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# COVID-19 Pandemic and environmental pollution: A blessing in disguise?

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**Abstract:** *In late 2019, a novel infectious disease with human to human transmission (COVID-19) was identified in Wuhan China, which now has turned into a global pandemic. Countries all over the world has implemented some sort of lockdown to slow down its infection and mitigate it. Lockdown due to COVID-19 has drastic effects on social and economic fronts. However, this lockdown also have some positive effect on natural environment. Recent data released by NASA (National Aeronautics and Space Administration) and ESA (European Space Agency) indicates that pollution in some of the epicenters of COVID-19 such as Wuhan, Italy, Spain and USA etc. has reduced up to 30%. This study compiled the environmental data released by NASA and ESA before and after the coronavirus pandemic and discuss its impact on environmental quality.*

**Key words:** *COVID-19; Environmental pollution; NO<sub>2</sub> emissions*

## 1. Introduction

A novel infectious disease of coronavirus family was identified in Wuhan, China in late December 2019, which was later named as COVID-19 (Chen et al., 2020). In January 2020, WHO (world health organization) confirmed human to human transmission of COVID-19 through respiratory droplets (WHO, 2020). Later on the same month, authorities confirmed a cluster of COVID-19 cases in Wuhan, which increased rapidly not only in surrounding areas but also spread in the whole country and the outbreak turned into epidemic (Dutheil et al., 2020). On January 23<sup>rd</sup>, Wuhan was placed under quarantine, while Hubei province follows within few days. Subsequently, Chinese government placed the whole country on lockdown to slow down the spread of infection and ease burden on health facilities (Wilder-Smith and Freedman, 2020). Chinese authorities shutdown public transport, educational institutes, businesses centers, parks and other social interaction points to curtail the transmission of COVID-19. On January 30<sup>th</sup>, WHO declared worldwide public health emergency. In February, outbreak begin in Iran, Italy and other countries around the globe. Subsequently, the epidemic turns into pandemic and by end of March half of the world population was under some form of lockdown (Tosepu et al., 2020). As of April 16, 2020, the total no of COVID-19 cases surpassed 2.1 million worldwide, with no of total deaths more than 135,000 (WHO, 2020).

As countries went into lockdown the industrial activities shutdown globally. Among many other sectors, transport is the most hard hit sector due to lockdown. Road and air transport came to halt as people are not allowed or hesitate to travel. According to report, air travel dropped by 96% due to COVID-19, lowest in 75 years (CNN, 2020). Furthermore, not only transport sector but also industrial and manufacturing sector is heavily effected by pandemic. Global oil demand declined drastically and prices cut down sharply, as industrial and transport sectors came to halt

worldwide. COVID-19 has severe negative impact on human health and world economy, however it also results in pollution reduction due to limited social and economic activities (Dutheil et al., 2020).

NO<sub>2</sub> (nitrogen dioxide) is highly reactive pollutant and emitted especially from the combustion of fossil fuels. Traffic pollution is considered as the major source of NO<sub>2</sub> emissions (He et al., 2020). NO<sub>2</sub> is considered highly lethal to human health as studies shows that both short term and long term exposure to NO<sub>2</sub> can increase mortality rate (Faustini et al., 2014). NO<sub>2</sub> may cause bronchial hyper responsiveness, cellular inflammation and respiratory problems (He et al., 2020). Annually 4.6 million people die worldwide due to poor air quality. Air pollution is a global problem and its effects can be seen even across developed nations such as Europe where 193,000 people died due to air pollution in 2012 (Cohen et al., 2017).

## **2. Pollution assessment during COVID-19**

Lockdown due to COVID-19 reduced transport activities which results in less energy consumption and lower oil demand. These changes in transport activities and oil demand exerts a significant impact on the environmental quality. NASA (National Aeronautics and Space Administration) and ESA (European Space Agency) released fresh evidence which suggests that environmental quality improved and the emission of NO<sub>2</sub> reduced up to 30%. NASA collect the data using OMI (Ozone Monitoring Instruments) on its AURA satellite. While, ESA collect the data through Sentinel-5P satellite using TROPOMI (TROPOspheric Monitoring Instrument). NASA and ESA release satellite images of various countries before and after lockdown.

