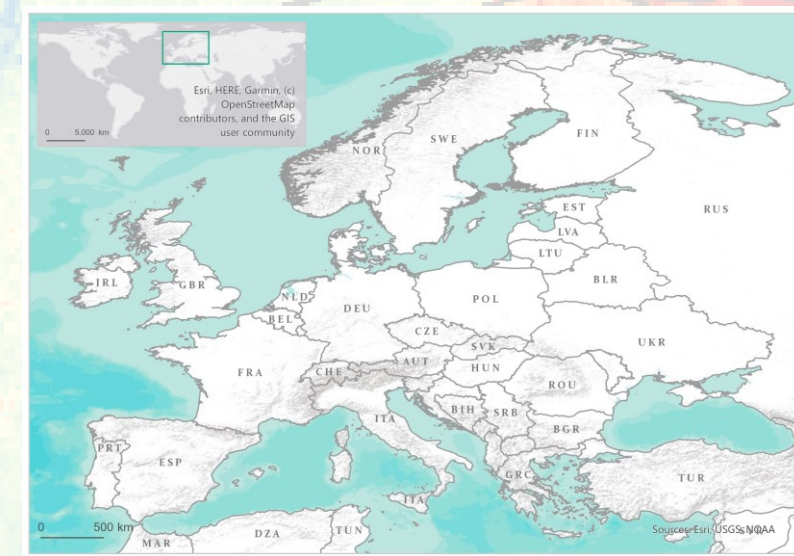


Using Sentinel-5P time-series products for Nitrogen Dioxide (NO₂) Spatio-Temporal Analysis over Europe During the Coronavirus Pandemic Lockdown

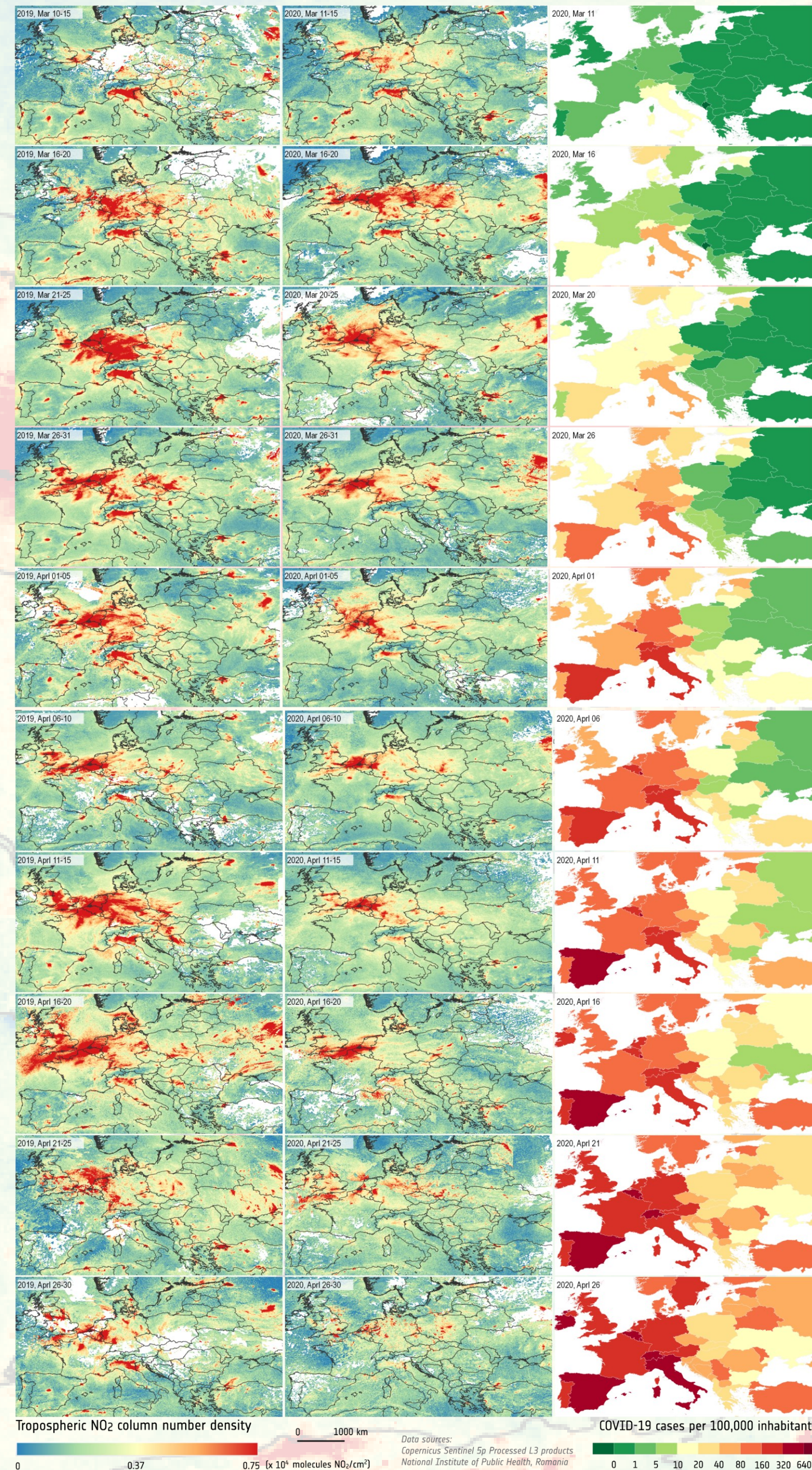
Vîrghileanu M.*, Săvulescu I., Mihai B.-A., Nistor C., Dobre R.

