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The **BAQUNIN** (Boundary-layer Air Quality analysis Using Network of INstruments) supersite for atmospheric research and satellite validation

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ABSTRACT

The Boundary-layer Air Quality-analysis Using Network of Instruments (**BAQUNIN**) super site has been collecting surface and columnar measurements of atmospheric constituents (aerosol, particulate matter and trace gases) as well as measurements of meteorological variables since 2017.

BAQUNIN has been promoted by the European Space Agency to create an experimental research infrastructure in order to contribute to the validation of present and future satellite atmospheric products and to the in-depth investigation of the phenomena characterizing the planetary and urban boundary layer. The peculiarity of the observatory is the involvement of various active and passive remote sensing instruments installed in multiple measurement points, covering a highly urbanized area near the Tyrrhenian coast. BAQUNIN collaborates with several research institutes to ensure continuous instrumentation operation and excellent product quality. Direct and free access to data and related documentation is one of BAQUNIN's requirements and is guaranteed through the website www.baqunin.eu.

Specific datasets are available through international networks to which instruments belong:

- EVDC (<u>https://evdc.esa.int/</u>)
- EUBREWNET (<u>http://www.eubrewnet.org/eubrewnet</u>)
- AERONET (<u>https://aeronet.gsfc.nasa.gov/</u>)
- PGN (<u>https://www.pandonia-global-network.org/</u>)
- SKYNET (<u>https://www.skynet-isdc.org</u>)

SITES LOCATION



INSTRUMENTS

BAQUNIN consists of three sites :

- ✤ SAPIENZA-APL: Rome downtown (Sapienza University Campus)
- CNR-ISAC: semi-rural environment
- CNR-IIA: rural environment

Colours represent the Shuttle Radar Topography Mission (SRTM) digital elevation model on a logarithmic scale. The black line depicts the boundaries of the municipality of Rome. Iannarelli et al., 2022

<u>Remote sensing</u>: FTIR (EM27SUN), LIDAR(s), Ceilometer, Pandora, SODAR, PREDE-POM, CIMEL, Pyranometer, Sky-Camera, Brewer In situ: Micro-barometer, weather stations **Atmospheric modeling**: Weather Research and Forecasting (WRF) **Next to come:**, in-situ air-quality stations

Instantaneous measurements (Brewer #067) Monthly averages (Brewer #067)

early averages (Brewer #067) Ionthly averages (Pandora #117)



DATA HOMOGENIZATION



Plume generated by organic waste disposal plant fire on 11 December 2018 (Rome): (a) photo of the plume, (b) WRF dimensionless smoke concentration and wind field (150 m.a.s.l.) at 10:00 UTC, (c) volume size distribution from Prede-POM, (d) LIDAR LOG(RCS)1064 nm, (e) AERONET (green) and EUROSKYRAD (blue) AOD at 500nm, (f) NO₂ tropospheric amount (red dotted line)



SEA BREEZE REGIME



NO₂ Total Column from (SAPIENZA-APL): Brewer instantaneous measurements (grey dots), monthly and yearly averages (continuous lines). The monthly averages retrievals the from **O**t Pandora #117 are also shown (dashed line). Diémoz et al. 2021



Comparison of the NO₂ slant column densities retrieved at SAPIENZA-APL from Brewer and Pandora #117

REFERENCES:

Di Bernardino et al. (2021) On the effect of sea breeze regime on aerosols and gases properties in the urban area of Rome, Italy, Urban Clim., 37. DOI:10.1016/j.uclim.2021.100842 Diémoz et al. (2021) Advanced NO₂ retrieval technique for the Brewer spectrophotometer applied to the 20-year record in Rome, Italy, Earth Syst. Sci. Data, 13, 4929–4950. DOI:10.5194/essd-13-4929-2021 Iannarelli et al. (2021) The Boundary-layer Air Quality-analysis Using Network of INstruments (BAQUNIN) supersite for atmospheric research and satellite validation over Rome area, Bull. Amer. Meteorol. Soc., 103(3). DOI:10.1175/BAMS-D-21-0099.1