**Table 1**

NO<sub>2</sub> emissions data acquisition across different regions.

Location	Agency	Satellite	Time	% Reduction	Source
Wuhan	NASA and ESA	Aura and Sentinel-5P	Jan –Feb (2019 and 2020)	30 %	(NASA, 2020)
China	ESA	Sentinel-5P	Jan and Feb 2020	20-30 %	(ESA, 2020)
Europe	ESA	Sentinel-5P	Mar 2019 and Mar 2020	20-30 %	(ESA, 2020)
Italy	ESA	Sentinel-5P	Mar 2019 and Mar 2020	20-30 %	(ESA, 2020)
France	ESA	Sentinel-5P	Mar 2019 and Mar 2020	20-30 %	(ESA, 2020)
Spain	ESA	Sentinel-5P	Mar 2019 and Mar 2020	20-30 %	(ESA, 2020)
USA	NASA	Aura	Mar 2015-19 and Mar 2020	30 %	(NASA, 2020)

In addition, google release data of mobility index report from February 23 to April 05 (*See* Table 2). The data shows that mobility has reduced up to 90%. Particularly across Spain, Italy and France. While, mobility has reduced the least across USA.

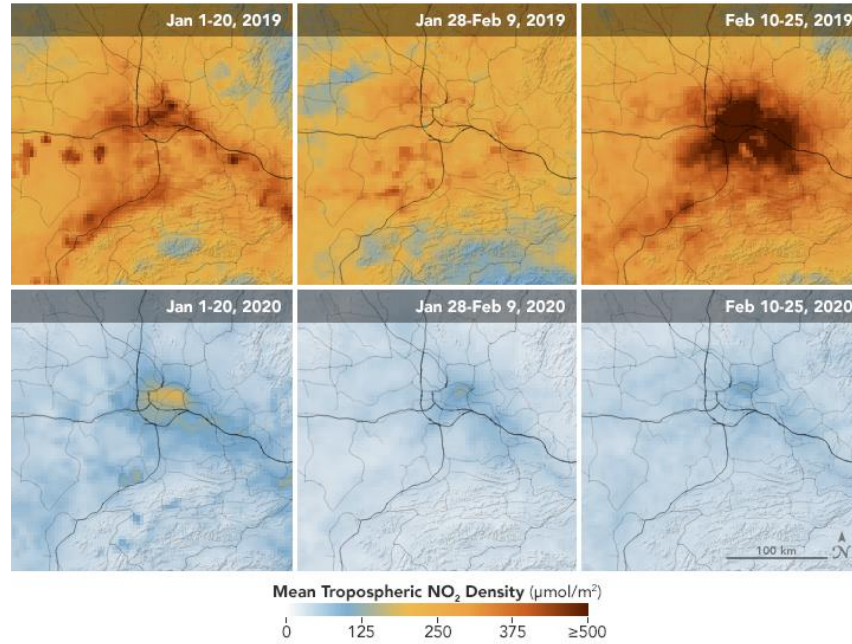
**Table 2**

Mobility index report based on google tracking.

Location	Transport	Grocery and pharmacy	Retail and recreation	Work place	Parks and outing	Residential
USA	-54%	-20%	-49%	-40%	-20%	+13%
Spain	-89%	-77%	-94%	-68%	-90%	+23%
Italy	-86%	-82%	-95%	-62%	-90%	+24%
France	-82%	-62%	-85%	-53%	-73%	+17%
Germany	-47%	-13%	-58%	-30%	+61%	+8%
Uk	-70%	-41%	-82%	-54%	-29%	+15%