Objective
to build a comparative analysis of the NO₂ pollutant spatial configuration, based on Sentinel-5P time-series data products, on European level between similar months from 2019 and 2020, corresponding to the abrupt transition from a normal condition situation to the COVID-19 outbreak context.

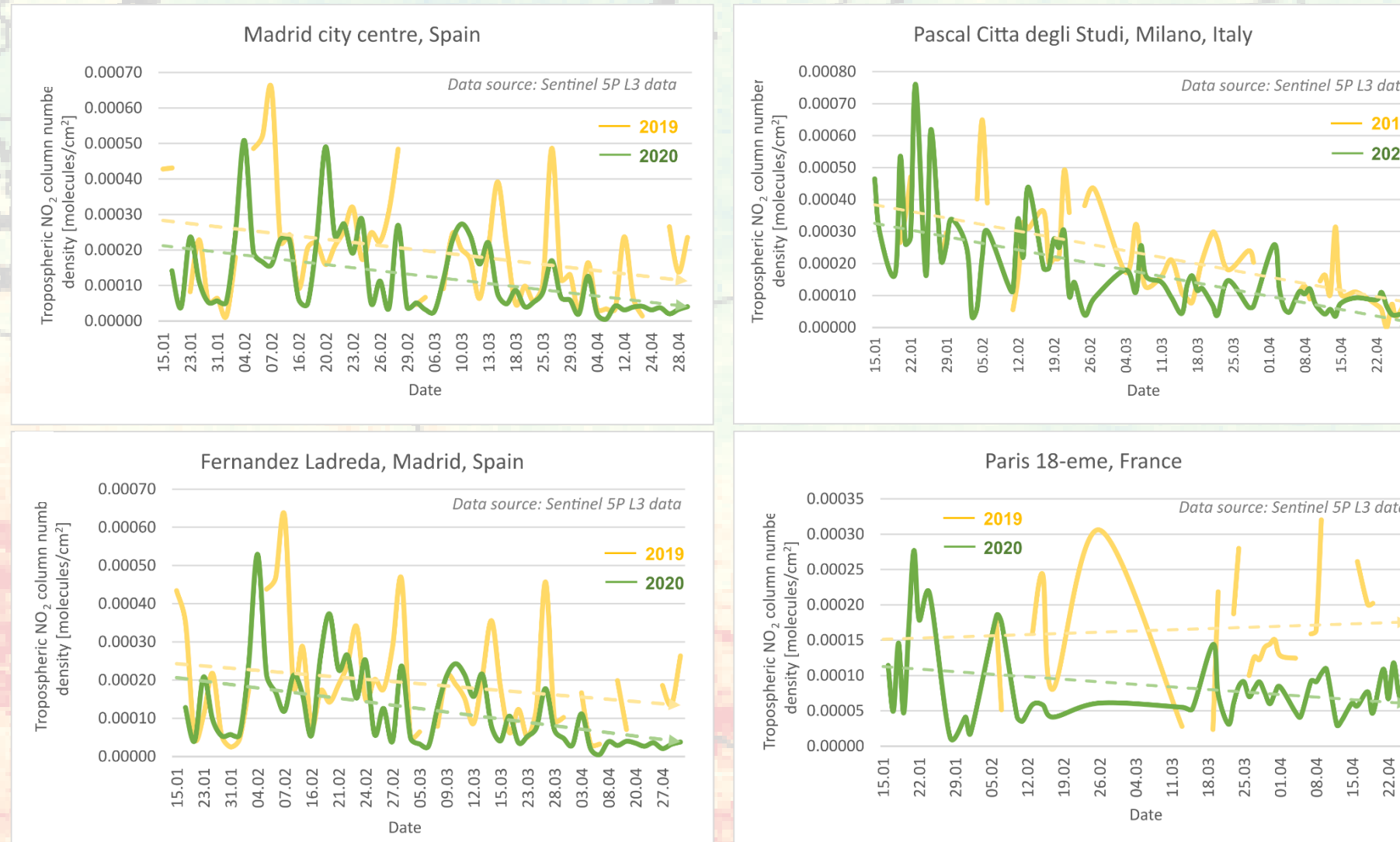


