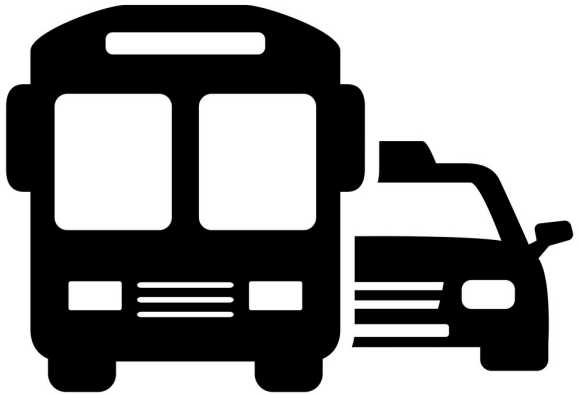
MINISTRY OF TRANSPORT,
INFRASTRUCTURE AND COMMUNICATIONS

UNECE

The development of international passenger rail transport
in the context of ITC Resolution No.264
Wednesday 18th November 2020, Geneva

Nitrogen Dioxide (NO2) Pollution Monitoring (generated by transport activity) with Sentinel-5P Satellite Imagery over Europe during the Coronavirus Pandemic Outbreak



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- Minister adviser

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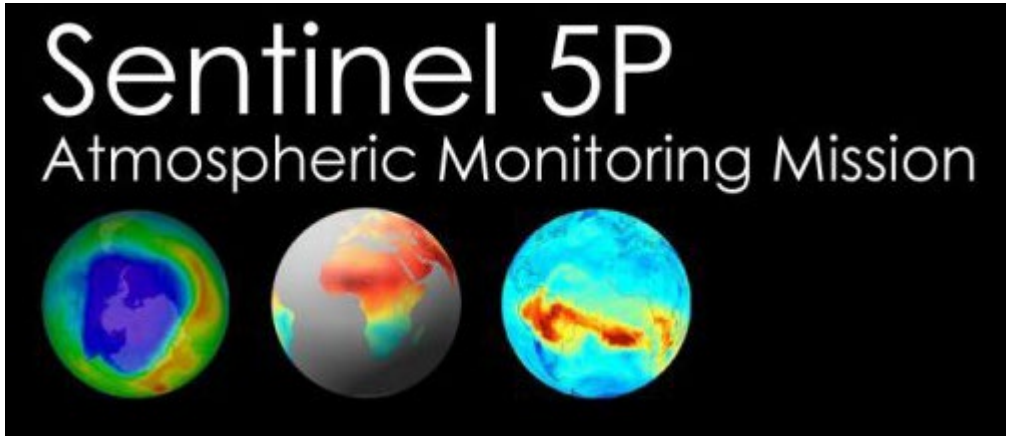
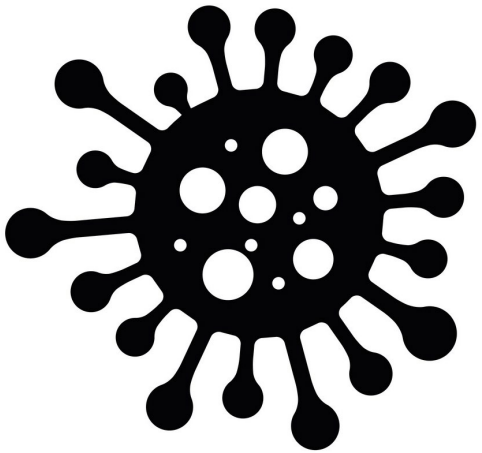
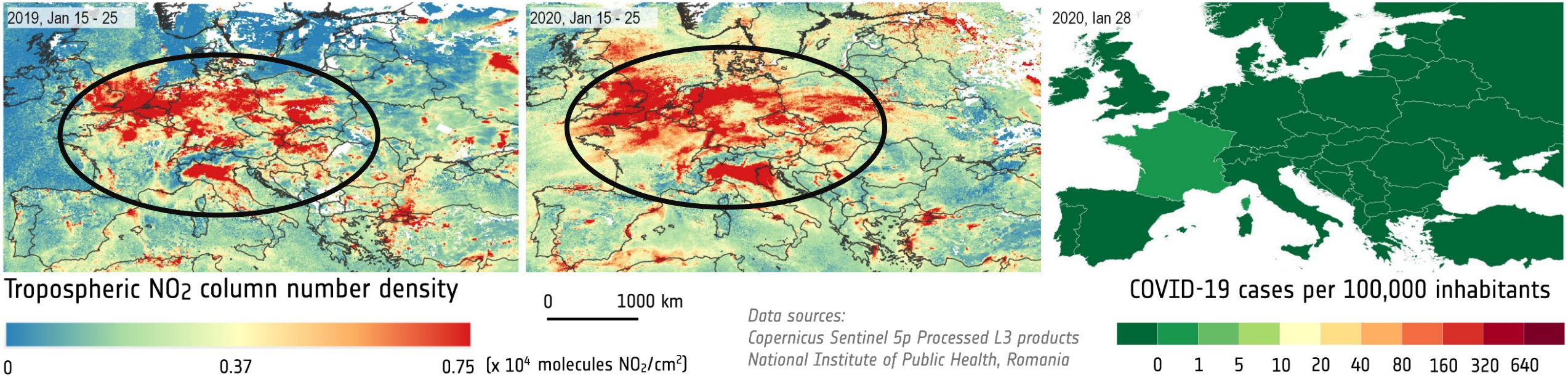