## 2.1. Wuhan

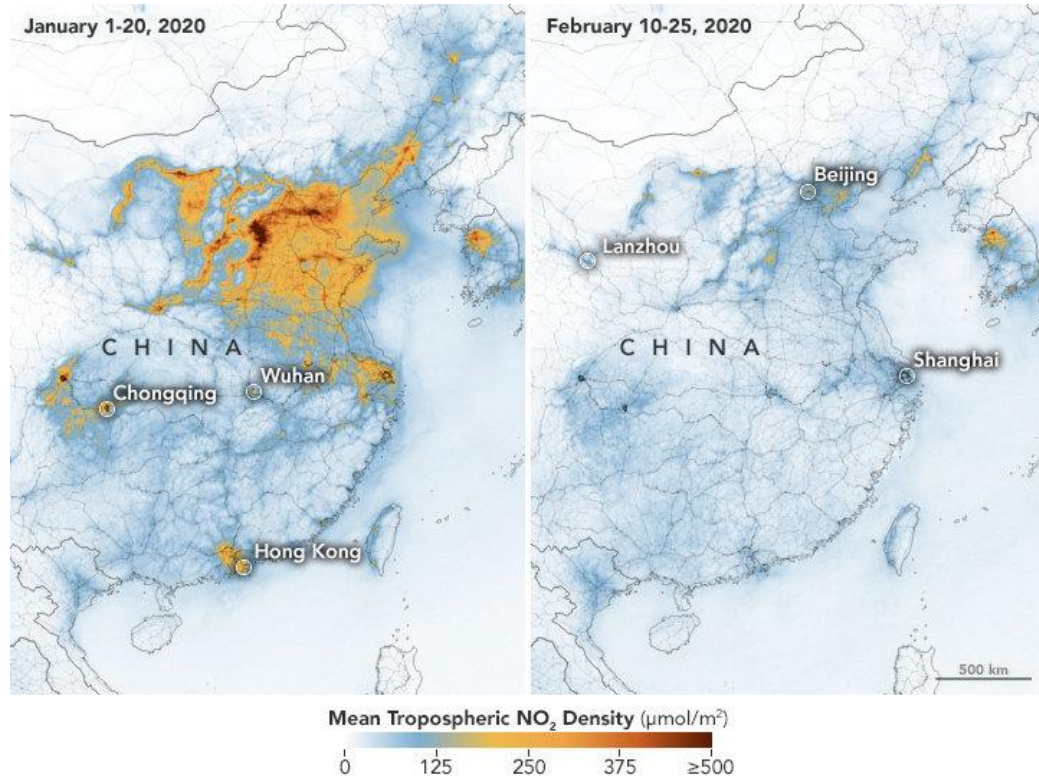
Fig. 1 shows the NO<sub>2</sub> concentration in Wuhan during 2019 and 2020. Where NO<sub>2</sub> emissions is reduced up to 30% (NASA, 2020). NO<sub>2</sub> emissions is measured using TROPOMI instruments through Sentinel-5P satellite. The image provide comparison between Wuhan 2019 (Jan and Feb) and 2020 (Jan and Feb), NO<sub>2</sub> emissions. Where it clearly indicates that NO<sub>2</sub> emissions reduced significantly due to COVID-19.



**Fig. 1.** NO<sub>2</sub> emissions in Wuhan during 2019 and 2020. (NASA, 2020)

## 2.2. China

Fig. 2 represents NO<sub>2</sub> emissions sequence of China before and after lockdown. Where NO<sub>2</sub> emissions is reduced up to 20-30% from February 10 to 25 after lockdown was implemented (ESA, 2020). The satellite image was captured by ESA satellite Sentinel-5P using TROPOMI Instrument.