Data and methods

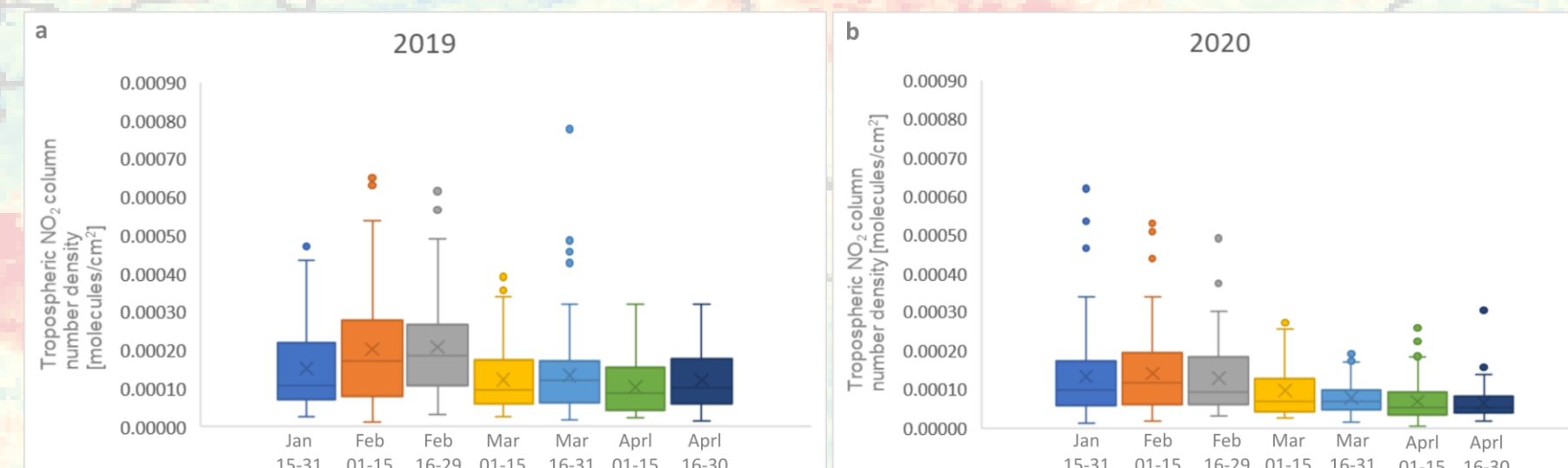
- 492 offline Sentinel-5P L2-NO₂ products;
- Daily coverages for each temporal frame: January 15 – April 30, 2019 and 2020;
- Free and open platform of RUS Service;
- Values on daily and average 5-day or 10-day tropospheric NO₂ column density;



