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

A.M. Iannarelli (1), M. Cacciani (2), A. Scoccione (3), S. Casadio (1), M. Campanelli (3), A.M. Siani (2), G. Casasanta(3), H. Diemoz (4), E. Cadau (5), J. von Bismarck (6)

(1) Serco SpA (2) Physics Department, "Sapienza" University of Rome
(3) CNR – ISAC (4) ARPA Valle d'Aosta, Saint-Christophe, Aosta
(5)Sardegna Clima ONLUS (6) ESA/ESRIN SPPA

BAQUNIN Super-Site

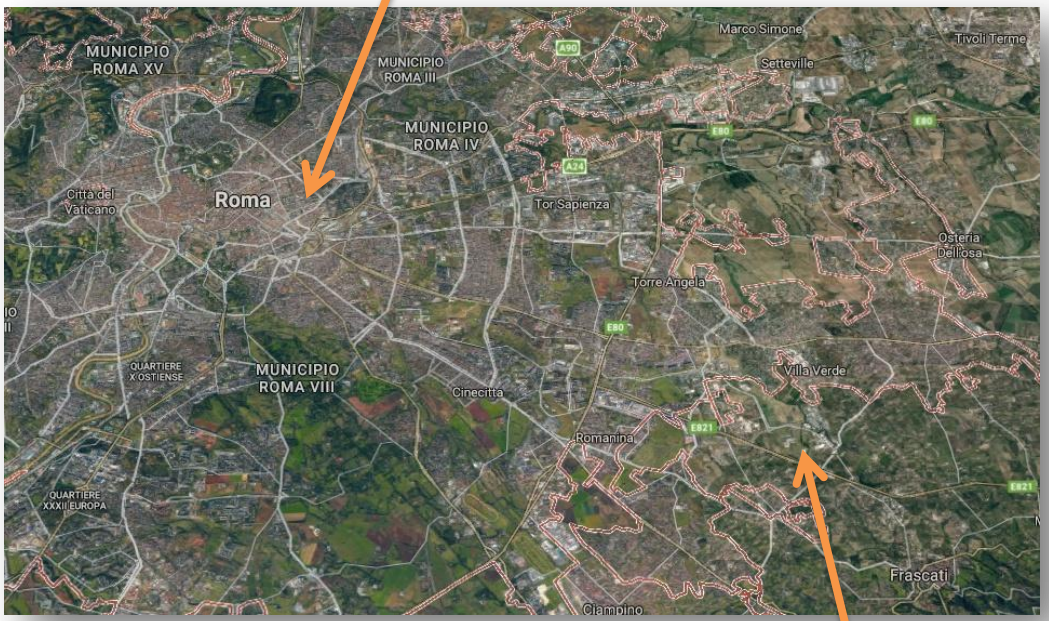
Context: IDEAS+ support contract (ESA/ESRIN SPPA) and PANDONIA project (ESA)

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

Locations

"Sapienza" University



ISAC-CNR Rome

Distance ~ 10 Km

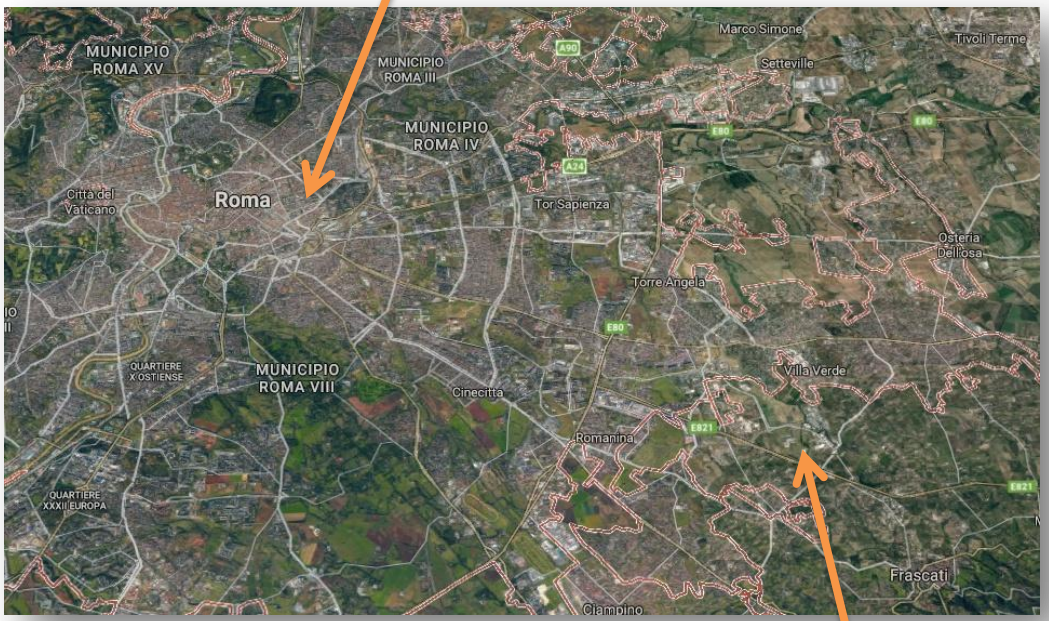
BAQUNIN Super-Site

Instruments

Pandora 2S Spectrometer #115
Pandora 2S Spectrometer #117
Cimel Photomer
Prede Pom 01 Sun-sky radiometer
MFRSR Radiometer
Pyranometer Radiometer
Brewer Spectrophotometer
Yes Broad-band UV Radiometer
Meteorological Sensors
All Sky Camera
LIDAR Raman and elastic
SODAR triaxial Doppler

Locations

"Sapienza" University



ISAC-CNR Rome

Distance ~ 10 Km

BAQUNIN Super-Site products & instruments

Product	Instruments
O3 surface, tropospheric and total columnar	PANDORA 2S, BREWER
NO2 surface, tropospheric and total columnar	PANDORA 2S, BREWER
SO2 surface, tropospheric and total columnar	PANDORA 2S
HCOH surface, tropospheric and total columnar	PANDORA 2S
H2O columnar, profile	CIMEL, Raman LIDAR, *PANDORA 2S, PREDE, MFRSR*
Aerosol Optical Depth (AOD)	CIMEL , PREDE, MFRSR, Elastic LIDAR, *PANDORA 2S*
Aerosol backscattering and extinction profiles	Elastic LIDAR
Scattering and Absorption Ångström Exponent (SAE & AAE)	CIMEL
Angstrom Exponent (AE)	CIMEL, PREDE, PANDORA 2S
Single Scattering Albedo (SSA)	CIMEL, PREDE
Real and imaginary part of Refractive Index (Refr. Indx)	CIMEL , PREDE
Volume size distribution (VSD)	CIMEL, PREDE
Phase Function (PF)	CIMEL, PREDE
Solar Irradiance	PYRANOMETER
UV Dose, UV Index	BREWER
Cloud boundary	Elastic LIDAR
Cloud detection	All Sky Camera
Thermal Turbolence	SODAR
Wind Speed and Direction	SODAR
Surface air temperature, relative humidity, pressure and wind	Meteorological sensors, WRF

BAQUNIN instruments

Pandora 2S #115

Pandora2S #117

Cimel

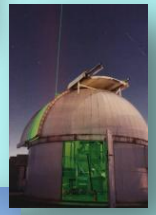
Prede Pom 01

Brewer

Yes Broad-band UV Meteorological

MFRSR

Pyranometer



LIDAR

SODAR

Networks and local data analysis

Pandonia

Aeronet

Euroskyrad

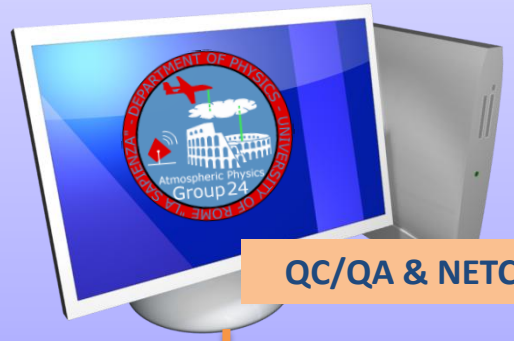
Eubrewnet

Auxiliary meteo data

WRF THE WEATHER RESEARCH & FORECASTING MODEL

Meteo AERONAUTICA

BAQUNIN products



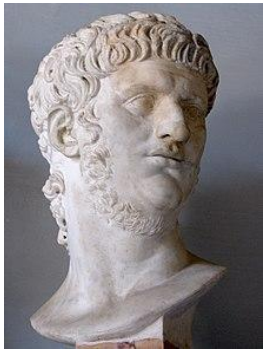
QC/QA & NETCDF

evdc esa

BAQUNIN Super-Site activities

Nero come back in town!

