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Study of relation between spread of Covid-19 and Nitrogen dioxide

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ABSTRACT

The Covid-19 virus is being spread all over the world and infected citizens of more than 212 territories with corona disease. About 1395136 people are infected by Covid-19 and 81580 total deaths up to now due to corona virus are recorded according to WHO data. Emergency is being declared and order of lockdown are given in most of the countries. The level of air pollution mainly nitrogen dioxide (NO₂) is lowered drastically. There is relation between spread of Covid-19 and nitrogen dioxide and temperature of various countries which we tried to study in this paper.

Keywords— COVID-19, Coronavirus, Nitrogen dioxide, Respiratory track

1. INTRODUCTION

As lockdown is announced in many countries from few days there is significant reduction in nitrogen dioxide (NO₂) because of reasons like industrial shutdown, restriction on use of vehicles by citizens, sale of new vehicles, etc. We tried to study the effect of nitrogen dioxide on human body, how corona virus infects respiratory track of human beings, reduction in level of nitrogen dioxide in last weeks over the world and tried to find ways to restrict the spread of Covid-19 in future

1.1 Effect of Nitrogen Dioxide on human body

Health effects-Breathing air with a high concentration of NO₂ can irritate airways in the human respiratory system. Such exposures over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions and visits to emergency rooms. Longer exposures to elevated concentrations of NO₂ may contribute to the development of asthma and potentially increase susceptibility to respiratory infections. People with asthma, as well as children and the elderly are generally at greater risk for the health effects of NO₂. NO₂ along with other NO_x reacts with other chemicals in the air to form both particulate matter and ozone. Both of these are also harmful when inhaled due to effects on the respiratory system.

1.2 Corona and respiratory track

The coronavirus is thought to spread mainly from person to person. This can happen between people who are in close contact with one another. Droplets that are produced when an infected person coughs or sneezes may land in the mouths or noses of people who are nearby, or possibly be inhaled into their lungs. Coronavirus can also spread from contact with infected surfaces or objects. Corona virus is a respiratory virus similar to the flu. People having heart disease, lung disease, and diabetes, increase risk even further in those who are older.

1.3 Relation between Corona virus and Nitrogen dioxide

Corona virus is a respiratory virus means it attacks primarily on respiratory track of human being. People suffering from respiratory diseases like Asthma, lung diseases and other are at high of getting infected by corona virus and suffering more while infected by corona virus as compare to other people. Nitrogen dioxide is a pollutant which affects respiratory track of humans and weakens the respiratory system of human being. If there is high concentration of nitrogen dioxide in air then citizens will have weak immune system particularly for respiratory system and in such situation if there is infection of Covid-19 among people then it will spread rapidly as its victim will already have weak immune system for respiratory track. So, to avoid infection of Covid-19 one should have a strong respiratory system which can be achieved only if there is less nitrogen dioxide in air.

1.4 Causes of increase in Nitrogen dioxide

Nitrogen dioxide is not usually released directly into the air. Nitrogen dioxide forms when nitrogen oxide (NO) and other nitrogen oxides (NO_x) react with other chemicals in the air to form nitrogen dioxide. The main source of nitrogen dioxide resulting from

human activities is the combustion of fossil fuels (coal, gas and oil) especially fuel used in cars. It is also produced from making nitric acid, welding and using explosives, refining of petrol and metals, commercial manufacturing, and food manufacturing. Natural sources of other nitrogen oxides include volcanoes and bacteria.

Nitrogen Dioxide (NO₂) is one of a group of highly reactive gases known as oxides of nitrogen or nitrogen oxides (NO_x). Other nitrogen oxides include nitrous acid and nitric acid. NO₂ is used as the indicator for the larger group of nitrogen oxides. NO₂ primarily gets in the air from the burning of fuel. NO₂ forms from emissions from cars, trucks and buses, power plants, and off-road equipment.

The emissions from diesel cars of nitrogen oxides on the road are typically five times higher than measured on the road – although performance varies widely between individual models. In contrast, emissions from most gasoline cars are similar in tests and on the road and about 10 times lower than produced by diesels.

