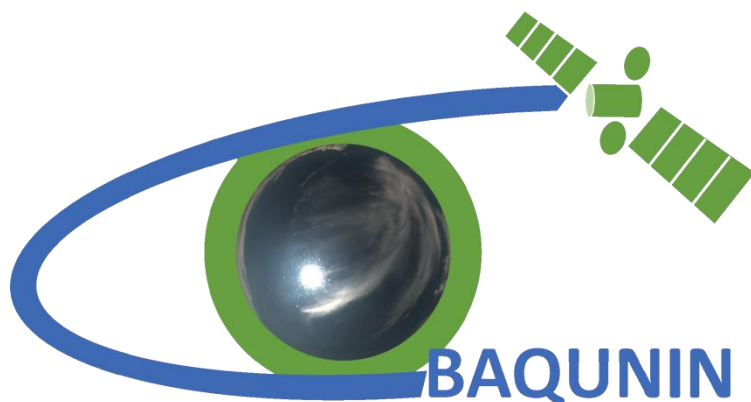


1st PGN workshop: 3 Pandora instruments hosted in Rome



Boundary-layer Air Quality-analysis Using Network of Instruments Supersite

June 2016: WP of ESA - IDEAS+ project
March 2019: ESA - BAQUNIN Project

BAQUNIN staff:

SERCO: A.M. Iannarelli, S. Casadio, G. Mevi, M. Cardaci, E. De Grandis

Atmospheric Physics Laboratory Sapienza: M. Cacciani, A.M. Siani, A. Di Bernardino

CNR-ISAC: M. Campanelli

CNR-IIA: C. Bassani

Sardegna Clima Onlus: A. Murgia

BAQUNIN Project mandate:

- Sustain the maintenance and operation of ground based remote sensing instruments for Satellite Cal/Val and Atmospheric Monitoring/Research purposes
- Perform inter-calibration and validation campaigns
- Stimulate research in Urban Atmospheric Boundary Layer physics/chemistry by facilitating inter-connections between research institutes

BAQUNIN Super Site Locations

APL

Atmospheric Physics
Laboratory Sapienza
University

City center

CNR - ISAC

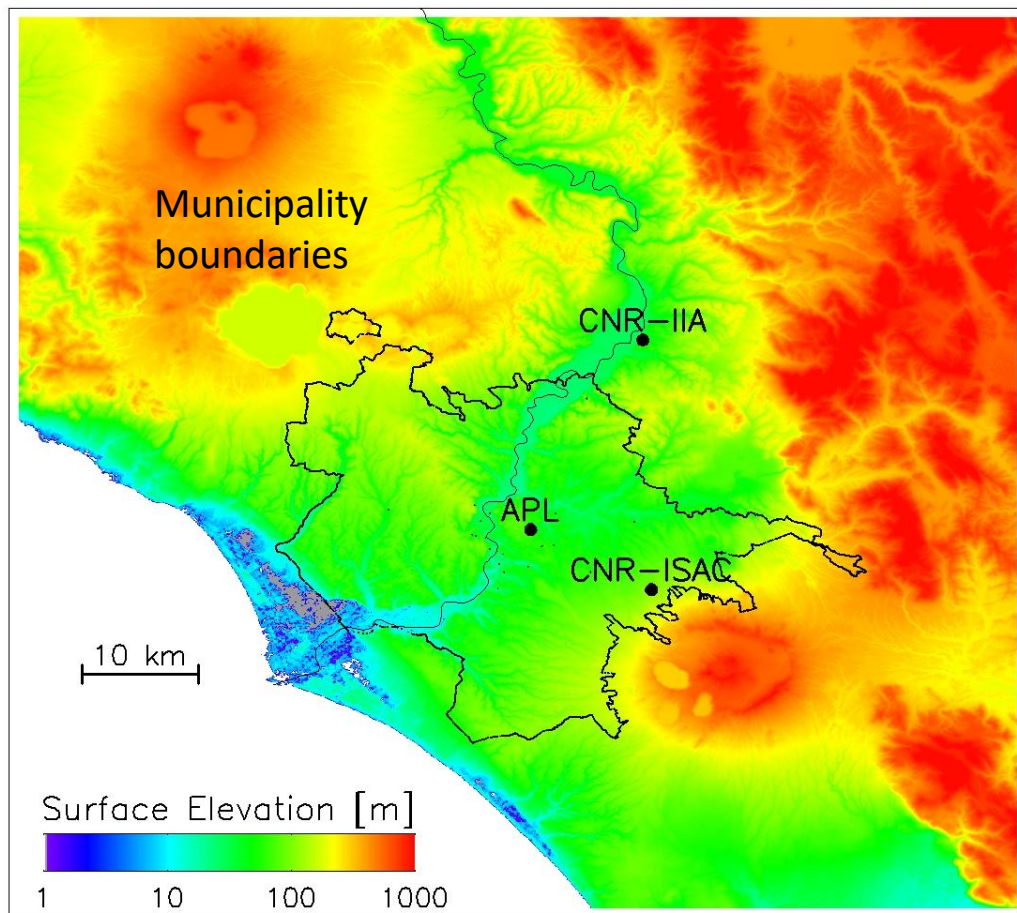
Institute of Atmospheric
Sciences and Climate