18 July to 27 July, 64 AD



Nerō Claudius Caesar
Augustus Germanicus

- **Pomezia fire,** 5th May 2017
- **Tor Vergata fire,** 14th July 2017

Measurement campaigns

- **LRMC-2017** May, 2017
  Lidar & Radiometer measurement campaign

- **H24 Experiment** 18-19 May, 2017
  30 hours of continuous operation to test the system robustness

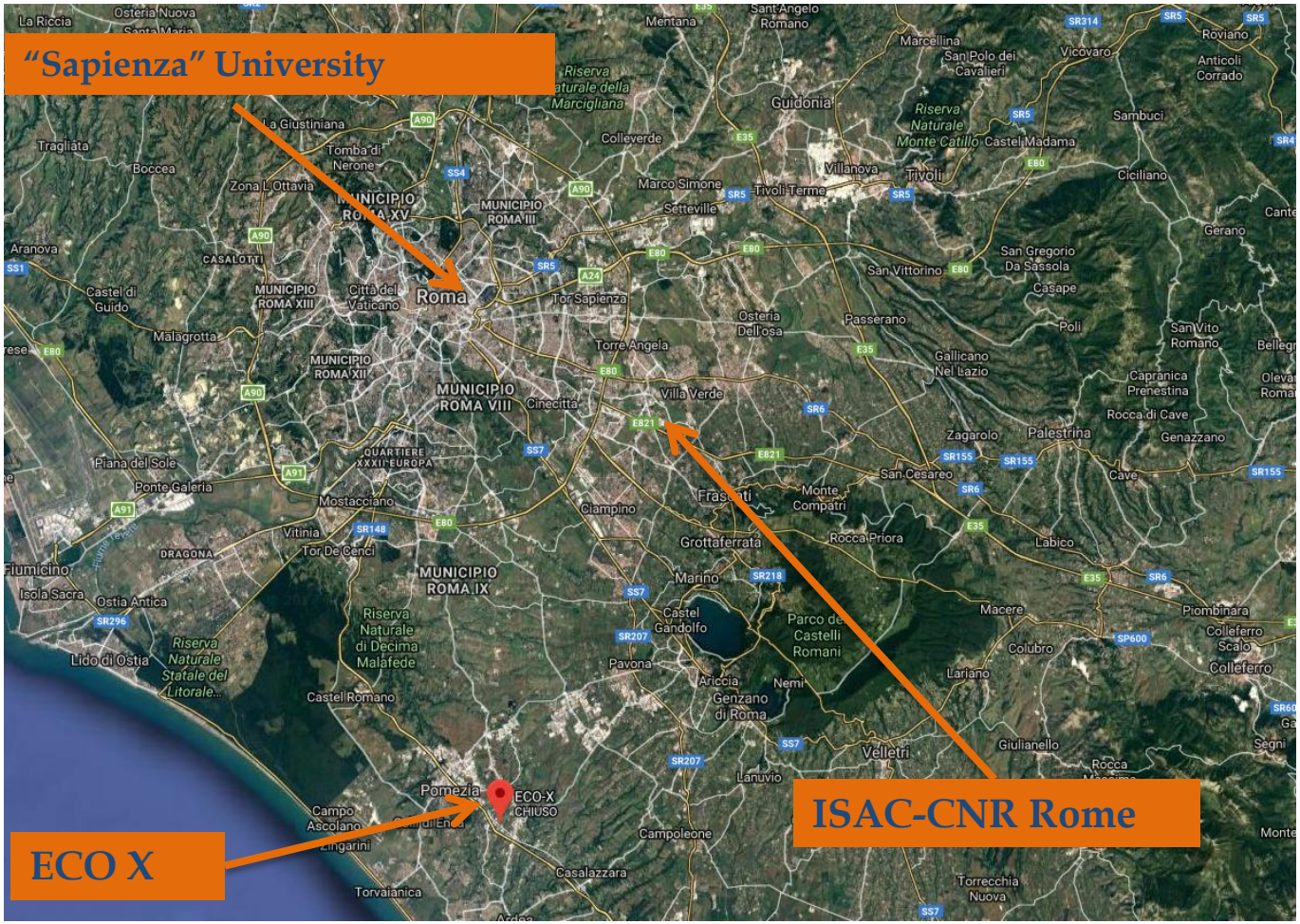
- **EMeRGe** 10-30, July, 2017
  Effect of Megacities on the Transport and Transformation of Pollutants on the Regional to Global Scales

- **QUATRAM** October, 2017
  QUAlity and TRaceabiliy of Atmospheric aerosol Measurements

- **VIEPI** November, 2017 – August, 2018
  Valutazione Integrata dell'Esposizione a Particolato in ambiente indoor

Pomezia fire, 5th May 2017

On 5th of May, at around 6 UTC, a blaze started at the ECO-X rubbish depot in Pomezia, a municipality in the Metropolitan City of Rome (~ 50 Km).
The fire was active for about two days and the cloud of smoke was visible from several kilometres away.



The smouldering rubbish, which included plastics, sent a toxic cloud into the sky forcing both the fire service and the local health authority of Pomezia, to warn locals to keep windows closed in homes, schools, offices, and health and social care structures, keep animals inside, and to avoid all unnecessary travel.

Pomezia fire, 5th May 2017

Some pictures…

Pomezia fire, 5th May 2017

Some pictures…

Pomezia fire, 5th May 2017

Pomezia fire, 5th May 2017

Some pictures…

Pomezia fire, 5th May 2017

Some pictures…

Pomezia fire, 5th May 2017

Some pictures…

Pomezia fire, 5th May 2017

Pandoras see the fire!!!!