- In the latest years, the European Commission made remarkable efforts to reduce NO_2 pollution and increase the population health state. In this respect, new policies together with new standard limit levels for different pollutants and plans were established for the mitigation of the effects of atmospheric pollution.
- The recently launched ESA Sentinel-5P satellite system produces free and open data products at high spatial resolution, available offline and near-real time in order to help air quality monitoring at different scales of analysis, from the big cities to national, continental, or global coverages.
- The COVID-19 lockdown is an example showing that the air pollutant level can be reduced and even controlled. The images collected after mid-March highlight a remarkable decrease of the NO_2 pollution by 85% in some situations, as a result of the decrease of emissions from traffic or industrial activities, comparatively with the months before or with the same period from 2019.
- The abrupt decrease of NO_2 pollutant concentration over Europe from March to April 2020 was the direct effect of reactions by different official decision bodies at the state level against the COVID-19 pandemic.

Comparative cartographic representations of the 10- or 5-day average tropospheric NO2 density over Europe between mid-January to end of February in 2019 and 2020, and the incidence rate of COVID-19 confirmed cases in European countries.

2019 ***2020*** ***Rate of Covid-19***



- The analyses of the maps and data from mid-January reveal the fact that no considerable changes occurred between 2019 and 2020 with respect to the level of the NO2 pollution, as it maintains high values on large areas across Europe. This period corresponds to the normal condition of economic and transport activities.
- This can be explained by the

  - 1) intensive industrial activities and vehicle traffic superposing on a dense transportation infrastructure network (mainly motorways and highways) and

  - 2) isolated hotspots of pollution covering big cities across Europe and their adjacent areas, following the same causes as mentioned previously

Comparative cartographic representations of the 10- or 5-day average tropospheric NO2 density over Europe between mid-January to end of February in 2019 and 2020, and the incidence rate of COVID-19 confirmed cases in European countries.

