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Nitrogen Dioxide monitoring by synergy of remote sensing and surface concentration data in an Italian central region

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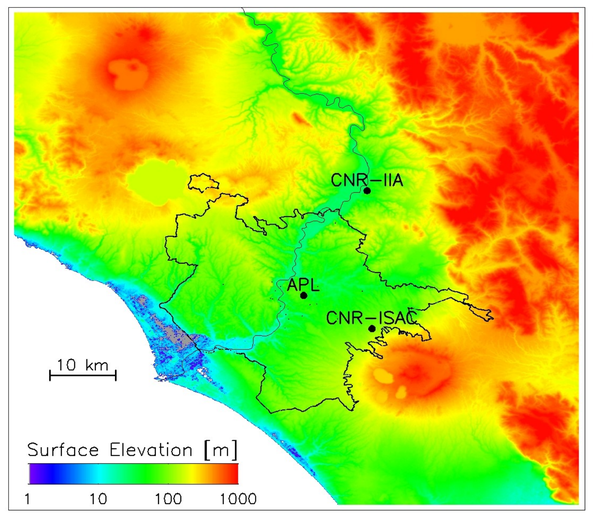
Nitrogen dioxide in Lazio region
- Tropospheric vertical column density (VCD)
Pandora & TROPOMI
- Surface concentration
In situ stations & Pandora

https://www.baqunin.eu/

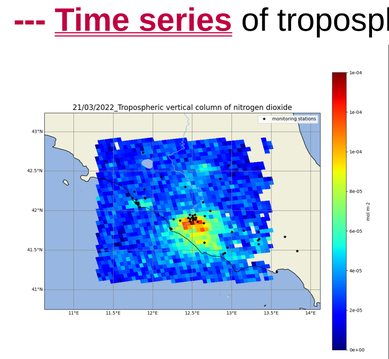
Boundary-layer Air Quality-analysis Using Network of Instruments (**BAQUNIN**) Super-Site

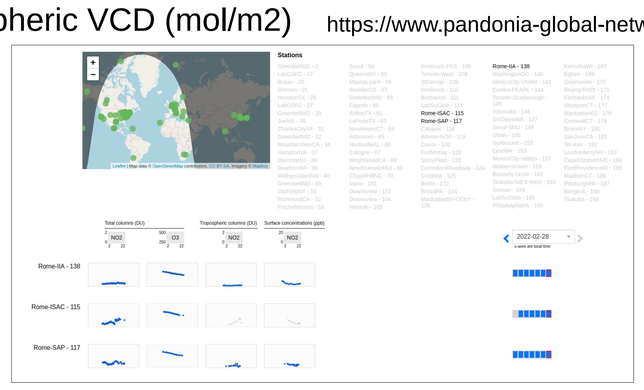


Urban to rural along the Tiber Valley
APL ==> Urban environment
CNR-ISAC ==> Semi-rural environment
CNR-IIA ==> Rural environment

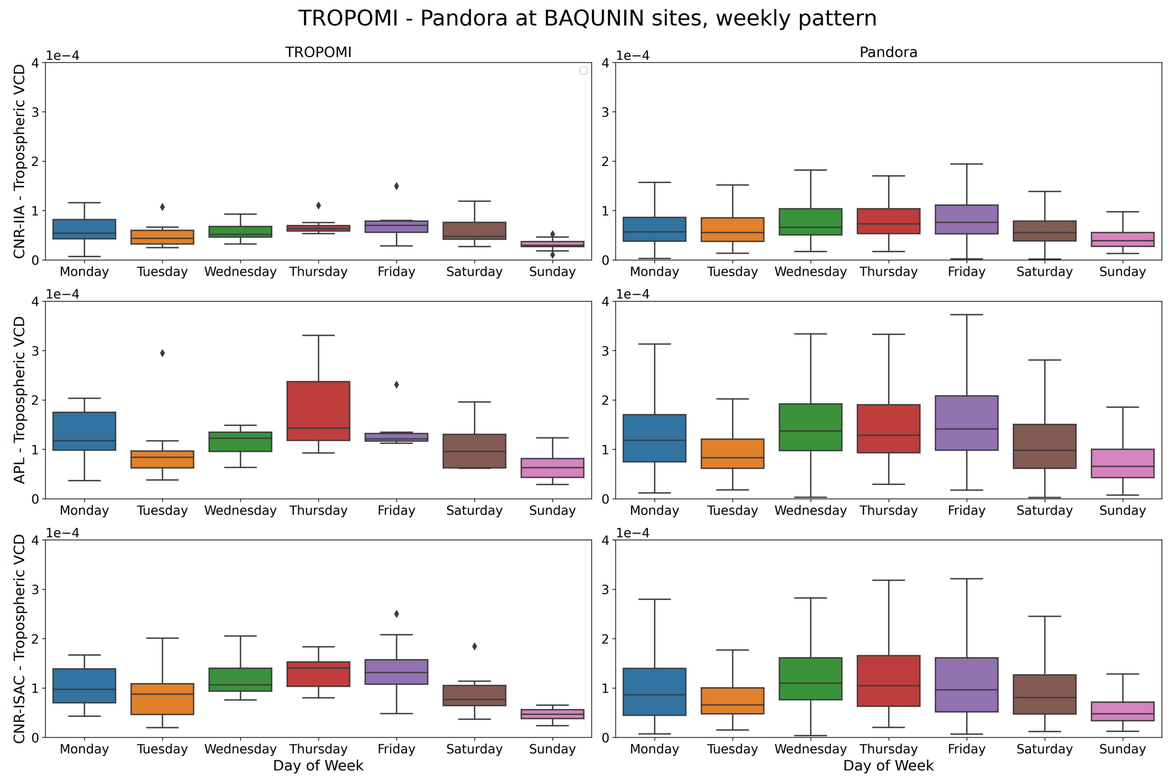
--- Time series of tropospheric VCD (mol/m2)