Pomezia fire, 5th May 2017

EARTH STARTS BEATING
Sentinels of the World

observing the earth esa

FLY ORBIT NEWS

Istituto di Scienze dell'Atmosfera e del Clima
Consiglio Nazionale delle Ricerche

ARPAT
Agenzia regionale per la protezione ambientale della Toscana
INSIEME PER UN FUTURO SOSTENIBILE

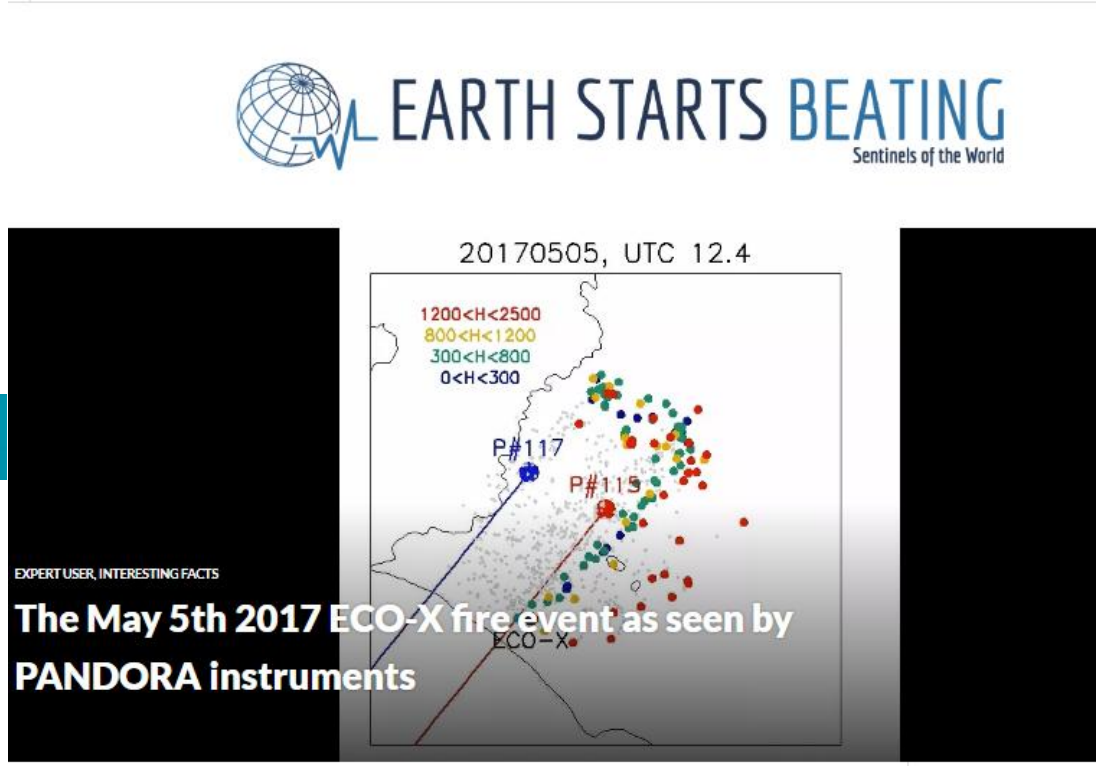
Sistema Nazionale per la Protezione dell'Ambiente

Serco Europe News

MeteoWeb

MENU la Repubblica
Economia&Finanza Bloomberg

teleborsa accedi



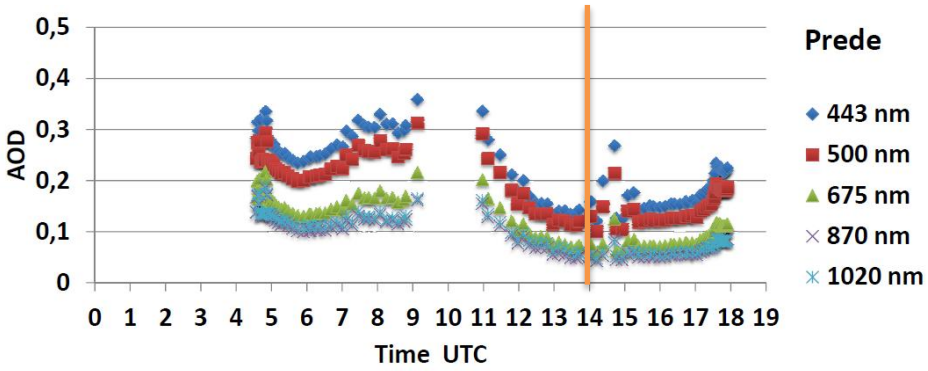
https://www.earthstartsbeating.com

Tor Vergata fire, 14th July 2017

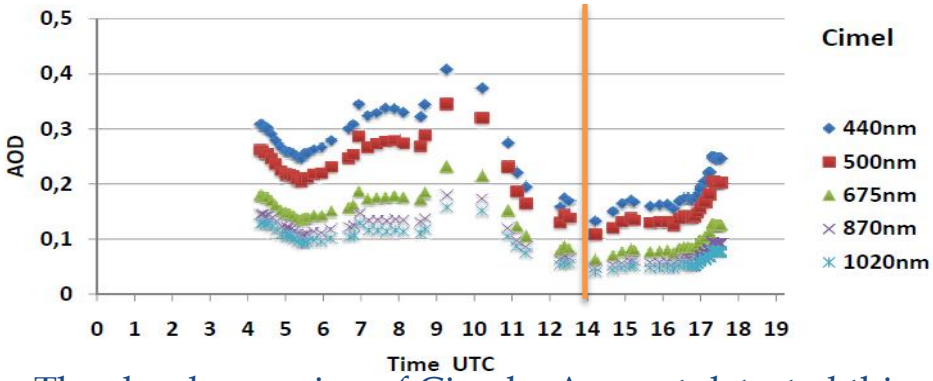
In the afternoon (14:00 utc) of July 14th a fire broke out in eastern suburbs of the capital, Tor Vergata.
A high smoke column has approached dangerously the buildings.
The burning area was at a distance of 1.5 Km from CIRAS ISAC-CNR site.

Tor Vergata fire, 14th July 2017

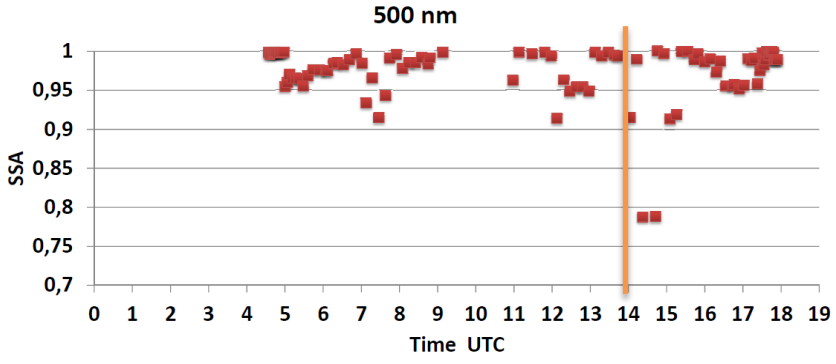
Operating instruments in CNR-ISAC:
- Prede Pom
- Cimel #232

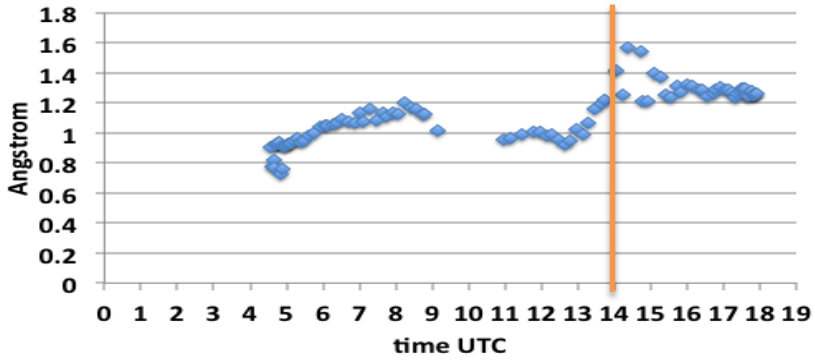


The cloud of fresh smoke moved toward CIRAS and it likely reached the site at about 14:30 as visible from Prede-ESR sudden increases of AOD.



The cloud screening of Cimel – Aeronet detected this sudden increase as cloud and rejected the measurement.