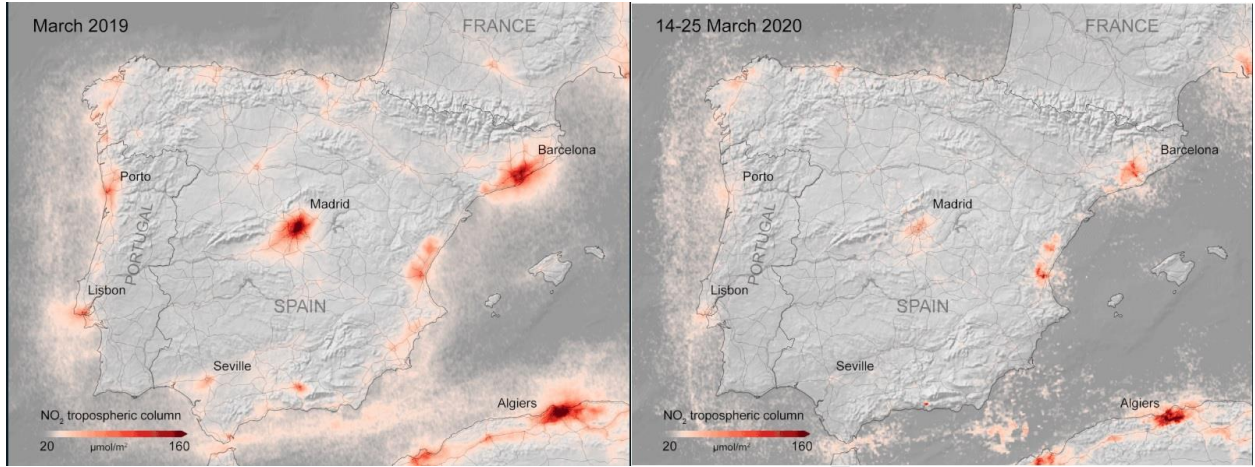


**Fig. 2.** NO<sub>2</sub> emissions in China before and after lockdown. (ESA, 2020)

### 2.3. Spain

Fig. 3 represents NO<sub>2</sub> emissions concentration in Spain during March 2019 and March 2020. According to (ESA, 2020), the NO<sub>2</sub> emissions reduced up to 20 to 30% in Spain due to lockdown, especially across the major cities such as Madrid, Barcelona and Seville. The satellite image was captured by ESA satellite Sentinel-5P using TROPOMI Instrument.