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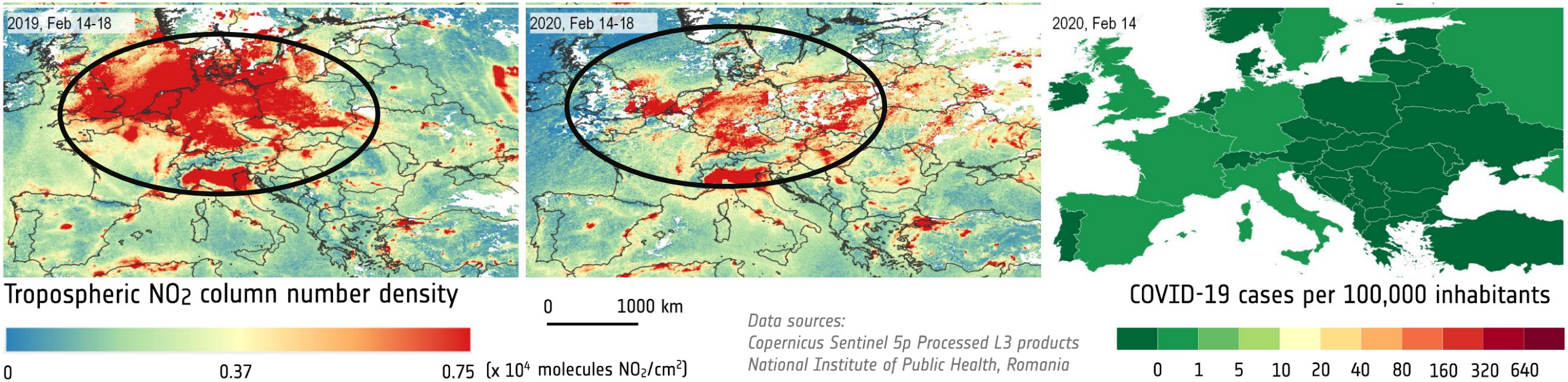
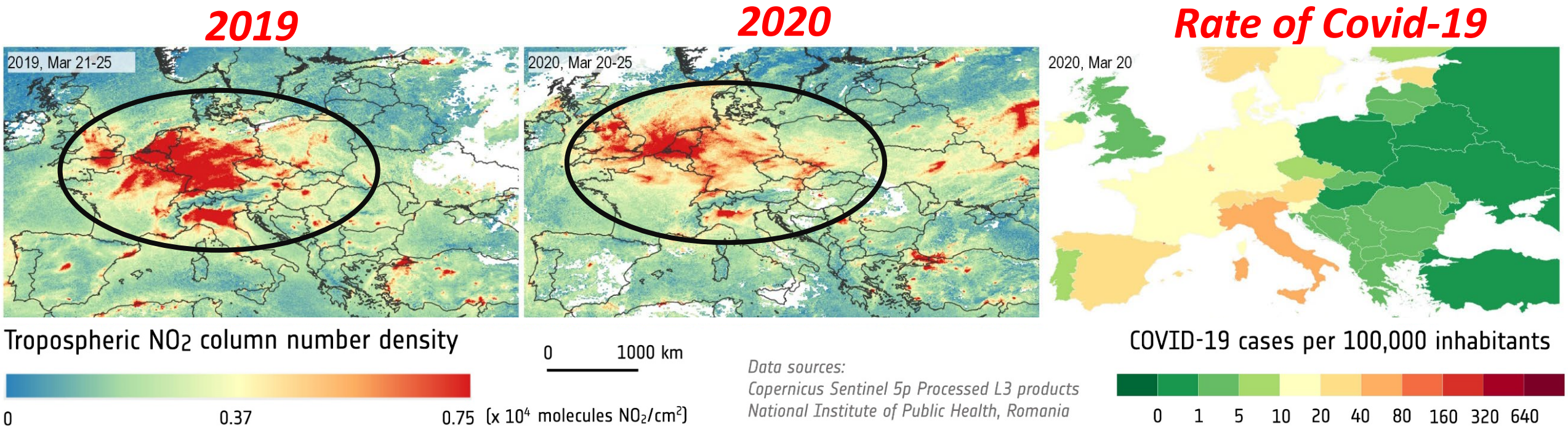


