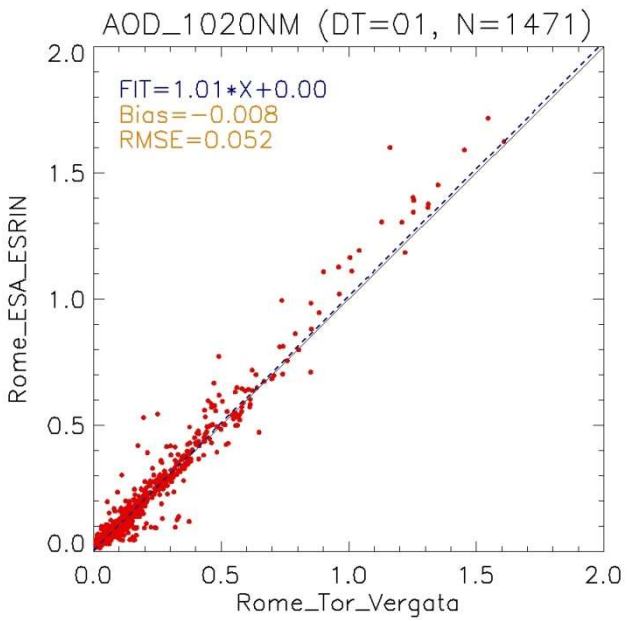
Aerosol Optical Depth
CIMEL photometers

CIMEL data: http://aeronet.gsfc.nasa.gov/

Rural



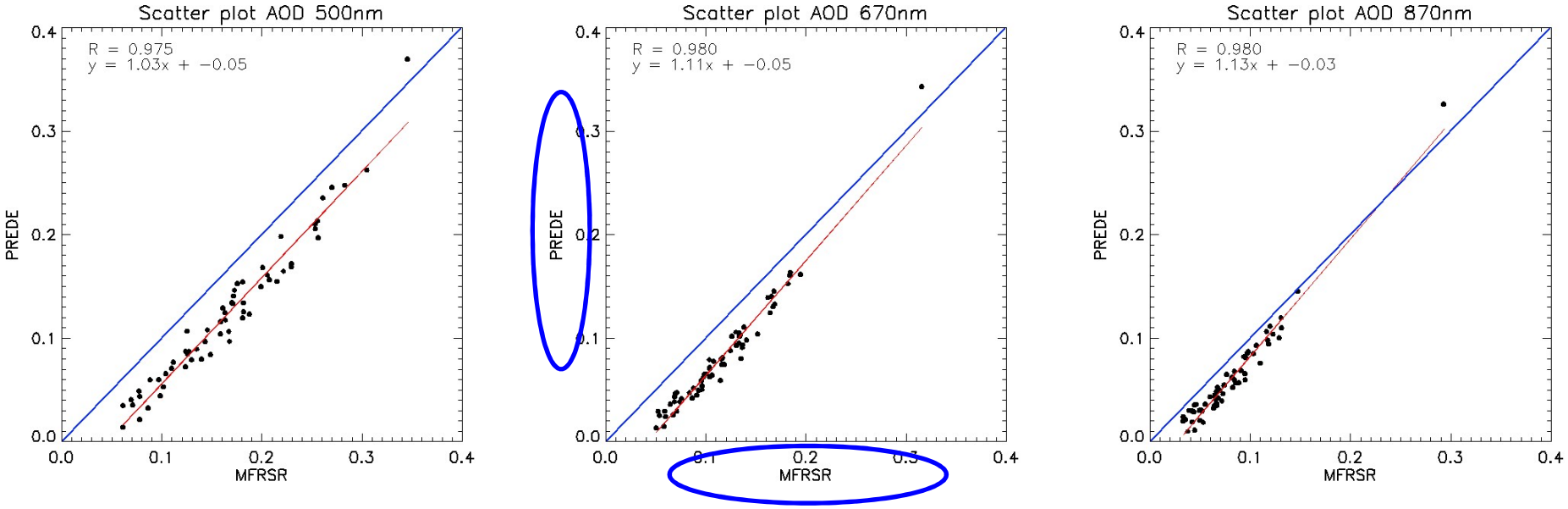