Tor Vergata
Southeast of the
city, 10 Km from the
city center

CNR - IIA

Institute for Atmospheric
Pollution

Montelibretti
Northeast of the city
20 Km from the city
center.



BAQUNIN Super Site Instruments

| Instrument | Site | Owner | Operation Conditions | Operative s/Status | Observables | Since |
|-----------------------|-------|--------------------|----------------------|---------------------------------|----------------------------------|-------------|
| SODAR | APL | APL | Day/Night | 7/24 | PBL winds and turbulence | 1990 |
| Brewer MKIV | APL | APL | Day | 7/24 | Radiance, trace gases | 1992 |
| MFRSR | APL | APL | Day | 7/24 | Radiance, aerosols | 2004 |
| POM #22 | APL | CNR-ISAC | Day | 7/24 | Radiance, aerosols, water vapour | 2010 |
| Meteo station | APL | Climate Consulting | Day/Night | 7/24 | Air temperature and humidity | 2014 |
| LIDAR | APL | APL - ESA | Day/Night | Overpass Campaign Special Event | Aerosols, water vapour, clouds | 2015 |
| WRF | ESRIN | Sard. Clim. | Day/Night | 7/24 | Meteorological variables | 2015 |
| Sun-photometer | APL | Univ. Lille | Day | 7/24 | Aerosols, water vapour | 2016 |
| All Sky Camera | APL | ESA | Day/Night | 7/24 | Clouds | 2018 |
| Pyranometer | APL | ESA | Day | 7/24 | Radiance, clouds | 2018 |

| | | | | | | |
|---------------------|----------|-----|------------------|------|---------------------------------|-------------|
| Pandora #115 | CNR-ISAC | | | | | 2016 |
| #117 | APL | ESA | Day/Night (Moon) | 7/24 | Radiance, trace gases, aerosols | 2016 |
| #138 | CNR-IIA | | | | | 2018 |

BAQUNIN & Pandora

Pandora #115 at ISAC-CNR

Both sites are Aeronet stations

Pandora #117 at Sapienza

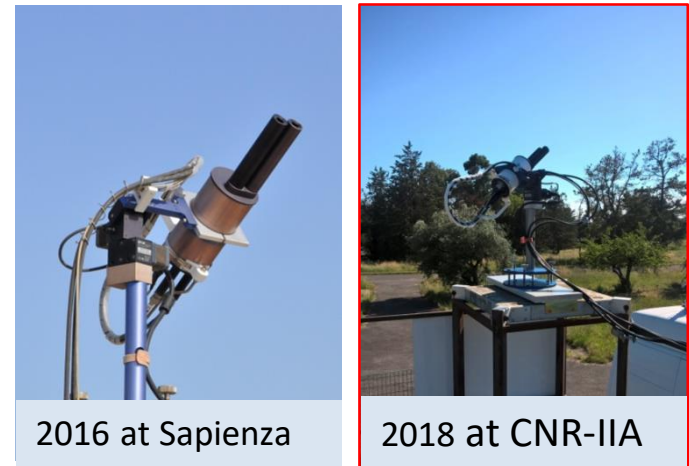
Site of Aeronet, Eubrewnet, Skyrad stations