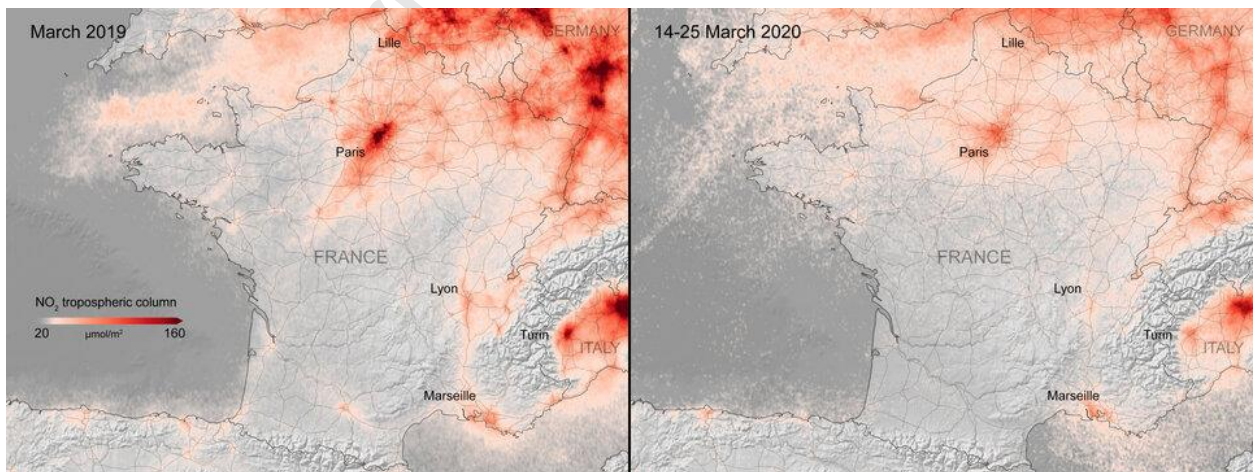




**Fig. 3.** NO<sub>2</sub> emissions in Spain before and after lockdown. (ESA, 2020)

## 2.4. France

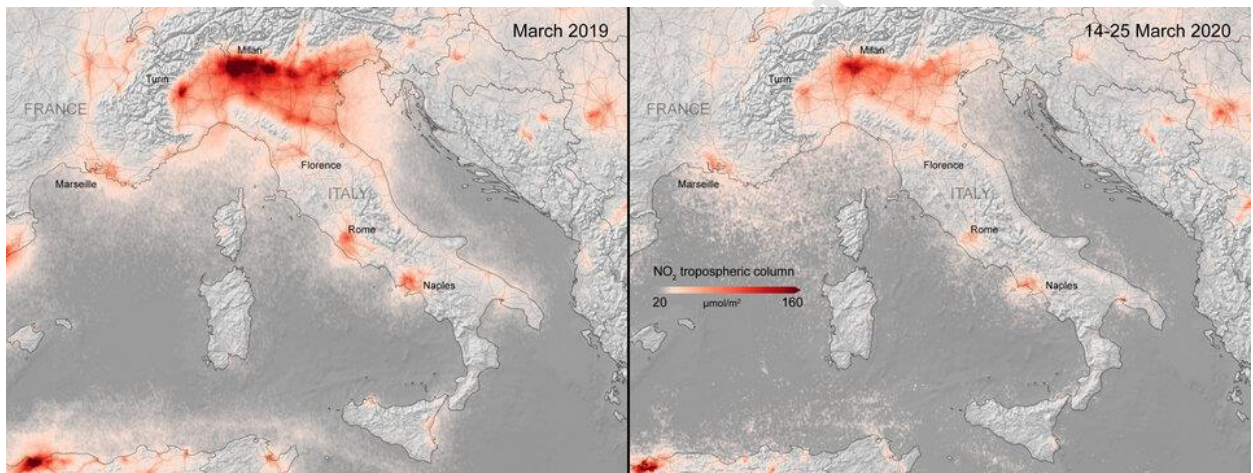
Fig. 4 represents NO<sub>2</sub> emissions concentration in France during March 2019 and March 2020. NO<sub>2</sub> emissions is reduced up to 20 to 30% in France (ESA, 2020). The satellite image was captured by ESA satellite Sentinel-5P using TROPOMI Instrument. NO<sub>2</sub> emissions reduced significantly during lockdown across Paris and other major cities due to transportation shutdown.



**Fig. 4.** NO<sub>2</sub> emissions in France before and after lockdown. (ESA, 2020)

## 2.5. Italy

Fig. 5 represents  $\text{NO}_2$  emissions concentration in France during March 2019 and March 2020. The image indicate that  $\text{NO}_2$  concentration reduced significantly during lockdown due to transport shutdown and low mobility. The satellite image was captured by ESA satellite Sentinel-5P using TROPOMI Instrument.  $\text{NO}_2$  emissions across Italy is reduced up to 20 to 30% (ESA, 2020).