Aerosol Optical Depth

MFRSR/Prede radiometers

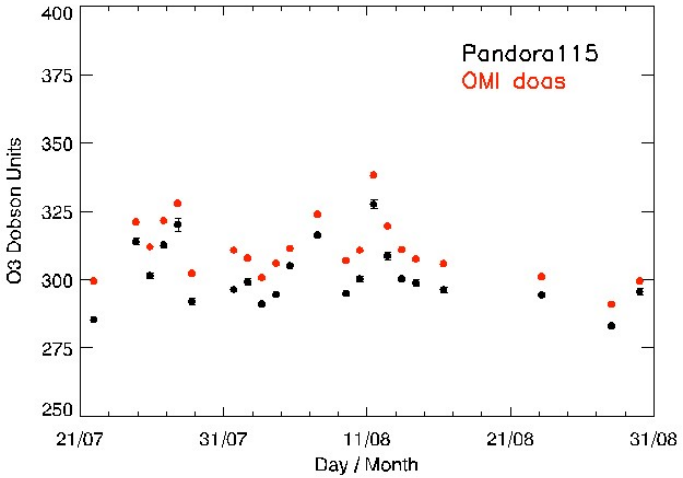
Urban

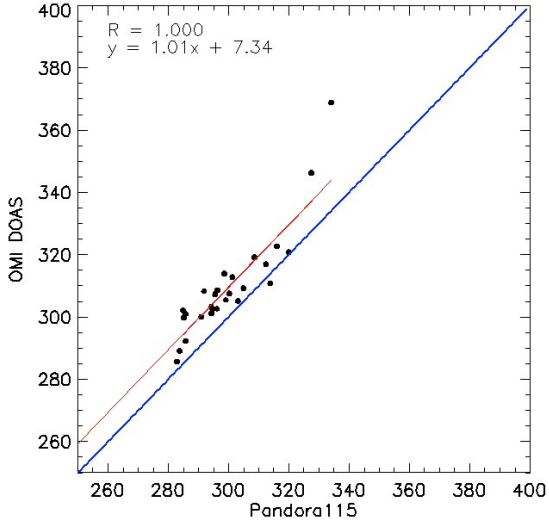


O3 total column amount

OMI data: giovanni.sci.gsfc.nasa.gov