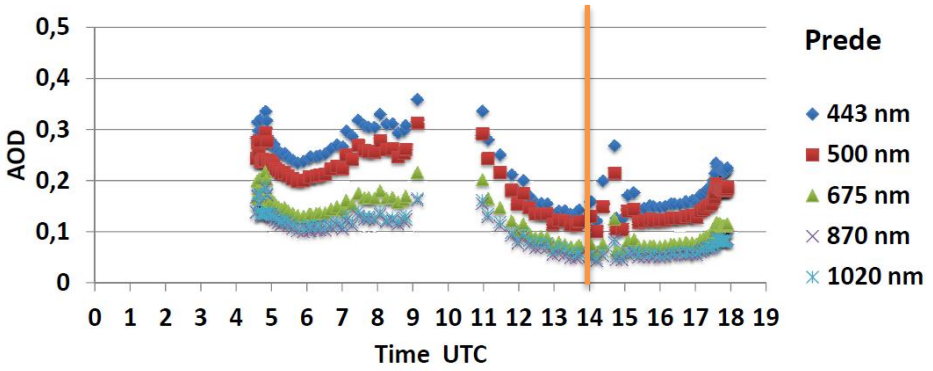




From PREDE-ESR analysis the presence of fresh carbonaceous particles is hilighted by simultaneous
- Lower SSA (more absorbent particles)
- Higher Angstrom exponent (smaller partcles)

Tor Vergata fire, 14th July 2017

Operating instruments in CNR-ISAC:
- Prede Pom
- Cimel #232



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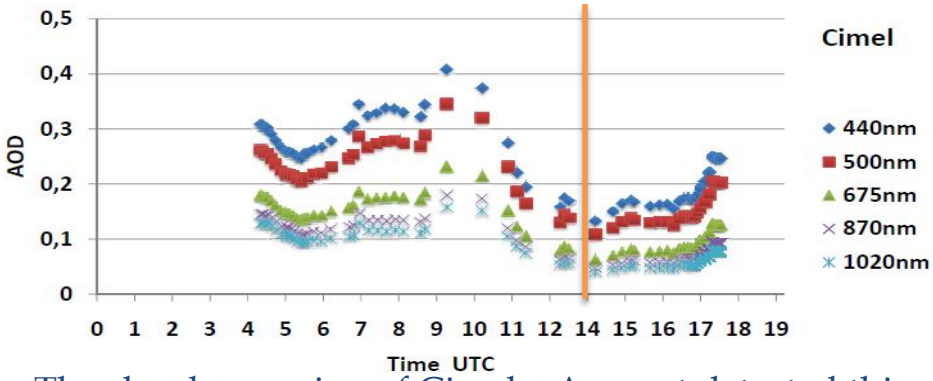

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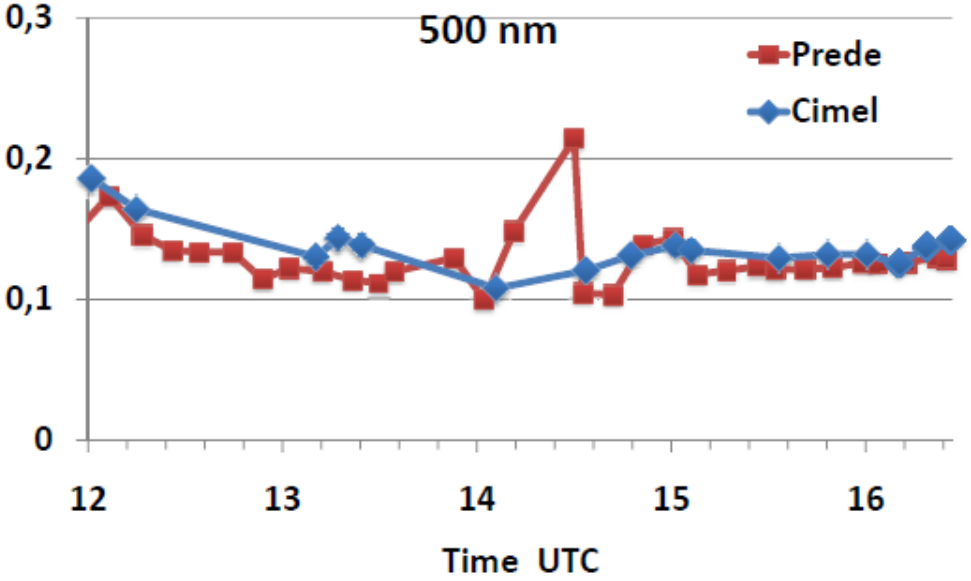


LRMC-2017

Lidar&Radiometer measurement campaign

May, 2017

Campaign object:

- Integration of EARLINET, AERONET and CALIPSO data to monitor long range aerosol transformations.
- Development and test of algorithms and the necessary software for retrieval of aerosol mode concentration profiles from CALIOP and ground-based data

Requirements for ground-based equipment

- Lidar: provides the measurements of intensity of backscatter signals at the wavelengths:
  1064 nm - 532 nm - 355 nm
- Radiometer: collocated station of AERONET.

Measurement conditions:

- Day-time combined lidar and radiometer measurements
- The data of coordinated ground-based and CALIOP measurements (in the region about 80-100 km) are of particular significance

Date	Time (utc)
21/05/2017	1:23
	12:29
30/05/2017	1:17
	12:23

2 hours of Lidar measurements for each overpass

Data Processing

Ground-based lidars and CALIOP data was gathered by IPNASB (Minsk) team

Data analysis is work in progress!

H-24 Experiment

30 hours of continuous operation to test the system robustness

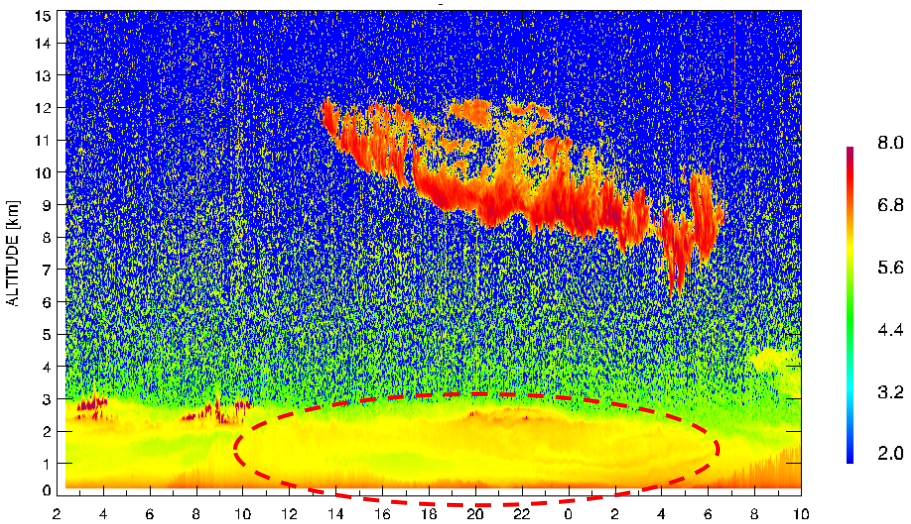
18-19 May, 2017

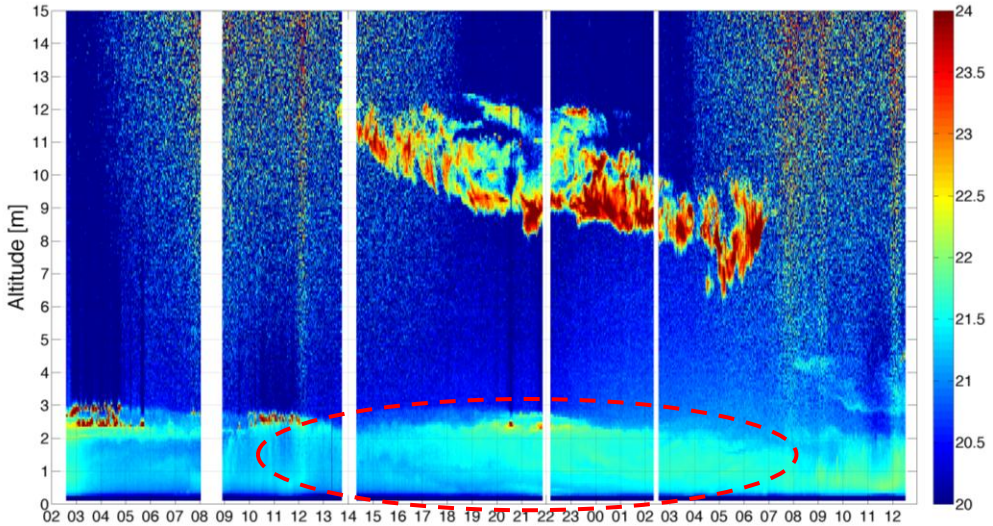
Ground based active and passive remote sensing instruments located in BAQUNIN and CIRAS ISAC-CNR sites are operating in synergy, offering information for a wide range of atmospheric parameters.