Pandora #138 at CNR-IIA

Several instrumental issues solved. Since one month, the instrument is hosted in the APL location near P117

Masurements kinds:

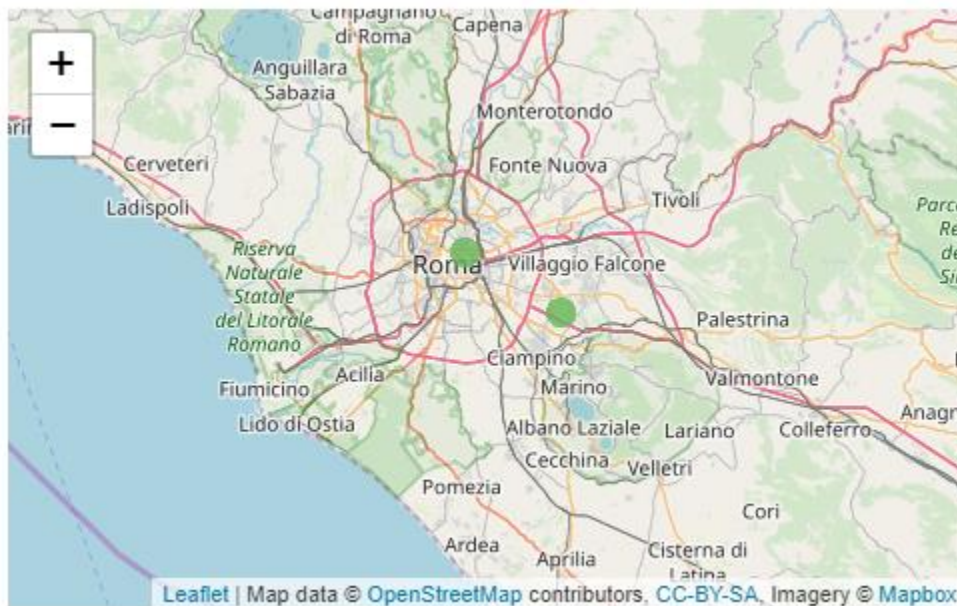
- Direct sun-moon
- Sky
 - P117 -> 6 azimuth angles ($\Delta \sim 60$ deg)
 - P115 -> 1 azimuth angle towards APL site
 - P138 -> 1 azimuth angle towards APL site



Pandora #115 at ISAC-CNR

Pandora #117 at Sapienza

<http://blickv.pandonia-global-network.org/>



Stations

GreenbeltMD - 32 - s1
CharlesCityVA - 40 - s1
MaunaLoaHI - 59 - s1
Izana - 101 - s1
Innsbruck - 106 - s1

Innsbruck - 110 - s1
Bucharest - 111 - s1
BuenosAires - 114 - s1
Rome-ISAC - 115 - s1
Rome-SAP - 117 - s1

