



# COVID-19: air pollution remains low as people stay at home

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## Abstract

Coronavirus diseases 2019 (COVID-19) is transmitted worldwide in over a very short time, as it was originated in late 2019 from Wuhan city, China. To reduce the possible effects due to COVID-19, some sort of lockdown activities have been applied in many countries. In this regard, the outcomes reported bonus benefits to the natural environment showing a significant decrease in air pollution worldwide due to COVID-19. The National Aeronautics and Space Administration (NASA) and European Space Agency (ESA) released air pollution data for Asian and European countries to assess the significant changes in air quality. The main objective of the study is to compare the air quality data released by international agencies before and after the novel coronavirus pandemic.

**Keywords** Air pollutant · Coronavirus · COVID-19 · Nitrogen dioxide (NO<sub>2</sub>) · NASA · ESA

## Abbreviations

COVID-19	Coronavirus diseases 2019
NASA	National Aeronautics and Space Administration
ESA	European Space Agency
NO <sub>2</sub>	Nitrogen dioxide
TROPOMI	Tropospheric Monitoring Instrument and Ozone Monitoring Instrument

## Introduction

The novel coronavirus started in Wuhan city, China, in late 2019 and it is now an ongoing global pandemic event (Gautam 2020; WHO 2020). Many researchers have reported that novel coronavirus is an acute respiratory disease, which may affect the lungs and respiratory system (Gautam and Trivedi 2020; Chen et al. 2020). As of April 24, 2020, there are a total of 2,709,483 and 190,861 persons reported as confirmed cases and as number of total deaths, respectively. There are three categories (i.e., history of smoking, older age, high blood pressure and heart diseases) which are considered important factors associated with the development of

the diseases (Wu et al. 2020; Gautam and Trivedi 2020; Gautam and Hens 2020; Liu et al. 2020; Muhammad et al. 2020). According to a report released by the Italian Institute of Health, 481 patients having background diseases passed away due to novel coronavirus infection. In this regard, Fig. 1 shows the description of the background diseases evident in over 20% of the cases due to COVID-19.

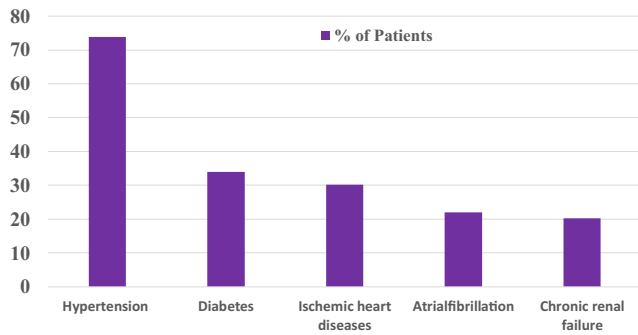
The main sources of NO<sub>2</sub> in the ambient atmosphere are transportation, power plants, and lighting (He et al. 2020; Sharma et al. 2020). Many studies (Saeha et al. 2020; Humbal et al. 2019; Arden Pope et al. 2004) have shown that the symptoms of harmful diseases (i.e., decreased lung function, premature death, lung disease, aggravated asthma, irregular heartbeat, and nonfatal heart attacks) reported due to long exposure to toxic component (i.e., nitrogen dioxide (NO<sub>2</sub>)). Persinger et al. (2002) reported the effects of long-term exposure to NO<sub>2</sub> on lungs (damage to epithelial cells) and respiratory functions. Faustini et al. (2014) stated that the mortality rate can be increased due to the short- and long-term exposure to NO<sub>2</sub>. As per documents, a total of 2.6 million people are significantly affected due to the degradation of air quality. Cohen et al. (2017) reported respiratory and pathogenic effects due to exposure to air pollutants and also suggested a link between air pollution and sick building syndromes.

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## Air quality during COVID-19

Transportation activities have significantly been affected due to COVID-19 lockdowns, as there are less energy



**Fig. 1** Description of background diseases evident in over 20% of the cases (Ogen 2020)

consumption and less oil demand. The outcomes of the lockdown can be easily identified as an improvement of the environmental quality (i.e., air, water, noise). According to data recently released by the National Aeronautics and Space Administration (NASA) and European Space Agency (ESA), the environmental quality has improved and there was a 30% reduction observed in the emission of  $\text{NO}_2$ . The ESA and NASA collect the data (images) through Sentinel – 5 P satellite and AURA satellite images which have produced using Tropospheric Monitoring Instrument and Ozone Monitoring Instrument (TROPOMI), respectively. Figure 2 shows the  $\text{NO}_2$  reduction (%) in Asian and European countries due to COVID-19 lockdowns.