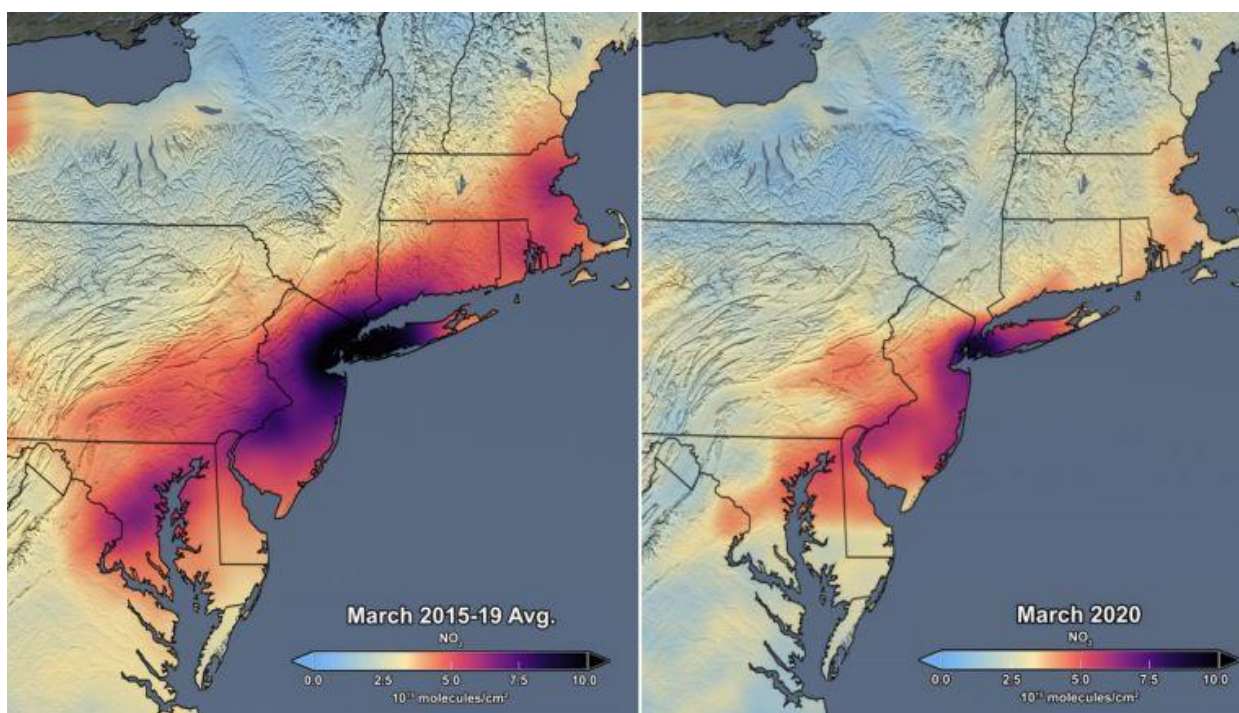


**Fig. 5.**  $\text{NO}_2$  emissions in Italy before and after lockdown. (ESA, 2020)

## 2.6. USA

Fig. 6 represents  $\text{NO}_2$  emissions concentration in northeastern part of United States during March 2015 to 2019 and March 2020. Satellite image was captured by NASA through AURA satellite using OMI instrument. Where  $\text{NO}_2$  emissions is reduced up to 30% due to lockdown in northeastern part of USA (NASA, 2020).





**Fig. 6.** NO<sub>2</sub> emissions in northeastern USA before and after lockdown. (NASA, 2020)

### 3. Conclusion

COVID-19 is a global pandemic and serious threat to human health which halt the economic activities, however it is also considered as a “Blessing in Disguise”, where pollution is reducing and nature is reclaiming itself. This positive impact on environment maybe temporary but governments and individuals should learn from this lockdown on how to reduce pollution on long term basis.

### Acknowledgement

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**Declaration of competing interests**

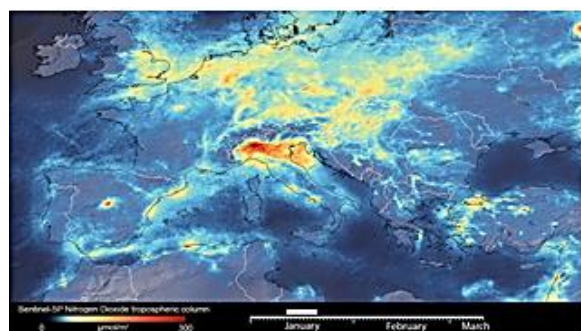
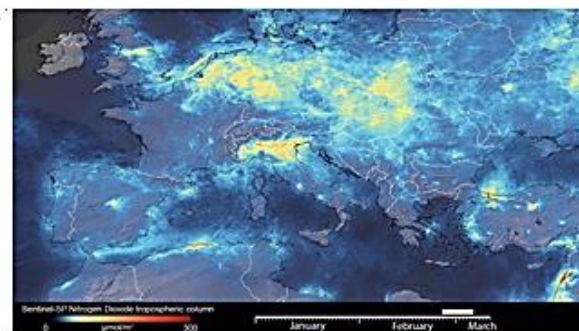
☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

### **Authorship contributions**

- Sulaman Muhammad: Conceptualization, data acquisition, Writing, editing, revision
- Xingle Long: Conceptualization, supervision and revision
- Muhammad Salman: Conceptualization and data acquisition

## Graphical abstract

**Before Lockdown****After Lockdown**

### Highlights

- Half of the world population is under some form of lockdown due to COVID-19
- Environmental pollution is reduced up to 30%
- Mobility is reduced up to 90%

Journal Pre-proof