Instrument type	Products	BAQUNIN	CIRAS
Elastic & Raman LIDARs	Aerosol backscattering and extinction, H2O profiles, AOD, cloud boundaries	✖	✖
Ceilometer	Aerosol backscattering profile, cloud boundaries		✖
SODAR	Thermal turbulence, wind speed and direction profiles	✖	✖
RADAR	Precipitation		✖
MFRSR	Total column of AOD, O3, H2O	✖	
POM 01 L (PREDE)	AOD, SSA, AE, Refr. Indx, PF, VSD	✖	
Brewer	Total Column of O3, NO2 and SO2, UV Dose and UV Index	✖	
Pandora	Total Column of NO2, O3, HCHO, others	✖	✖
Meteorological sensors	Air temperature, RH, pressure, wind, SW and LW radiation	✖	✖
CIMEL	Total column of AOD and H2O, SAE, AAE, SSA, Refr. Indx, VSD	✖	✖

H-24 Experiment

Evolution of the mixing layer height (MLH) and presence of a cirrus





H-24 Experiment

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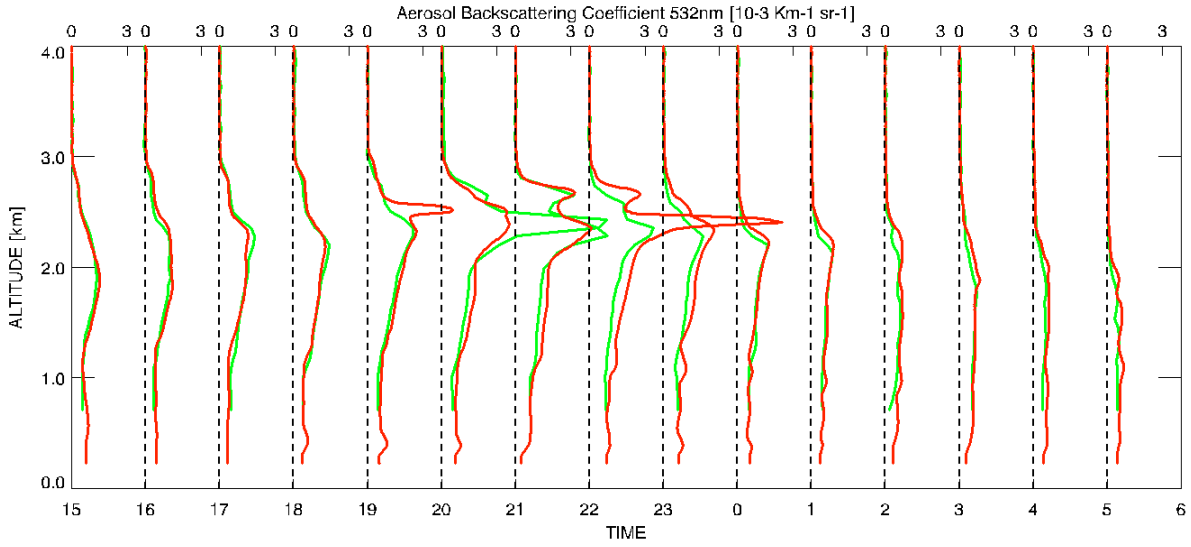
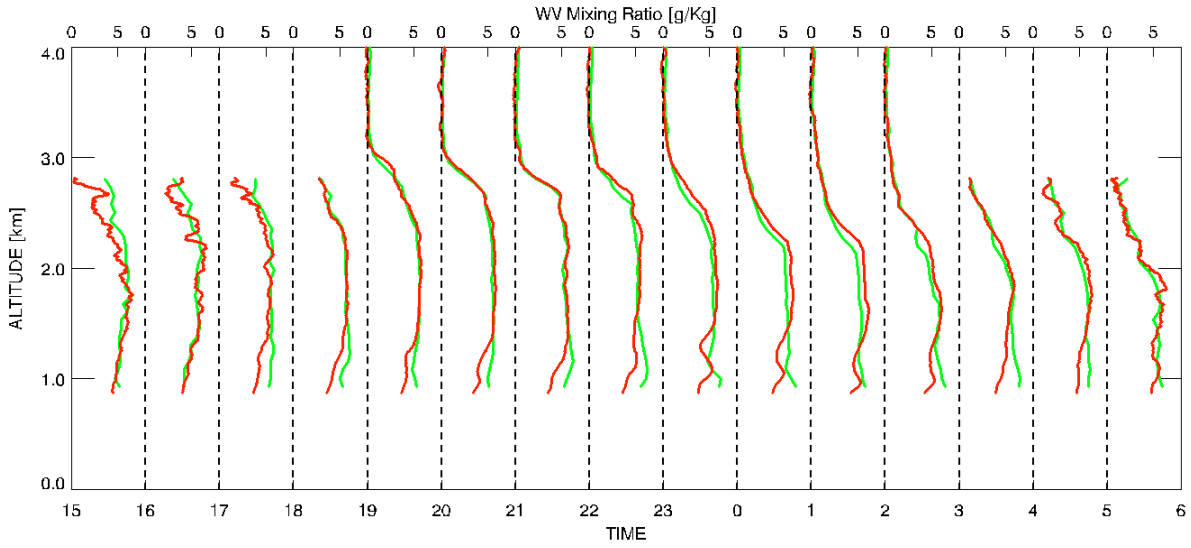
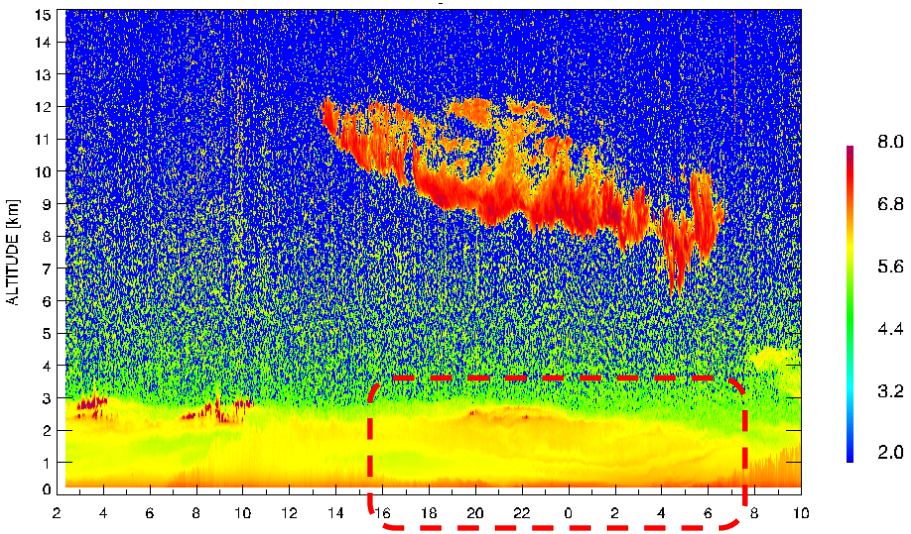