### South Asian countries

A significant reduction in the percentage of  $\text{NO}_2$  in south Asian countries (i.e., China and India) can be seen (Figs. 3 and 4). The ESA collects air quality data by using TROPOMI

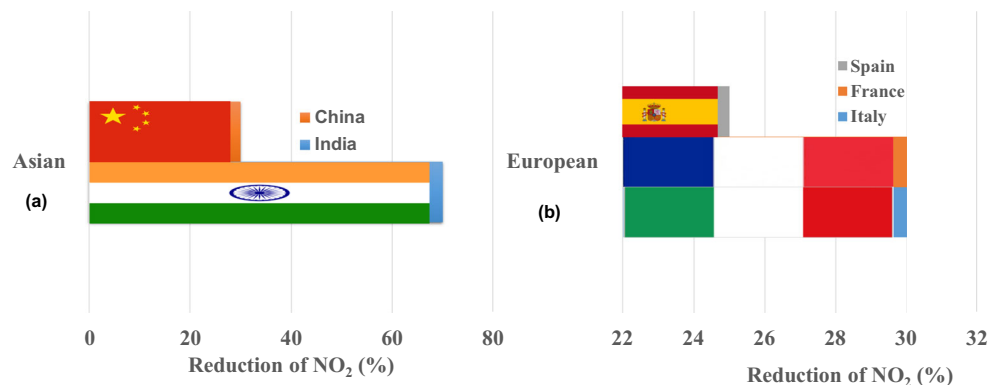
instruments using Sentinel – 5P satellite during COVID-19 lockdowns. The results (i.e., 70% and 20–30%  $\text{NO}_2$  reduction in India and China, respectively) indicate that there are significant changes in the level of  $\text{NO}_2$  identified in Asian countries due to COVID-19.

### European countries

It can be seen that there is a variation in the concentration level of  $\text{NO}_2$  before and after COVID-19 (March 2019–March 2020) (Fig. 5). According to ESA (2020), the  $\text{NO}_2$  reduced 20–30% in European countries (i.e., Spain, Italy, and France) due to lockdown applied by respective governments. The possible images were collected by satellite (Sentinel – 5P) using the TROPOMI instrument.

According to the overall assessment of  $\text{NO}_2$  reduction during COVID-19 lockdowns, it can be observed that lockdown is more effective in Asian countries compared with that in European countries. Asian countries' fight against the COVID-19 outbreak has been unique. While Asian countries placed travel restrictions relatively early and many states quickly shut off access to public places, the country's high population density, overburdened public health infrastructure, high prevalence of non-communicable diseases, and the prospect of transmission from younger people to the elderly in joint families all stack the odds against effective containment. Moreover, the total number of confirmed cases and deaths is more in the European than in Asian countries. For further studies, the relationship between  $\text{NO}_2$  variation and the number of deaths due to novel coronavirus should be carried out.

**Fig. 2**  $\text{NO}_2$  emission reduction data during lockdown: Asian countries (a) and European countries (b) (source: NASA 2020 and ESA 2020)