TROPOMI NO₂ concentration in the Tiber valley

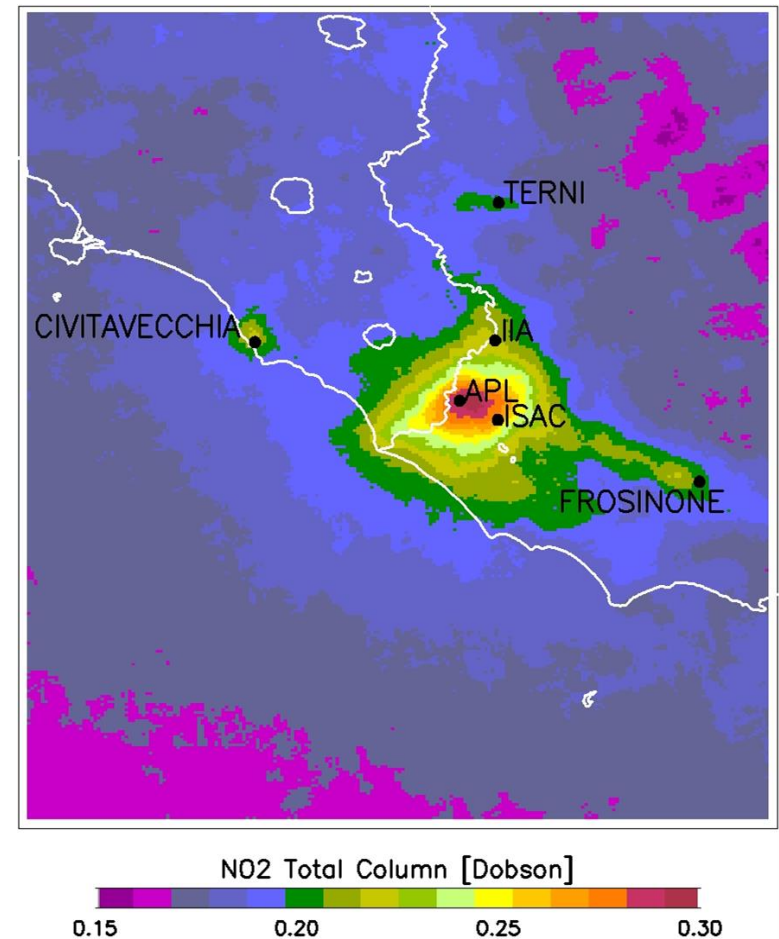
This map shows a 6 months average of NO₂ Total Columns obtained from cloud-free/high-quality TROPOMI measurements (3.5 x 7 km², 13:30 UTC). The output grid resolution is 1x1 km².

The positions of the three BAQUNIN Pandora instruments are also displayed:

APL (Sap) => Pan#117

CNR-ISAC => Pan#115

CNR-IIA => Pan#138



Statistical analysis of 5 months (Nov 2018 – March 2019)

Sodar and Pandora#117 data

The SODAR horizontal wind speed averaged over the 100-300 m a.m.s.l. range (U).