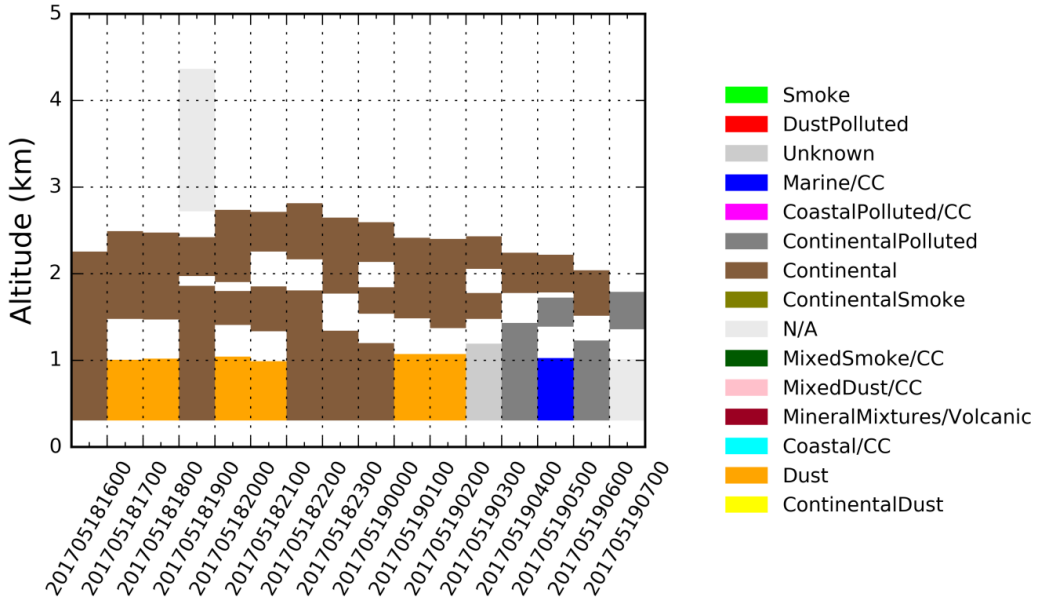
Temporal evolution of the 1-h integrated aerosol backscatter and Water Vapor Mixing Ratio profiles derived by BAQUNIN and CIRAS lidars during H24 experiment

H-24 Experiment

Evolution of the mixing layer height (MLH) and presence of a cirrus



Example of the employment of the Neural network Aerosol Typing Algorithm based on LIdar data (NATALI) using BAQUNIN measurements



EMeRGe

Effect of Megacities on the Transport and Transformation of Pollutants on the Regional to Global Scales

EMeRGe project led by the Institute of Environmental Physics of the University of Bremen.

Aim :
To investigate experimentally the patterns of atmospheric transport and transformation of pollution plumes originating from European megacities and Major Population Centers

Description of Campaign:

- Measurements of key reactive gases and aerosols will be performed by the German Gulfstream HALO aircraft in North Europe and in the Mediterranean area.
- Simultaneously with the aircraft flights, both gas and aerosol measurements will be performed from the ground, using in situ and remote sensing devices in the atmospheric observatories.

Observatories involved in this project in Rome area:

- BAQUNIN (University 'La Sapienza')
- CIRAS, ISAC-CNR (Tor Vergata)

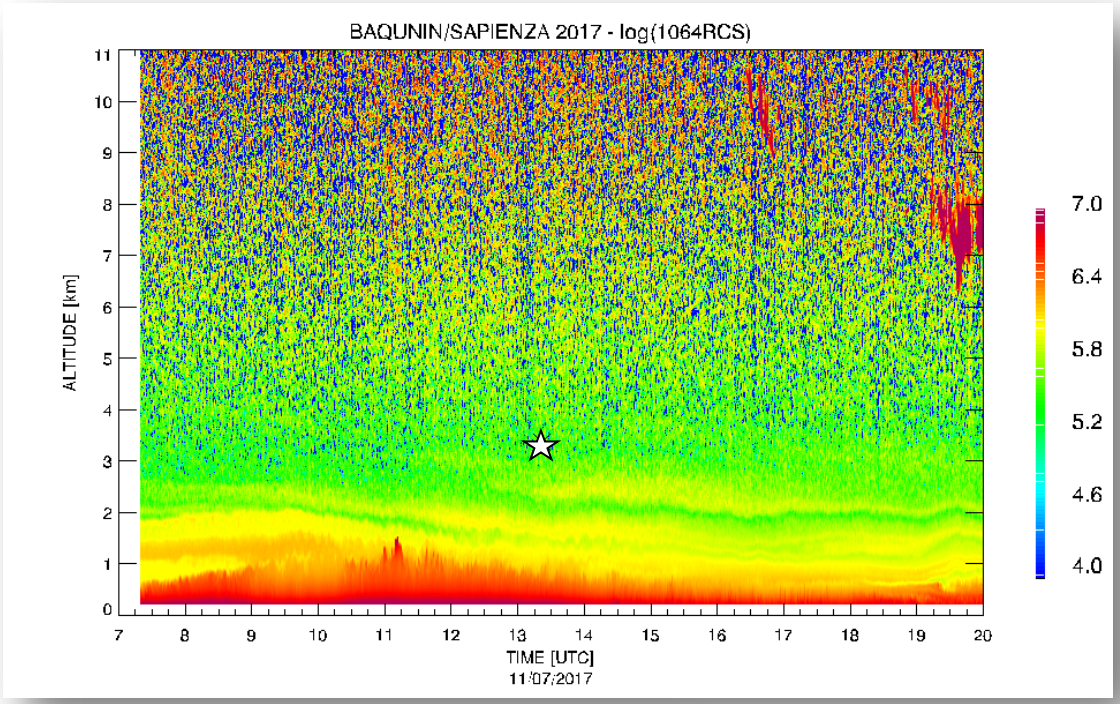
First flight of Halo on Rome, July 11

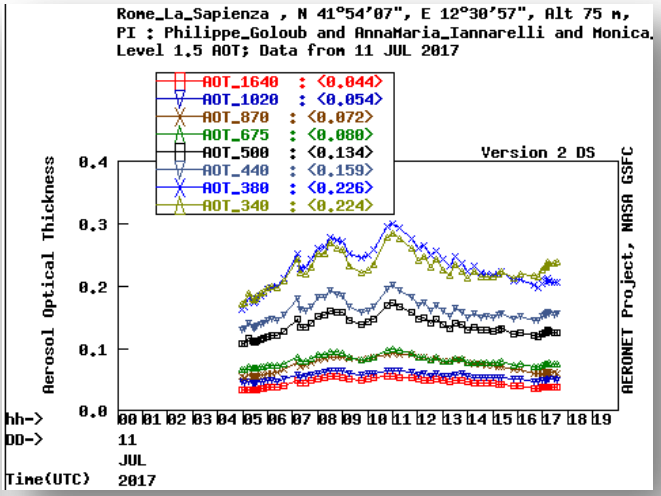
EMeRGe

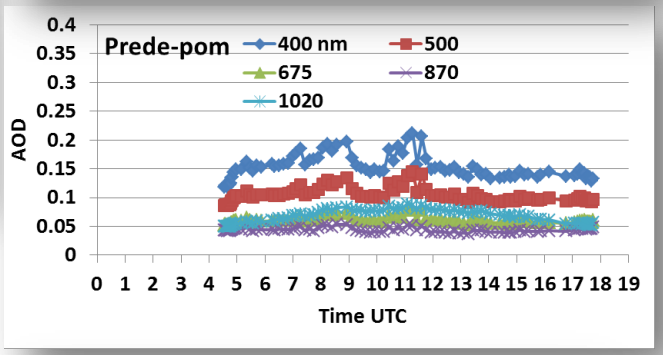
Effect of Megacities on the Transport and Transformation of Pollutants on the Regional to Global Scales