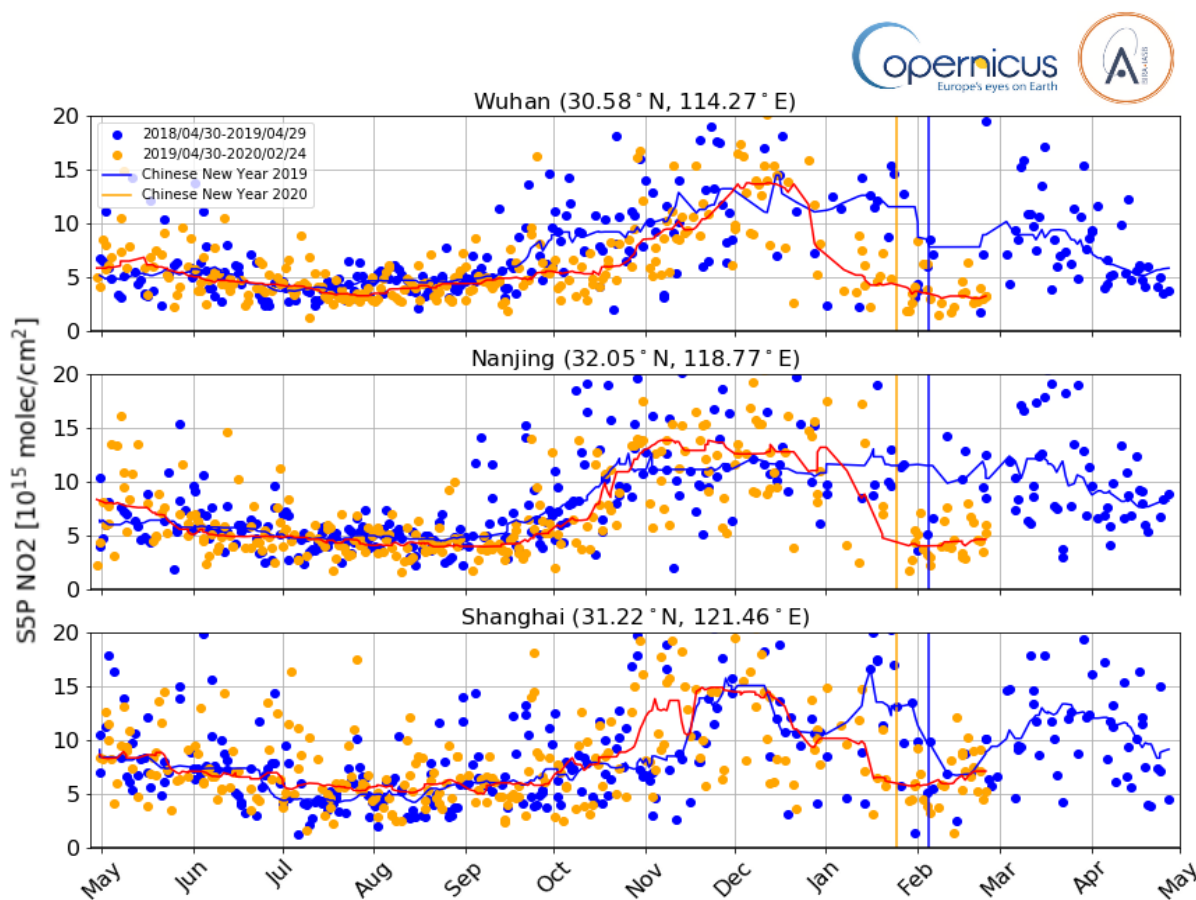
Testing conducted by the independent International Council on Clean Transportation (ICCT)¹ found a typical modern Euro 6 diesel emits 7-10 times more nitrogen dioxides (Nox) on the road than the Euro 6 limit achieved in tests (80mg/km). Petrol cars have a tighter limit (60mg/km) that is typically met on the road. More recent tests performed by Emissions Analytics² show diesel emissions on the road are typically four and a half times higher than permitted by Euro 6 standards. Other tests show similar results. Nox is a mixture of mainly nitric oxide (NO) and nitrogen dioxide (NO₂). Diesel cars also produce much more nitrogen dioxide (NO₂) within the Nox emissions they emit. The European Commission's scientists³ found the share of NO₂ in the total NOX emissions reached 60% for diesel vehicles but was substantially lower for gasoline vehicles (0-30%).

1.5 China's nitrogen dioxide level study of last few months

Because of lockdown of various cities in the Chinese province of Hubei, which started on January 23, 2020 there is significant decrease in nitrogen dioxide which was causing by vehicles and industries. The levels of NO₂ air pollution above major cities in China have decreased by 30 to 50% compared to a comparable period last year.