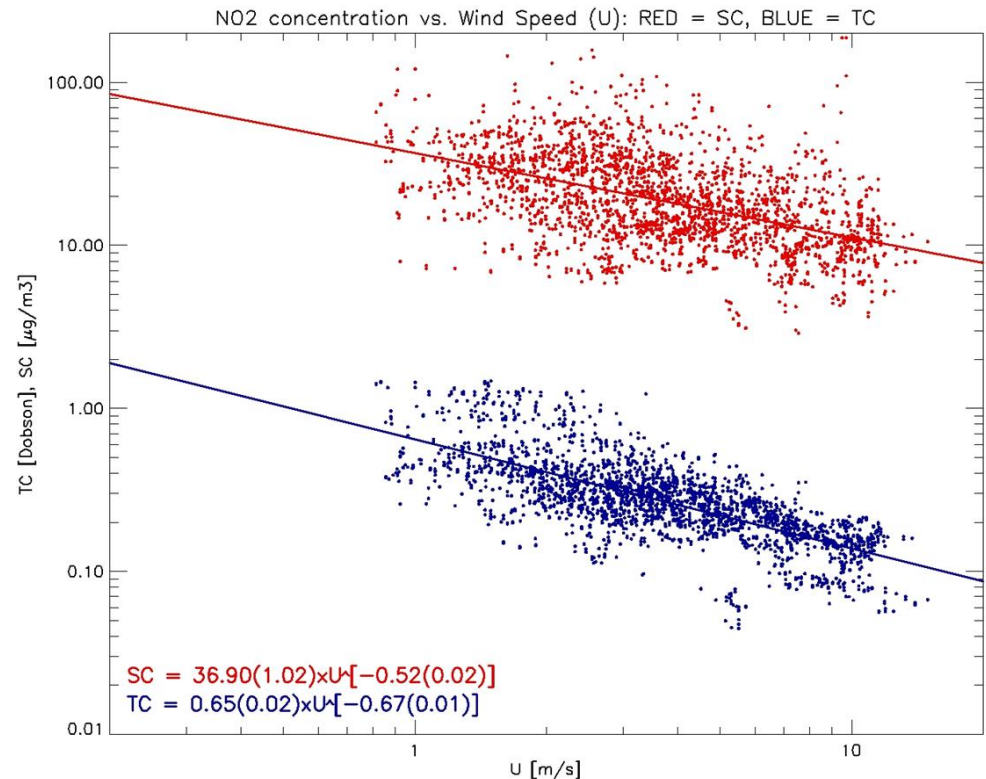
SC = surface concentration

TC = tropospheric column

Note: the plot is log/log!

The NO₂ TC and SC concentrations seen by the Pandora are very well correlated with the wind intensity in the lower urban boundary layer (surface layer).

Given that the Roman NO₂ is almost totally due to traffic and produced in the canopy layer, the observed behaviour suggests that only in low-wind / strong-turbulence conditions the urban pollution is transported upward so that can be probed by PAN#117.