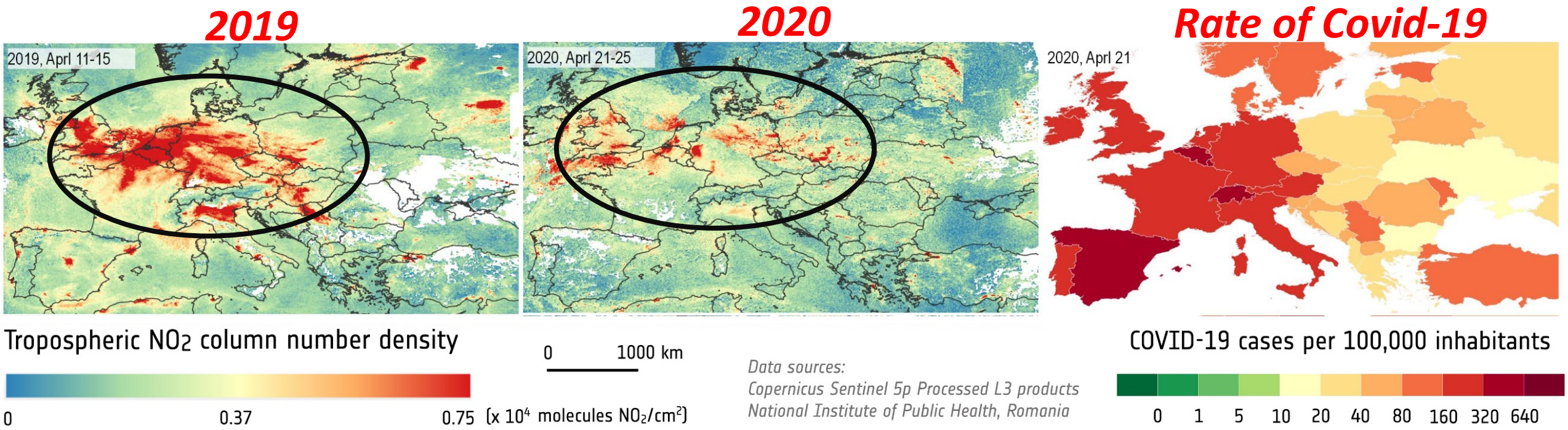
- Level of the NO2 pollution are still maintained at high values across Central Europe.
- But the incidence rate of Covid-19 is rising in Central and Western Europe and Rusia

Comparative cartographic representations of the 5-day average tropospheric NO2 density over Europe between 1 March to 5 April 2019 and 2020, and the incidence rate of COVID-19 confirmed cases in European countries.



- The diachronic representations reveal the gradually remarkable decrease of NO2 pollution over Europe, starting from the end of February and at the beginning of March 2020, corresponding to the period when WHO declared the COVID-19 disease as a pandemic on 11 March, together with the coronavirus lockdown restrictions in multiple countries such as Italy, France, Spain, Romania, etc.
- The incidence rate of Covid-19 is still rising in Central and Western Europe

Comparative cartographic representations of the 5-day average tropospheric NO2 density over Europe between 1 March to 5 April 2019 and 2020, and the incidence rate of COVID-19 confirmed cases in European countries.



As an effect of the massive lockdown of industrial activity and vehicle traffic across Europe, NO2 pollution reduced considerably until the end of April as shown in Figure, being dominant overall, together with the improvement of air quality. By the end of April, multiple European cities that previously featured high levels of air pollution reported very good values of the air quality index, including NO2 parameters. Moreover, the NO2 polluted areas in Central and Northern Europe and the Lombardian region recorded considerable reductions of their spatial extent, and only some isolated hotspots corresponding to some active industries (e.g., power industry) still occur.

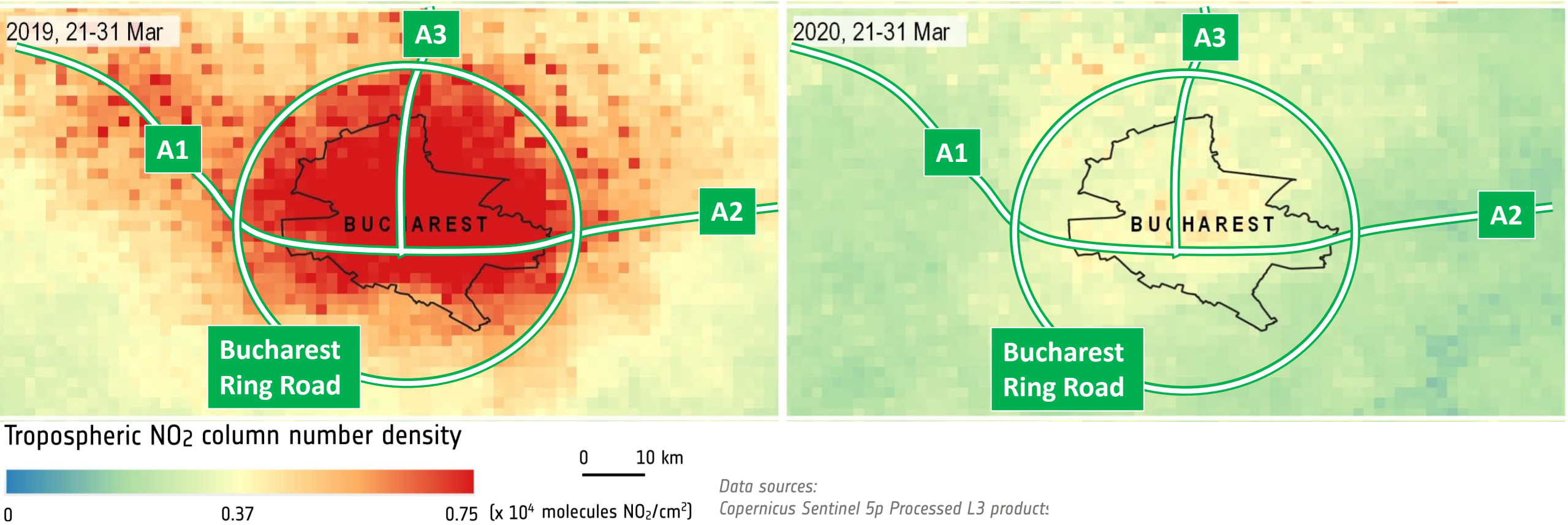
The incidence rate of Covid-19 is still rise in all Europe.