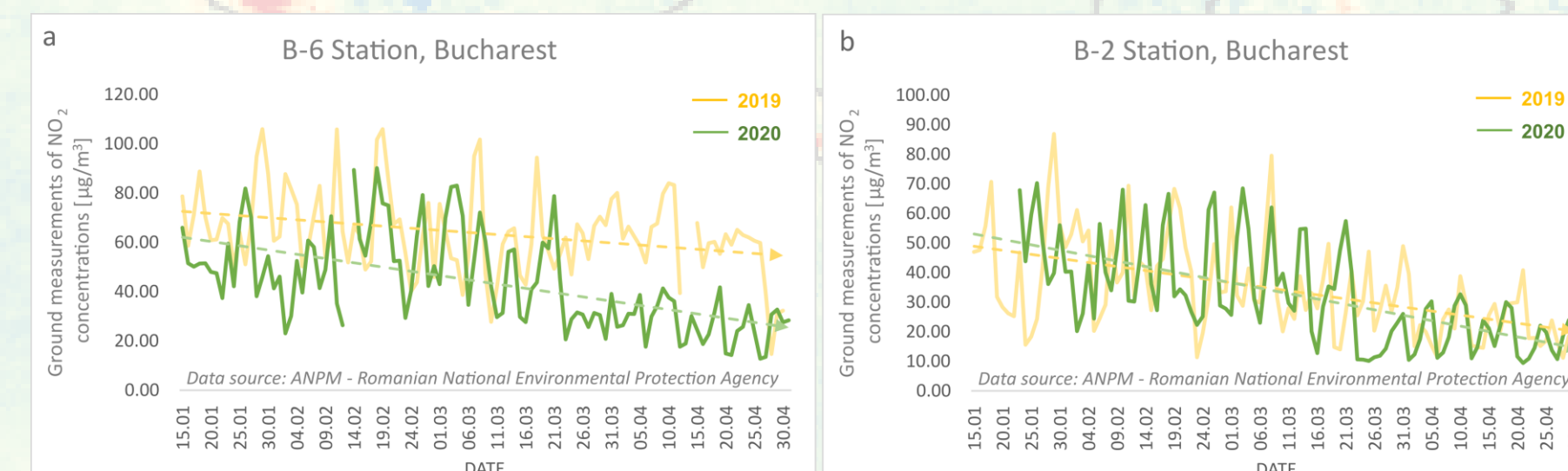
5-day average tropospheric NO₂ column number density in 2019 and 2020, and the incidence rate of COVID-19 confirmed cases



Comparative dynamics of NO₂ daily values based on clear-sky TROPOMI for selected european cities (15 Jan – 30 Apr 2019 and 2020)