Rural





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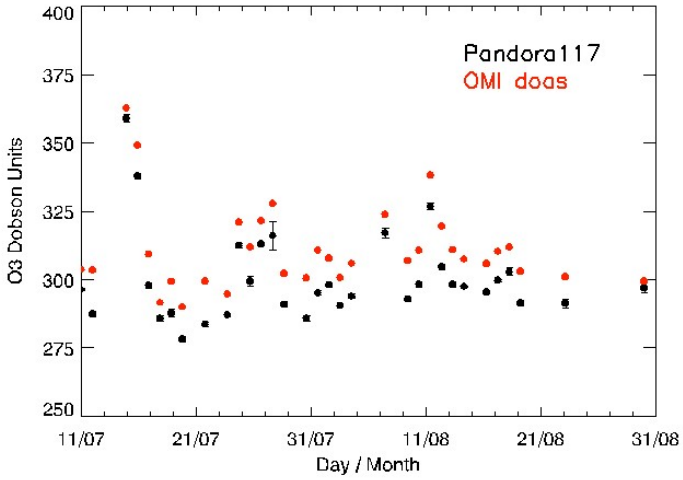
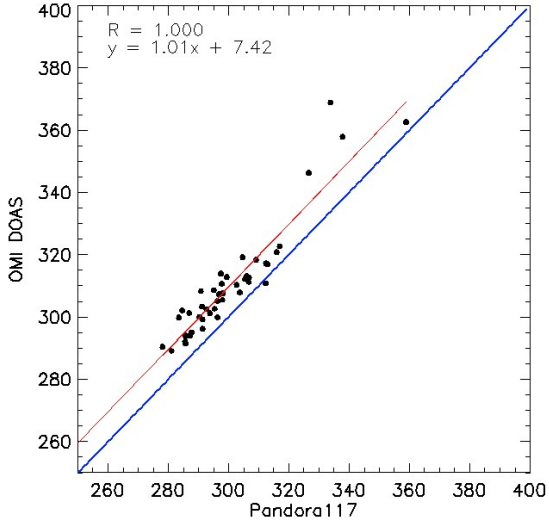
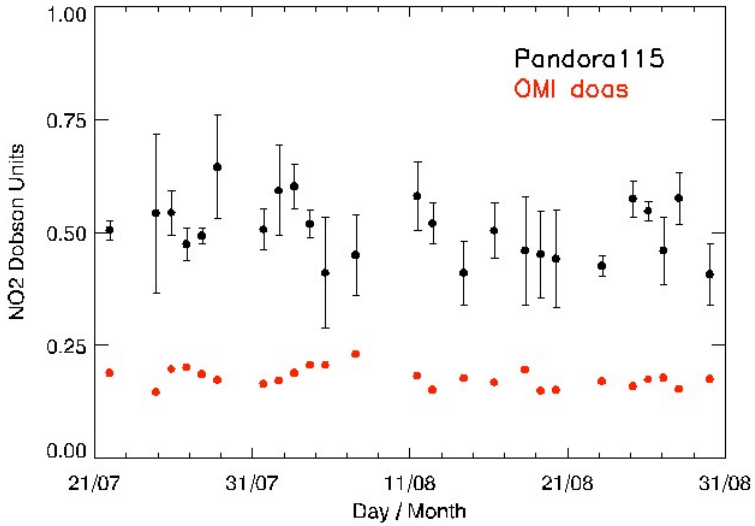