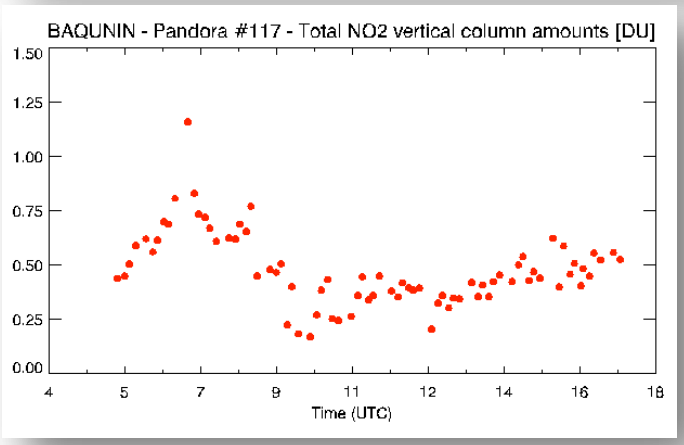
Measures at BAQUININ	Flight July 11	Flight July 20
Raman and elastic LiDAR (355 , 532, 1064 nm)	Continuous measurement during the period [7:30 -20:00]	Continuous measurement during the period [7:30 -20:00]
SKYNET-POM01 sunphotometer (400, 500, 675,870, 1020 nm)	AOD, Angstrom exponent (every 1 min), Volume size distribution, SSA,refractive index (every 10 min)	AOD, Angstrom exponent (every 1 min), Volume size distribution, SSA,refractive index (every 10 min)
AERONET – CIMEL Sunphotometer (340, 380,440,500,675,870, 1020,1640 nm)	AOD, Angstrom exponent AOD_fine and coarse (every 15 min) Volume size distribution, SSA,refractive index (when inversion is avalible)	AOD, Angstrom exponent AOD_fine and coarse (every 15 min) Volume size distribution, SSA,refractive index (when inversion is avalible)
MFRSR (496, 624, 670, 878 nm)	AOD (every 30 s)	AOD (every 30 s)
PANDORA spectrometer	NO2 , O3	NO2 , O3
In Situ Particle counters	Number of particles (every 1 min) with diameters (um) within: 0.3 - 0.5; 0.5 - 0.7; 0.7-1.0; 1.0-2.0; 2.0-3.0; 3.0-5.0; 5.0-10.0.	

EMeRGe BAQUNIN Flight July 11

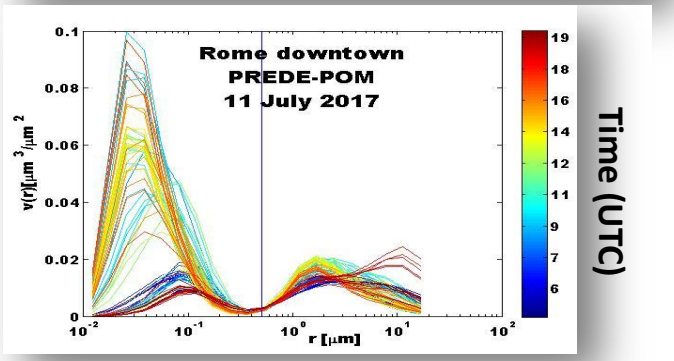








Vertical profiles by the elastic Lidar at 1064
The HALO aircraft passage over the observatory is indicated with a star



QUATRAM

QUAlity and TRaceabiliy of Atmospheric aerosol Measurements

October, 2017

Aim :

SKYNET network has been recently included as WMO-GAW contributing network and a program of traceability to CIMO defined standard instruments and methods, together with inter-comparison and calibration of the European branch (ESR) of SKYNET master instruments is necessary.

Description of Campaign:

Simultaneusly measurements performed by all the instruments

QUATRAM

Instrument	Institutions	Personnel
PREDE POM 01	ISAC-CNR	M.Campanelli
PREDE POM 01	University of Valencia	V. Estelles
PREDE POM 02	Arpa Valle D'Aosta	H. Diemoz
PREDE POM 01	Italian Air Force	Magg. S. Vergari
Cimel CE 318	ESRIN	M.Campanelli, A.M. Iannarelli
Pandora	ESRIN	A.M. Iannarelli (SERCO)
PFR	PMOD	S. Kazadzis, N.Kouremeti
MFRSR	University of Rome La Sapienza	M. Cacciani
MFRSR	ENEA	A.G. di Sarra
2 Middleton	ENEA	G. Pace
Microtop	ISAC - CNR	F. Barnaba

Leading the program

Providing the PREDE-POM sun-photometer as "primary master"

Providing calibration to the "primary master"

Hosting the Campaign (G24 research group)

VIEPI

Valutazione Integrata dell'Esposizione a Particolato in ambiente indoor

(Integrated Evaluation of the Particulate Exposure in an indoor environment)

November, 2017 – August, 2018

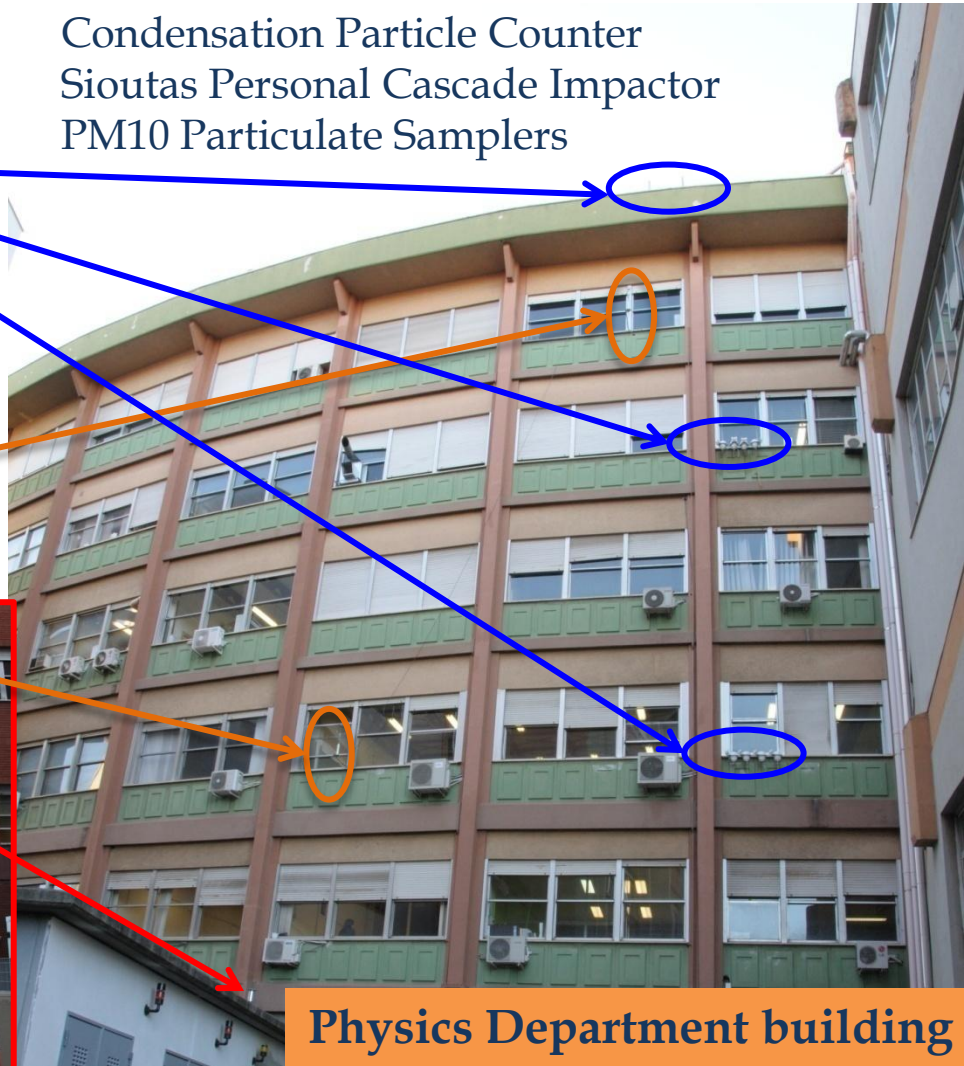
The project is coordinated and financed by the National Institute for Occupational Safety Insurance research area (INAIL)