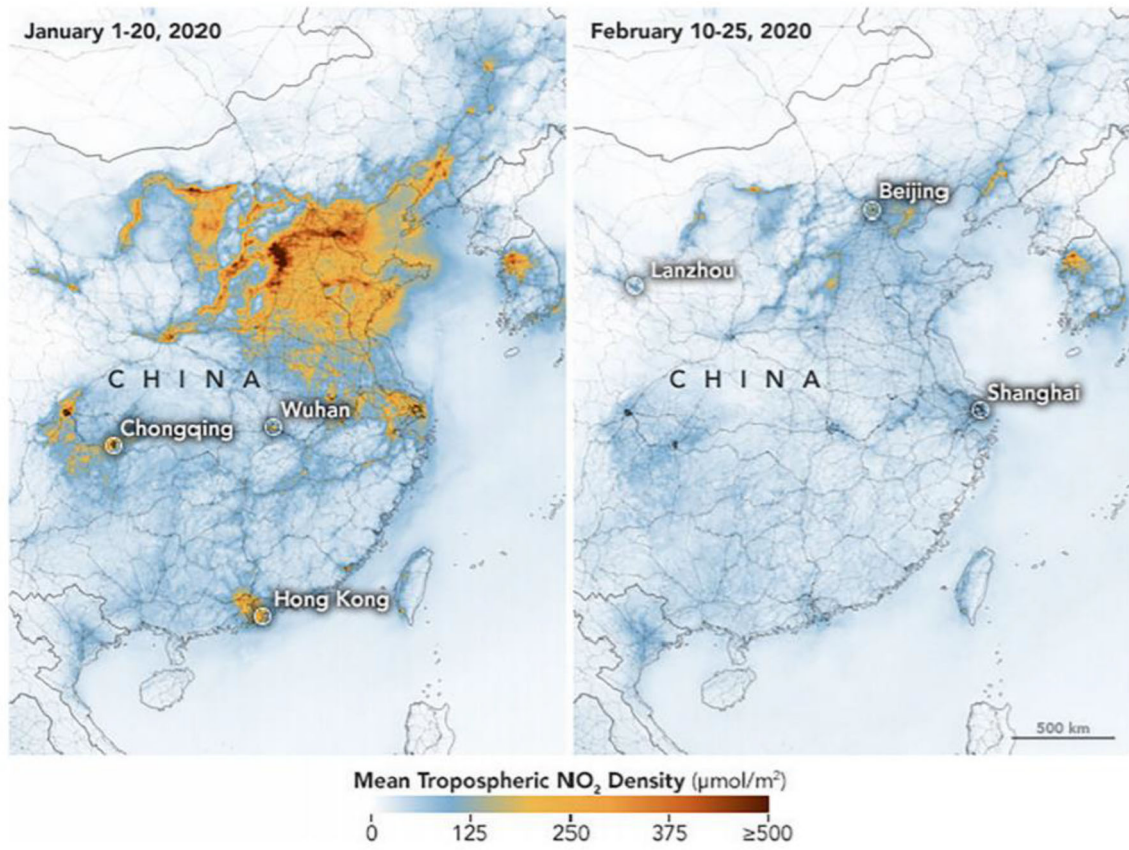


Fig. 3 Variation in the concentration of NO<sub>2</sub> in China during the COVID-19 lockdowns (ESA 2020)