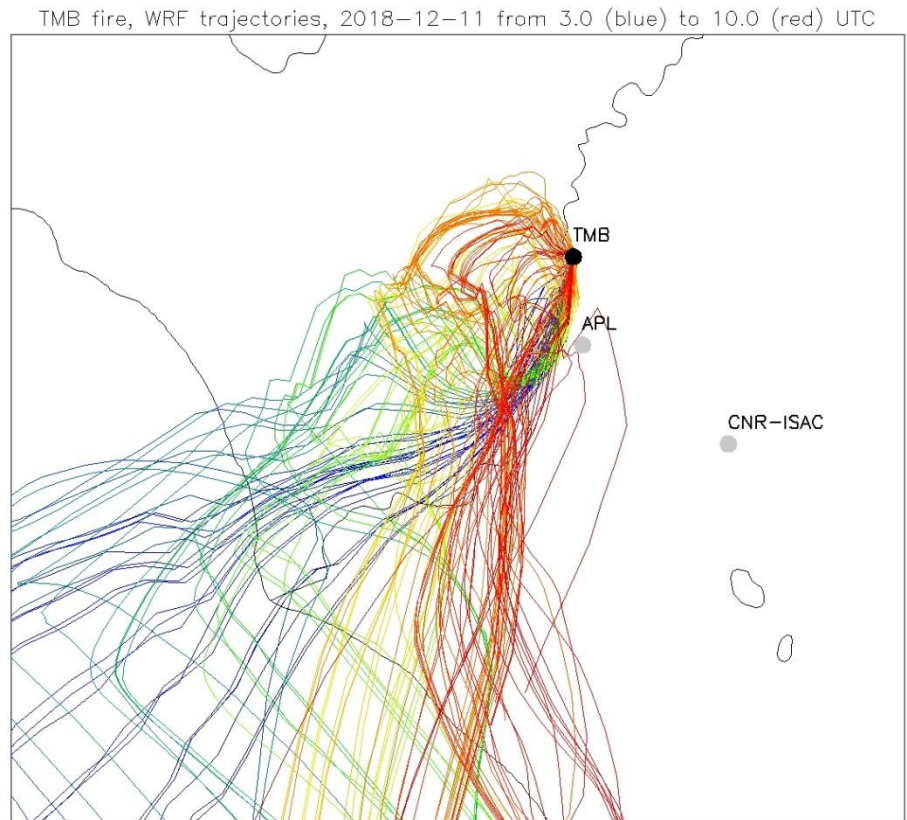
$$C = C_0 \cdot U^{-A}$$

TMB (waste facility) fire, 11 Dec 2018

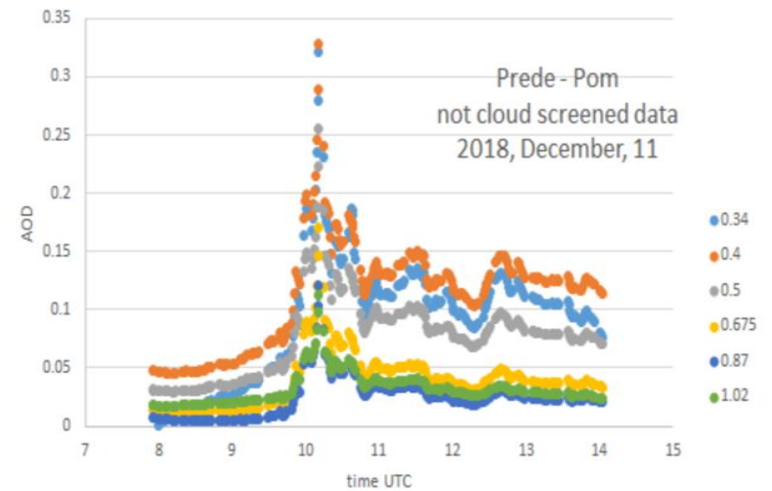
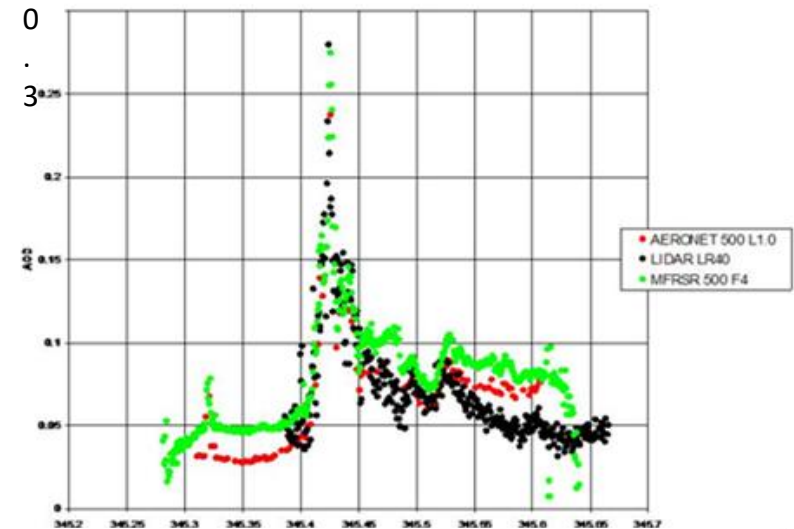
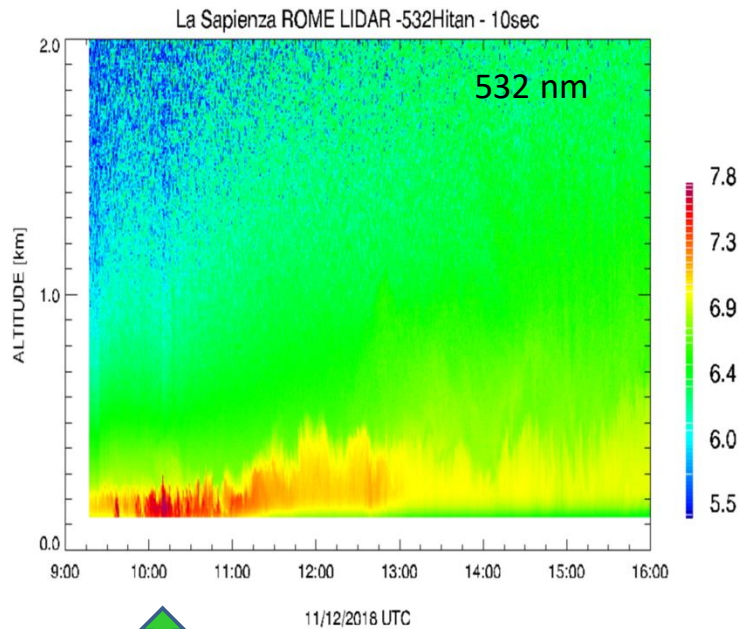
(ANSA) - Rome, December 11 2018 - A large fire broke overnight at a waste facility managed by Rome municipal trash company AMA. The fire at the 2,000-square-metre rubbish centre produced thick smoke on via Salaria, in the north of the historic capital, and the smell of smoke reached the centre. The city council has advised people in the area to keep their windows closed and refrain from outdoor activities.