NO2 total column amount

OMI data: giovanni.sci.gsfc.nasa.gov

Rural



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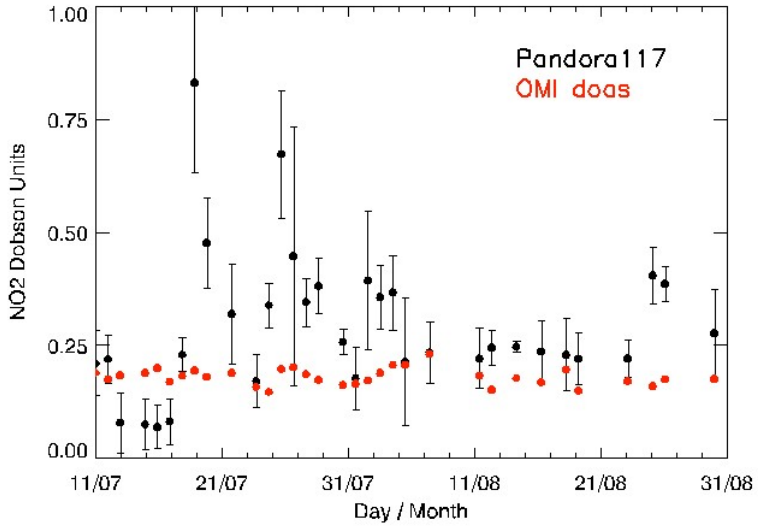
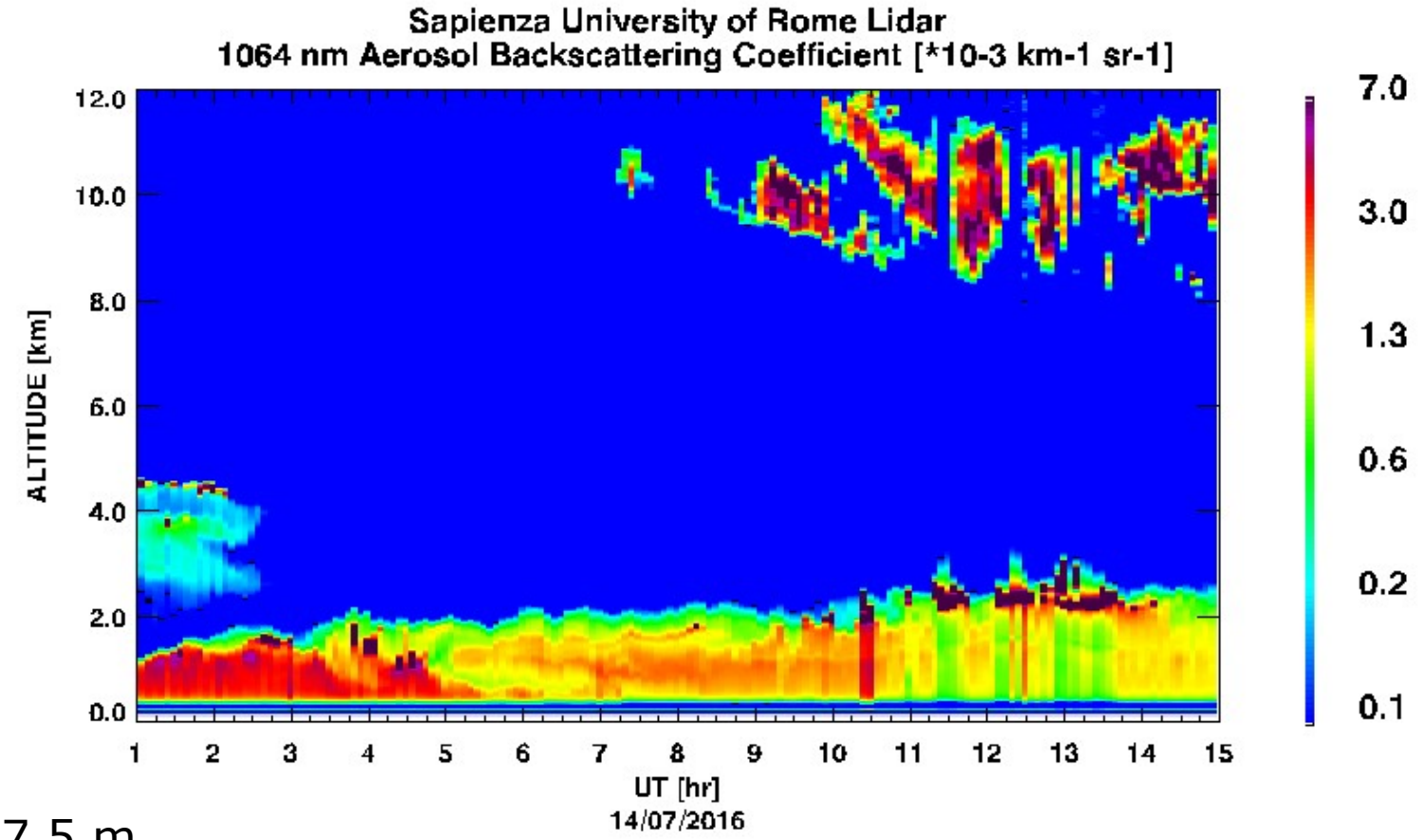