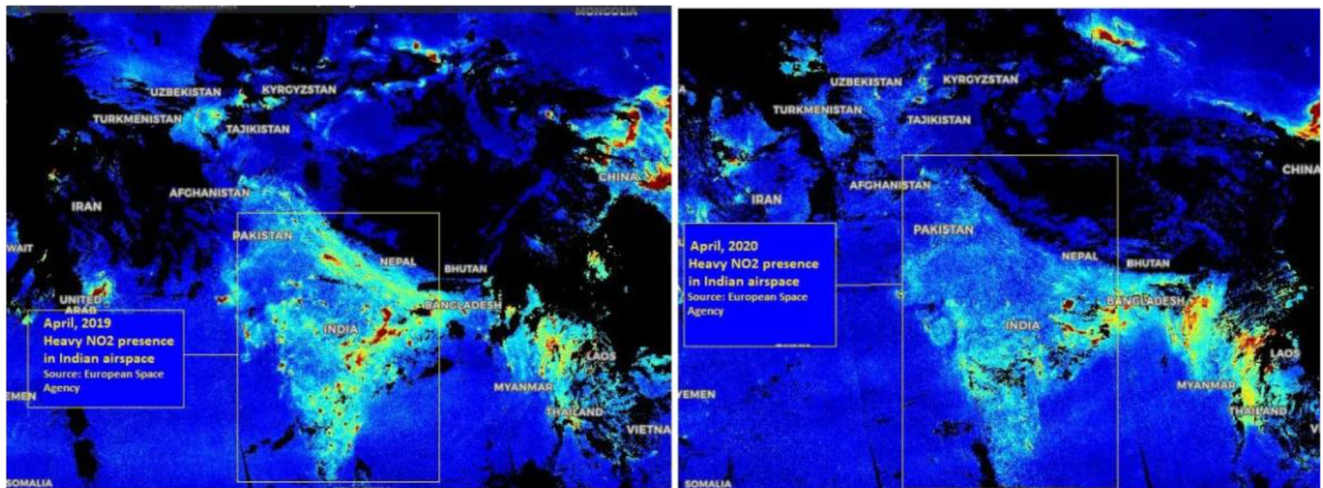
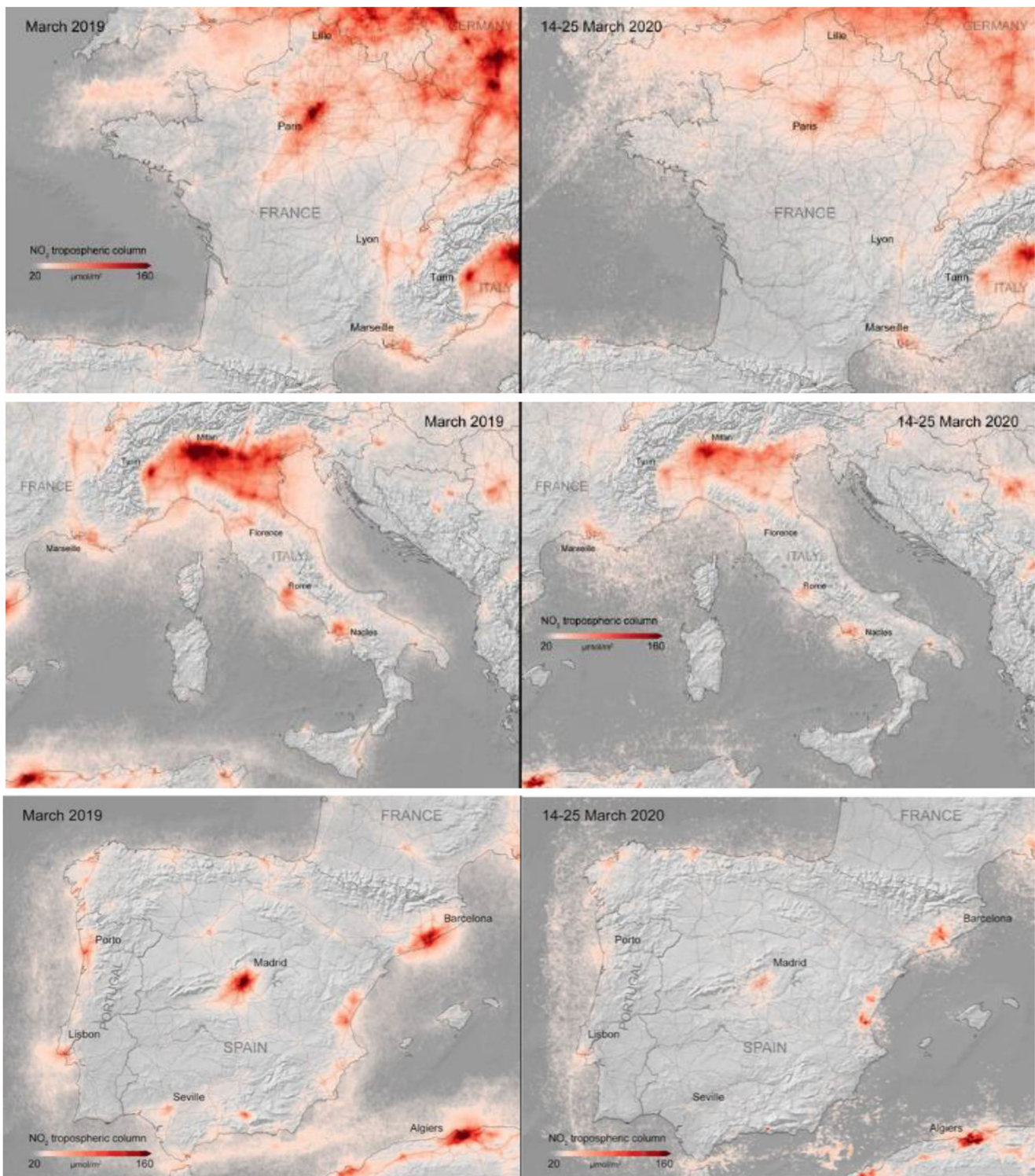


Fig. 4 Variation in the concentration of NO<sub>2</sub> in India during COVID-19 lockdowns (ESA 2020)



**Fig. 5** Variation in the concentration of NO<sub>2</sub> in European countries (Italy, Spain, and France) during COVID-19 lockdowns (ESA 2020)

## Conclusion

In this study, the variation of NO<sub>2</sub> which was collected from the satellite (Sentinel – 5P) was used to indicate the significant reduction in the level of NO<sub>2</sub> in Asian and European countries

due to COVID-19 lockdowns. The outcomes indicated that the novel coronavirus is considered a blessing in disguise. The current status of air quality may be temporary but there is a very good opportunity for us (scientists/researchers/students/individuals) to learn/understand from the applied

lockdown activities on how to minimize the concentration level of air pollutants on a long-term basis.

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