At the European level, we observed a very high correspondence between NO2 emissions and COVID-19 confirmed cases (figures presented above), with some regional variation.

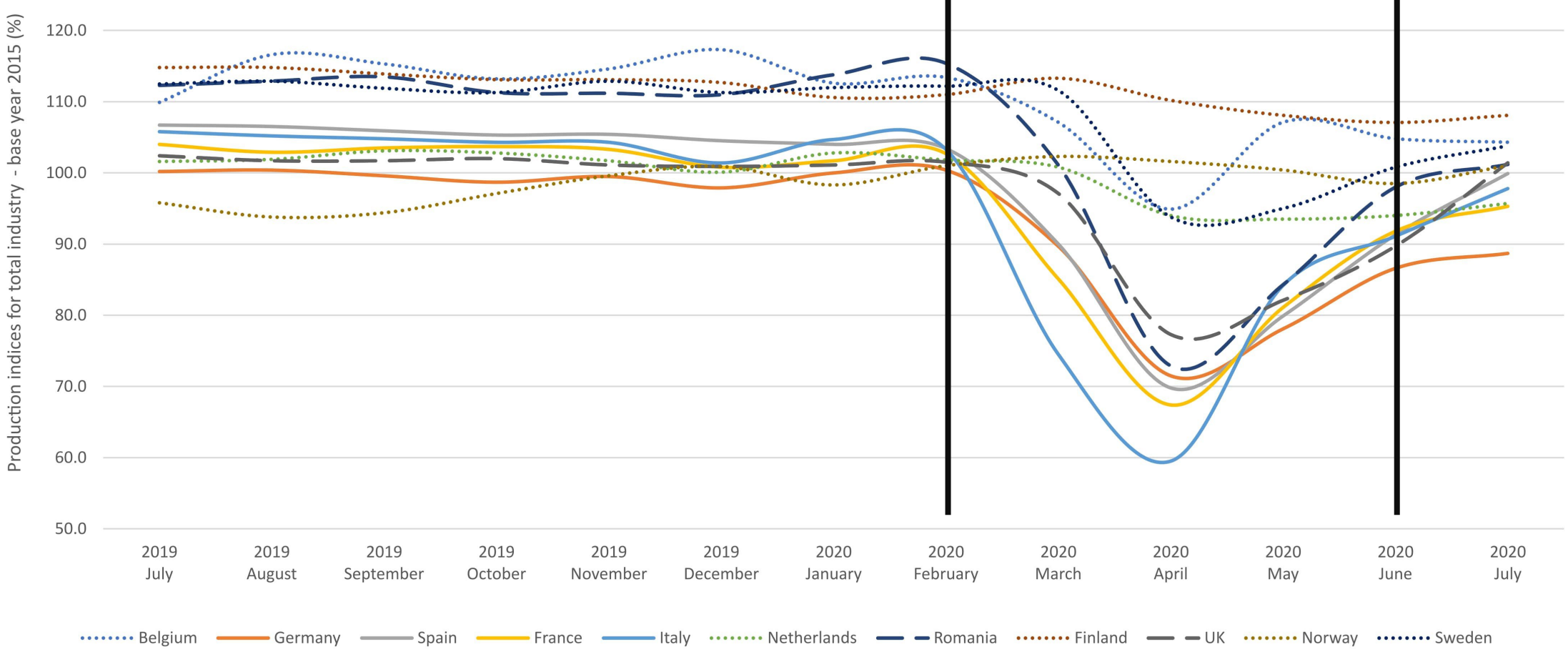
The Southern European case, as the most affected region by the COVID-19 pandemic, is the area that registered a remarkable contrast of NO2 pollution values between 2019 and 2020.