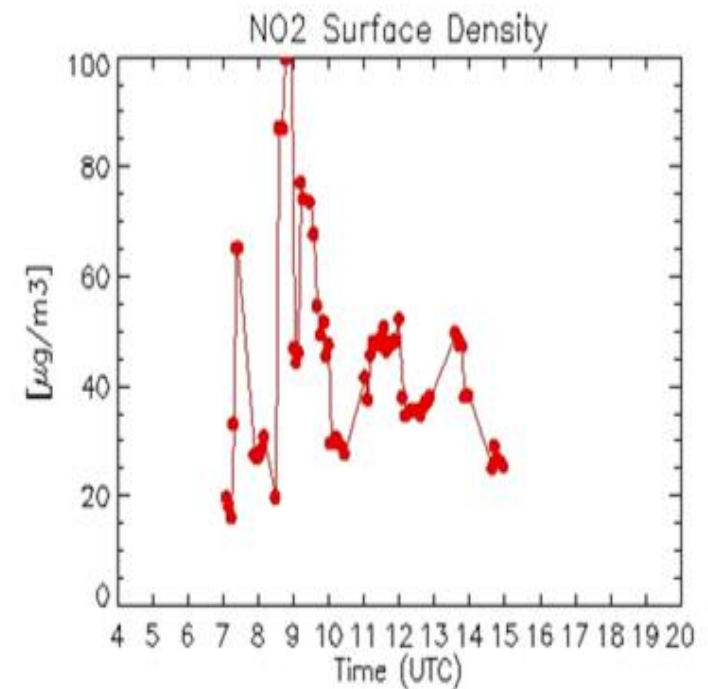
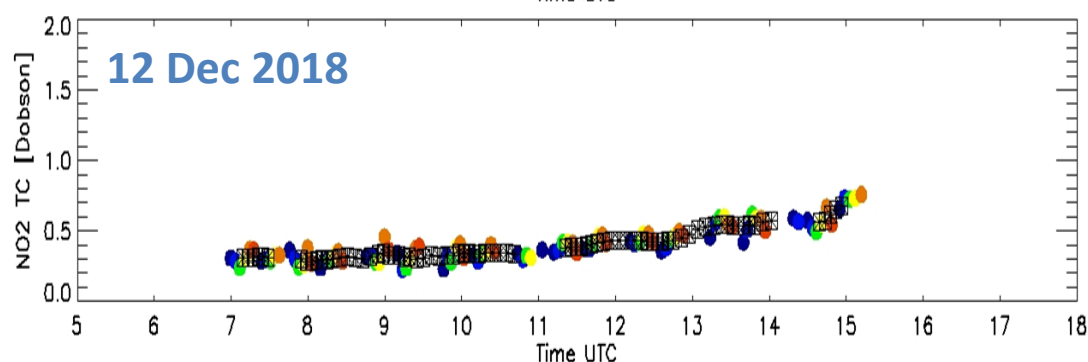
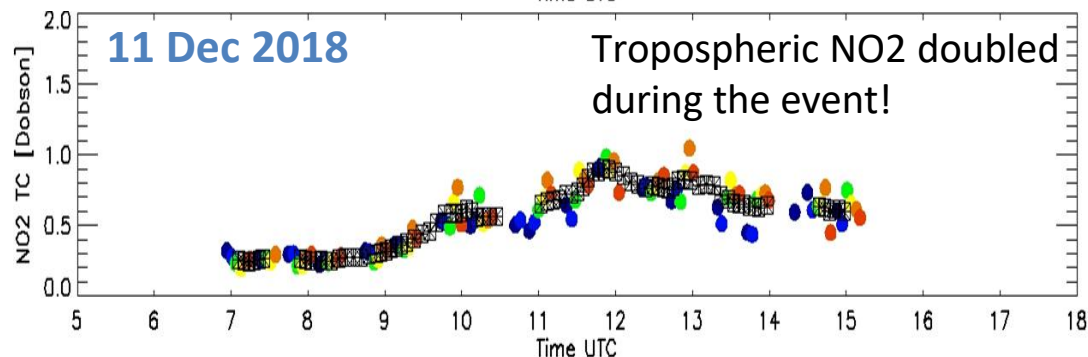
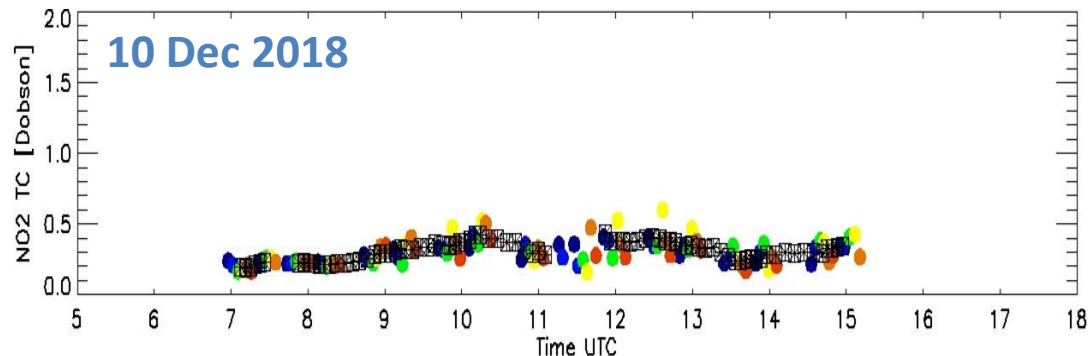
The local authority said Lazio's ARPA environmental agency had not registered air-pollution levels outside the permitted parameters.



