

The ESA/EOP-GMQ contribution to Sentinel-5 Precursor Validation: the "IDEAS+" Boundary-layer Air Quality-analysis Using Network of Instruments (BAQUNIN) super site

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Since 2014, the ESA Sensor Performance, Products and Algorithms (SPPA) section has been directly involved in the development and the operation of ground based instruments devoted to satellite (atmospheric) Cal/Val. In particular, SPPA invested resources in setting-up activities focused on the setting-up of an atmospheric probing super-site in the area of Rome, called BAQUNIN (Boundary-layer Air Quality-analysis Using Network of INstruments). In this framework, atmospheric physics experts of Sapienza University and CNR-ISAC, while hosting and operating the instrumentations at their premises, are supported by the SERCO team for what concerns specific satellite Cal/Val needs. In BAQUNIN, the ground based active and passive remote sensing instruments are operating in synergy, in both an urban context (Rome Sapienza) and in a semi-rural environment (CNR-ISAC). This instrumental set-up composes a “Super Site”, offering quantitative and qualitative information for a range of atmospheric parameters relevant to S5p validation. The list of the BAQUNIN instrumentation comprises:

- o Raman and elastic+depolarisation LIDAR (aerosols, H₂O, clouds),
- o SODAR (wind profiles in PBL),
- o MFRSR radiometer (aerosols, O₃, H₂O),
- o POM 01 L Prede radiometer (aerosols, H₂O), (EUROSKYRAD <http://www.euroskyrad.net/>, WMO-GAW)
- o Brewer spectrophotometer (O₃, SO₂, NO₂), (EUBREWNET <http://www.eubrewnet.org/cost1207/>)
- o Pandora Spectrometers (O₃, NO₂, H₂O, HCOH, SO₂, aerosols), (PANDONIA <http://pandonia.net/>)
- o CIMEL photometer (aerosols, H₂O), (AERONET, https://aeronet.gsfc.nasa.gov/new_web/index.html)
- o YES broad-band UV radiometer,
- o Pyranometer Radiometer,
- o All-sky camera (cloud detection),
- o Meteorological sensors (air pressure, temperature and relative humidity)

The SODAR and all the passive instruments are operated continuously, while the Lidar is generally operated at satellite overpass (± 1 hour). Geophysical products (and their related uncertainties) from all instruments are harmonised in terms of content (naming conventions, units), they underpass a quality screening and are stored in uniform data format (NetCDF-CF). 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, by EarthCare and Aeolus, and by the ESA Third Party Missions (TPM), such as the Ozone Monitoring Experiment (OMI). Finally, the Super site is operating for traceability and inter-comparison programs involving a large number of the above listed equipment (e.g. www.euroskyrad.net/quatram.html). A detailed description of instruments, products, methods and harmonization procedures will be presented in this contribution.