https://www.pandonia-global-network.org/





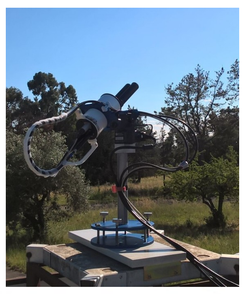
--- Weekly pattern of tropospheric VCD (mol/m2)

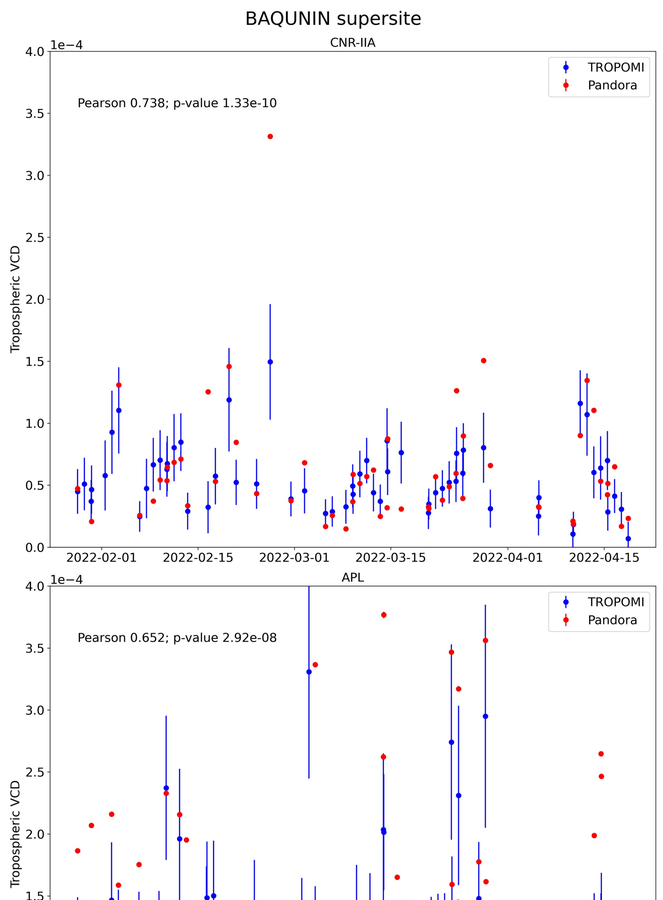


TROPOMI & Pandora show the typical weekly pattern with a decrease of compound during the weekend.

Under study:
- Workday. A decrease in VCD is shown on Tuesday in the three components of BAQUNIN.
- Workday. A VCD variability on Thursday is shown especially in the urban component (APL)
- Weekend. The decreasing trend is highlighted in all the three components

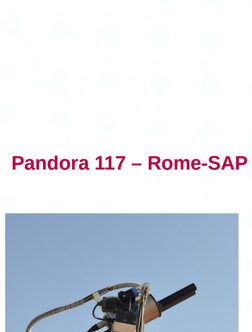
Pandora 138 – Rome-IIA





Pandora 117 – Rome-SAP

Pandora 115 – Rome-ISAC

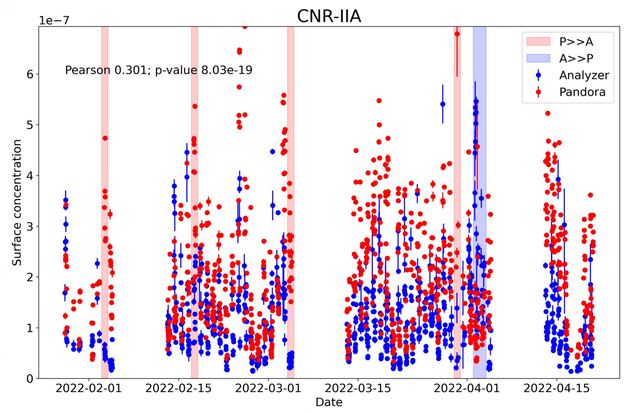


--- Daily & weekly pattern of surface concentration (mol/m3) – rural component of BAQUNIN supersite