Aim:
Determination of the infiltration factor of particulate matter present in the atmosphere of work and teaching environments, through environmental monitoring and numerical modeling.

Description of Campaign:
Sapienza –University of Rome is the selected area for monitoring activities, and the Physics Department for indoor measurements, also to take advantage of the observation and research instruments already present and operative at the Atmospheric Physics groups (BAQUNIN, G24 and GMET).
This instrumentation is supplemented by equipment provided by the other parties involved in the project: INAIL, Sapienza-DICEA (Department of Civil and Environmental Engineering), Chemistry department, CNR-IIA (Atmospheric Pollution Institute) and ISPRA (Higher Institute for the Protection and Environmental Research).

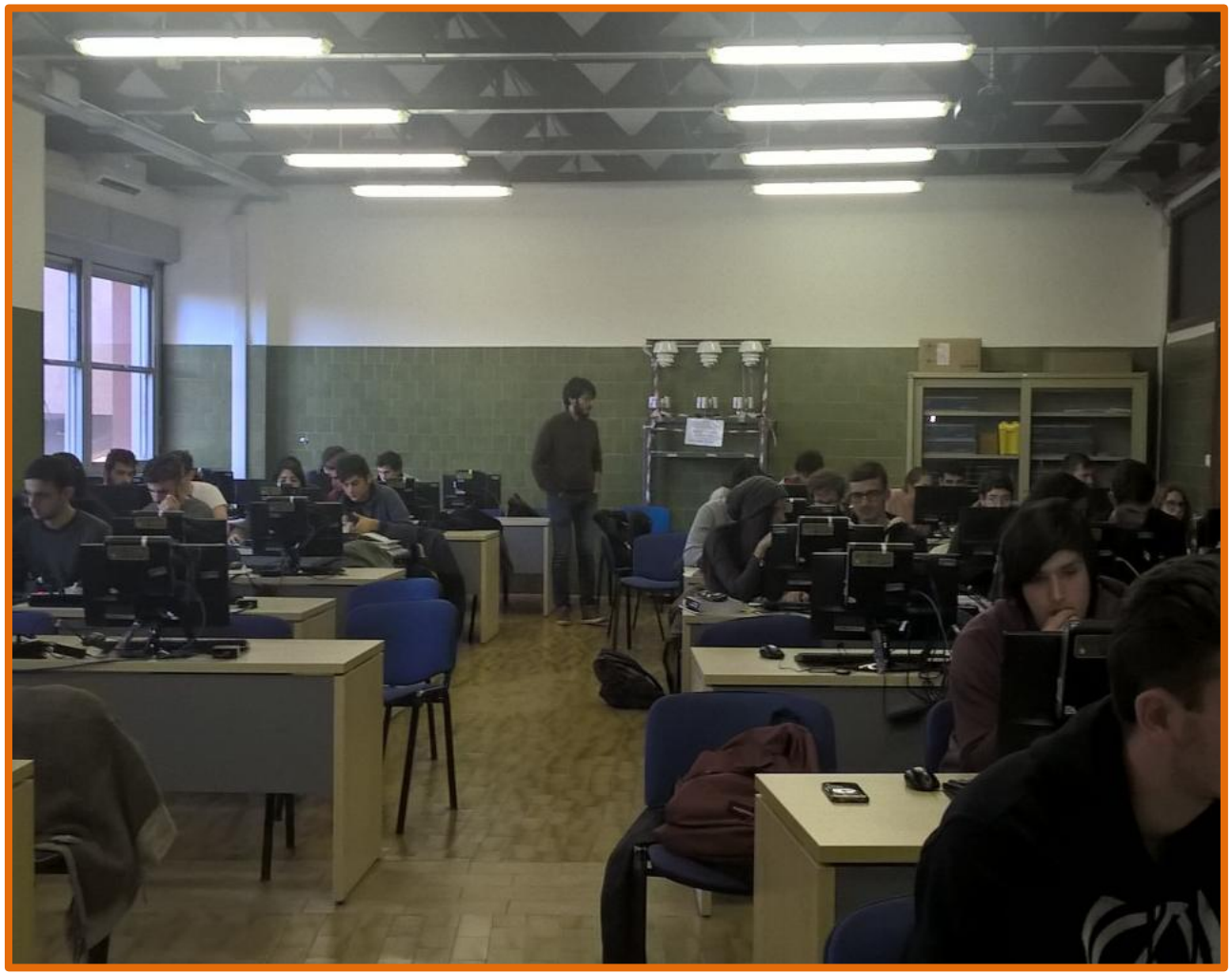
VIEPI

Instruments:
WindMaster 3D Sonic Anemometer
Volumetric sampler VPPS 2000
Fast Mobility Particle Sizer Spectrometer
Microclimatic control unit BABUC-A
Condensation Particle Counter
Sioutas Personal Cascade Impactor
PM10 Particulate Samplers



Physics Department building

Physics Department building: teaching environments



BAQUNIN Next activities

Work in progress on data

- Evaluation of data uncertainty
- QA/QC procedure

Participation to **DIVA** experiment

Demonstration of an Integrated approach for the Validation and exploitation of Atmospheric missions

Cal/Val activities for:

- Sentinel 5p
- EarthCARE mission

SORBETTO (SOlar Radiation Based Established Techniques for aTmospheric Observations) Summer school, Rome, July 2018

Aim

Forming and informing the new generations but also curious scientists, on the current status of solar radiation based techiques.

Invited speakers from the main Institutions in Europe, Japan and Australia

To be confirmed!

Contact: Monica Campanelli, m.campanelli@isac.cnr.it

BAQUNIN Staff		
Jonas von Bismarck	Jonas.Von.Bismarck@esa.int	ESA ESRIN
Stefano Casadio	Stefano.Casadio@esa.int	SERCO / ESA ESRIN
Anna Maria Iannarelli	Annamaria.Iannarelli@serco.com	SERCO / Univ. Sapienza
Marco Cacciani	Marco.Cacciani@uniroma1.it	Univ. Sapienza
Andrea Scoccione	AndreaScoccione@libero.it	Univ. Sapienza (now CNR)
Monica Campanelli	Campanellimonica@gmail.com	CNR Tor Vergata
Giampietro Casasanta	g.casasanta@isac.cnr.it	CNR Tor Vergata
Annamaria Siani	Annamaria.Siani@uniroma1.it	Univ. Sapienza
Daniele Di Erasmo	Daniele.dierasmo@serco.com	SERCO
Enrico Cadau	Enrico.Cadau@esa.int	Sardegna Clima ONLUS

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