Countries like Spain and Italy reported between 320 and 640 cases per 100,000 inhabitants at the end of the April 2020 and, at the same time, they registered the highest number of deaths. Economic activities were drastically affected by the lockdown, as this situation was also being revealed by the substantial decrease of NO2 emissions.

Comparative map of the 10-day average tropospheric NO2 column number density over Bucharest, Romania, between 21 March and 31 March in 2019 and 2020.



The 10-day periods between 21–31 March are reflected in the cartographic and statistical data as NO_2 pollution peaks, as the road traffic and many economical activities were closed because of the COVID-19 outbreak.
The high pollution are along the highways that start from Bucharest



1. Countries such as France and the United Kingdom, where the socioeconomic activities continued until 23 March, when the statistics reveal a number of about 10,000 coronavirus confirmed cases. - The lockdown measure is reflected shortly after in the NO_2 level of emissions.
2. Countries such as Belgium, the Netherlands, Luxembourg, Germany, Switzerland, Norway, Finland, the Netherlands, Sweden and Austria, featured by a performant sanitary system, the socioeconomic activities were not completely closed, but several prevention measures were adopted by limiting the nonessential activities.

Remote Sens., Volume 12, Issue 21 (November-1 2020)

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Nitrogen Dioxide (NO_2) Pollution Monitoring with Sentinel-5P Satellite Imagery over Europe during the Coronavirus Pandemic Outbreak

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Remote Sens. **2020**, *12*(21), 3575; https://doi.org/10.3390/rs12213575

Received: 23 September 2020 / Revised: 28 October 2020 / Accepted: 29 October 2020 / Published: 31 October 2020

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Abstract

Nitrogen dioxide (NO_2) is one of the main air quality pollutants of concern in many urban and industrial areas worldwide, and particularly in the European region, where in 2017 almost 20 countries exceeded the NO_2 annual limit values imposed by the European Commission Directive 2008/50/EC (EEA, 2019). NO_2 pollution monitoring and regulation is a necessary task to help decision makers to search for a sustainable solution for environmental quality and population health status improvement. In this study, we propose a comparative analysis of the tropospheric NO_2 column spatial configuration over Europe between similar periods in 2019 and 2020, based on the ESA Copernicus Sentinel-5P products. The results highlight the NO_2 pollution dynamics over the abrupt transition from a normal condition situation to the COVID-19 outbreak context, characterized by a short-time decrease of traffic intensities and industrial activities, revealing remarkable tropospheric NO_2 column number density decreases even of 85% in some of

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Received: 23 September 2020; Accepted: 29 October 2020; Published: 31 October 2020

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Keywords: NO_2; TROPOMI sensor; air quality; atmospheric pollution; remote sensing data; COVID-19 outbreak

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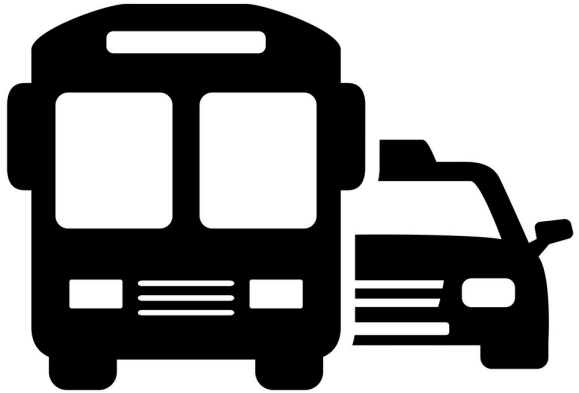
Thank you very much!