Analyzer

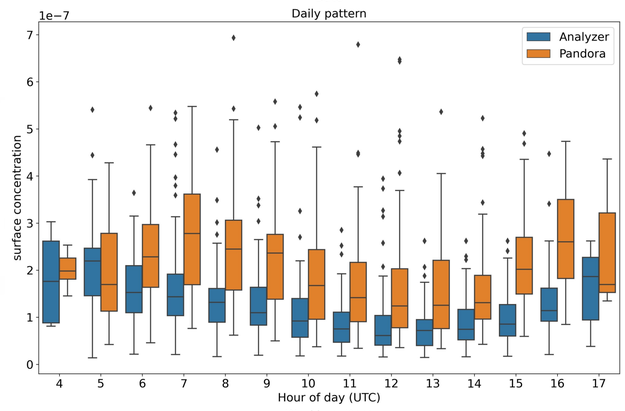
Time series of surface concentration retrieved by Pandora and measured by the analyzer, show similar behaviour.

Under study:
- Red shaded area (P>>A). Days with surface concentration of Pandora much higher than measured by analyzer.
- Blue shaded area (A>>P). Days with the surface concentration of Pandora lower than the concentration measured by analyzer.



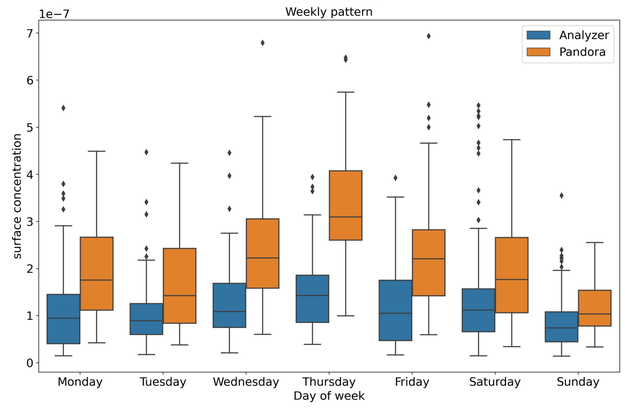
Pandora & Analyzer show the typical daily patterns of the surface concentration.

Under study:
- Delay. Regarding Pandora retrievals, the peaks of higher levels seem about one hour before the measurements of the analyzer.
- Daily seasonal pattern. The available data are between winter and springer, more data are required to perform a complete analysis.



Pandora & Analyzer show the typical weekly patterns of the surface concentration.

Under study:
- Workday. On Tuesday, surface concentration decreases as retrieved for VCD.
- Workday. On Thursday, the Pandora surface concentration shows a peak not retrieved from the analyzer data.
- Weekend. The decreasing trend in concentrations is more evident from Pandora than from analyzer.



--- Conclusions

Nitrogen dioxide is well-monitored with the integration of the tropospheric VCDs and the surface concentrations provided by analyzers, and satellite (TROPOMI), and ground based (Pandora) sensors.
BAQUNIN represents a good experience to study air quality in different environments exposed to air pollution of a high emission source as Rome.

Bibliography

- Bassani, C.; Vichi, F.; Esposito, G.; Montagnoli, M.; Giusto, M.; Ianniello, A. (2021) Nitrogen dioxide reductions from satellite and surface observations during COVID-19 mitigation in Rome (Italy), Environmental Science and Pollution Research, 22981-23004, volume 28, ISNN 1614-7499, https://doi.org/10.1007/s11356-020-12141-9
- Iannarelli, A. M., Di Bernardino, A., Casadio, S., Bassani, C., Cacciani, M., Campanelli, M., Casasanta, G., Cadau, E., Diémoz, H., Mevi, G., Siani, A. M., Cardaci, M., Dehn, A., & Goryl, P. (2022). The Boundary Layer Air Quality-Analysis Using Network of Instruments (BAQUNIN) Supersite for Atmospheric Research and Satellite Validation over Rome Area, Bulletin of the American Meteorological Society, 103(2), E599-E618. Retrieved May 10, 2022, from https://journals.ametsoc.org/view/journals/bams/103/2/BAMS-D-21-0099.1.xml