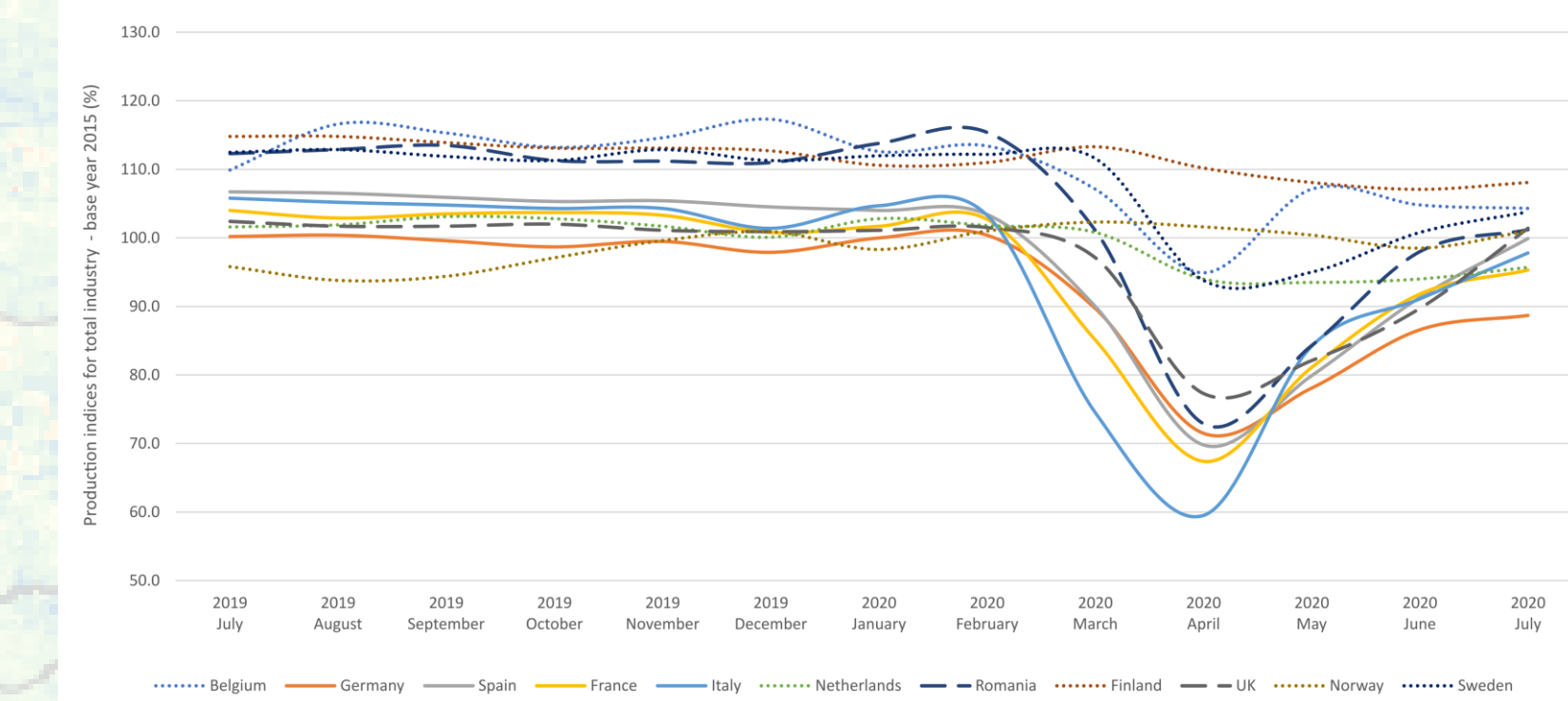
The variability of the daily tropospheric NO₂ column values compared to the average value of the half-month, based on TROPOMI data in 2019 (a) and 2020 (b).



Comparative dynamics of NO₂ ground concentrations measured at urban-traffic station (a) and urban background station in Bucharest, between 15 Jan- 30 Apr 2019 and 2020

Results and discussion

- Two NO₂ pollution patterns:
 - Large areas: Central and Northern European Region; Lombardia;
 - Isolated hotspots: big European cities;
- A remarkable **decrease of the NO₂ pollution by 85% in some situations after mid-March 2020**, as a result of the decrease of emissions from traffic or industrial activities within the COVID-19 lockdown;
- Declining values of NO₂ pollutants are confirmed by ground-stations, especially **for the urban-traffic station**;
- Higher values in winter season months compared to spring for both periods;
- 2020 winter recorded higher surface temperatures compared to 2019, which favours the conversion of NO₂ to secondary pollutants;
- The effect of reactions by different official decision bodies at the state level against the COVID-19 pandemic is highlighted by both, NO₂ pollution decrease and industrial production index;



Industrial Production Index (base year 2015) for the July 2019–July 2020 period (data source: Eurostat, 2020).

Conclusion

- A general image of the NO₂ pollution dynamics across the Europe, based on large volumes of Copernicus Sentinel-5P data, providing also an example of a tool for various air pollutants monitoring and for decision making.

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* marina.virghileanu@geo.unibuc.ro