Aerosol Backscattering coefficient profiles

Elastic LIDAR system

Urban

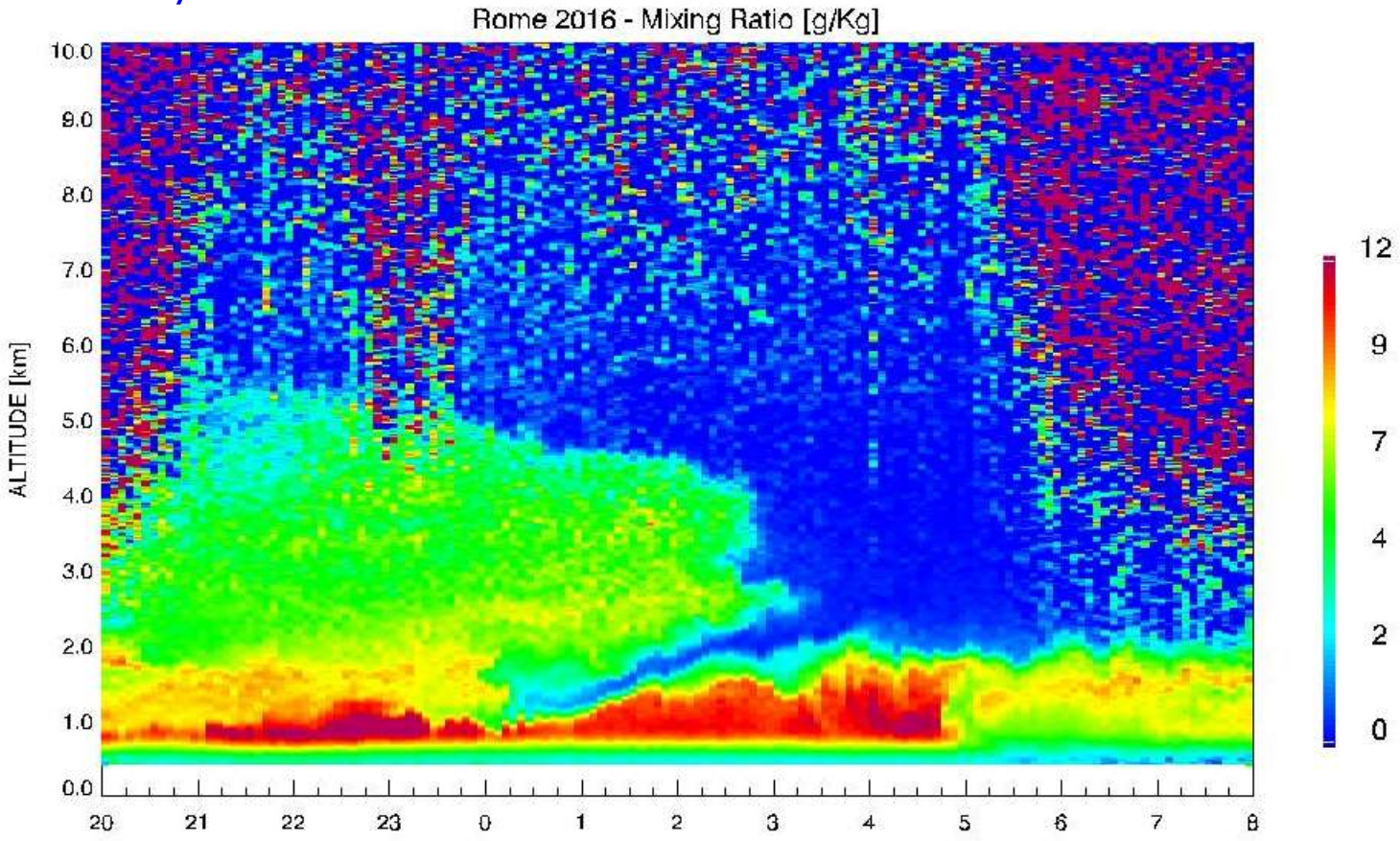


Δz = 7.5 m
Δt = 5 min

Water vapor mixing ratio profiles

Raman LIDAR system

Urban



$\Delta z = 7.5$ m

$\Delta t = 5$ min

BAQUNIN Super-Site

Strategy for Satellite Validation

- All instruments (except Lidars) operate continuously
- Synchronisation of Lidar acquisitions with Satellite(s) overpass (2 hours before and after overpass time)
- Pandora operated in order to maximise FOV overlap at overpass
- Most of the acquired data processed in near-real-time
- Satellite and BAQUNIN data stored on 16 TB NAS

Strategy for PBL studies

- Campaign-based
- All instruments operate continuously (Lidar day&night)
- Off-line processing
- Data analysis

Conclusions

- Instruments located in urban and rural environements
- Some instruments to be properly calibrated
- Other products from the instruments will be available

- Measurements strategy for Satellite Atmospheric Chemistry Validation
- Urban Boundary Layer studies

- The overall system should be ready by the first months of the next year
- Website for BAQUNIN data download
- Possible collaboration with CNR Isac

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Thank you for your attention!