TMB (waste facility) fire, 11 Dec 2018



TMB (waste facility) fire, 11 Dec 2018



Thanks for your attention!!!

Campaigns 2017/2019

2017 - LRMC- ACTRIS - Lidar&Radiometer Measurement Campaign
Lidar + CIMEL (at CALIPSO overpass)

2017 - EMERGe - Effect of Megacities on the Transport and Transformation of Pollutants on the Regional to Global Scales
All instruments (two overpasses, low-thick clouds in both cases!)

2017 - QUATRAM - QUALity and TRaceabiliy of Atmospheric aerosol Measurements
POM-PREDE, Pandora, Middleton, PFR, CIMEL + Lidar(4 weeks intense operations)

2017 -2018 VIEPI - Valutazione Integrata dell'Esposizione a Particolato in ambiente indoor (VIEPI)
All instruments (continuous operations) +3D Sonic Anemometer, Volumetric sampler, Particle Sizer Spectrometer,
Condensation Particle Counter, Sioutas Personal Cascade Impactor, PM10 Particulate Samplers

2019 - on going - QUATRAM2 - QUALity and TRaceabiliy of Atmospheric aerosol Measurements
POM-PREDE, Pandora, Middleton, PFR, CIMEL

Projects

DIVA ESA Project selected Lidar-CIMEL station (SERCO, SAPIENZA)

PANDONIA ESA Project "POp" and "FRM4AQ" (SERCO, SAPIENZA ,CNR-ISAC/IIA)

EarthCare Validation Proposal ID **38811** (SERCO, ENEA, CNR-ISAC, SAPIENZA)

S5p Validation Proposal ID **42807** (SERCO, ENEA, CNR-ISAC/IIA, SAPIENZA, Sard. Clim.)

Summer schools

2018 SORBETTO Solar Radation Based Established
Technique for aTmospheric Observation
18 Speakers from Europe and Japan, 35 Students
from Europe, Africa and Asia
(CNR-ISAC, SAPIENZA, SERCO)

2020 - SORBETTO 2