1.6 Consequences for air quality

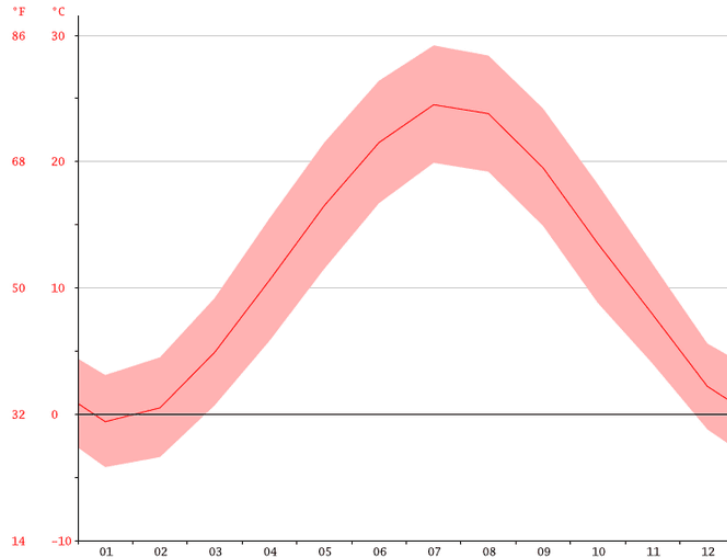
NO₂ is a gas that enters the atmosphere during all kinds of combustion processes, such as in a car's engine, in heating boilers, in industry or in power stations. Tropospheric NO₂ is therefore an important indicator for air pollution. The TROPOMI sensor on board the Sentinel-5 Precursor platform measures the composition of the atmosphere worldwide and on a daily basis with an unprecedented spatial resolution. This also provides us with crucial information about air quality over China, and in particular above cities such as Wuhan or Nanjing, one of the cities in the pollution chain around Shanghai.



Time series of TROPOMI tropospheric NO₂ above three major Chinese cities (Wuhan, Nanjing and Shanghai) over a 2-year period (orange/red for this year, 2019-2020; blue for last year 2018-2019). The concentrations are average values over a circle with a radius of 50 km around these cities, using a moderate cloud filter. The full lines are a rolling median in 30 days.

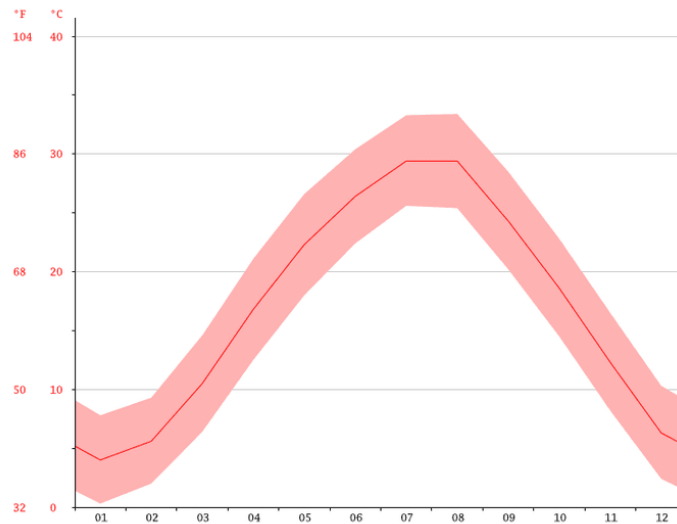
1.7 Temperature of countries where nitrogen emission was high and temperature was

(a) New York



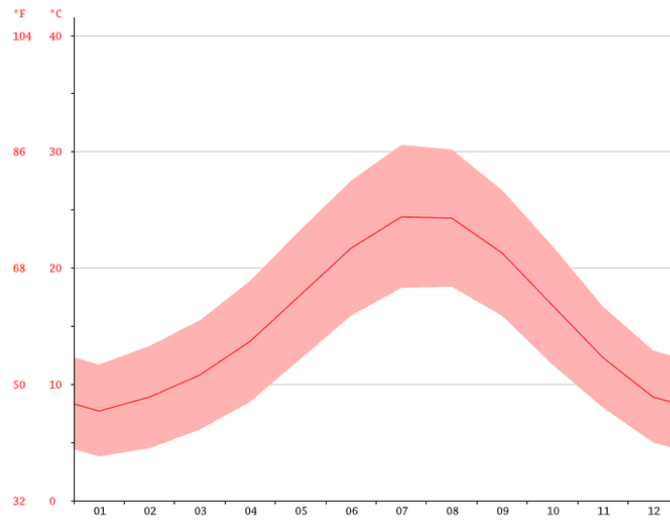
	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	-0.6	0.5	4.9	10.6	16.5	21.5	24.5	23.8	19.5	13.5	7.9	2.2
Min. Temperature (°C)	-4.2	-3.4	0.7	5.8	11.5	16.7	19.9	19.2	14.9	8.8	4	-1.2
Max. Temperature (°C)	3.1	4.5	9.2	15.5	21.5	26.4	29.2	28.4	24.2	18.2	11.9	5.6

(b) Wuhan



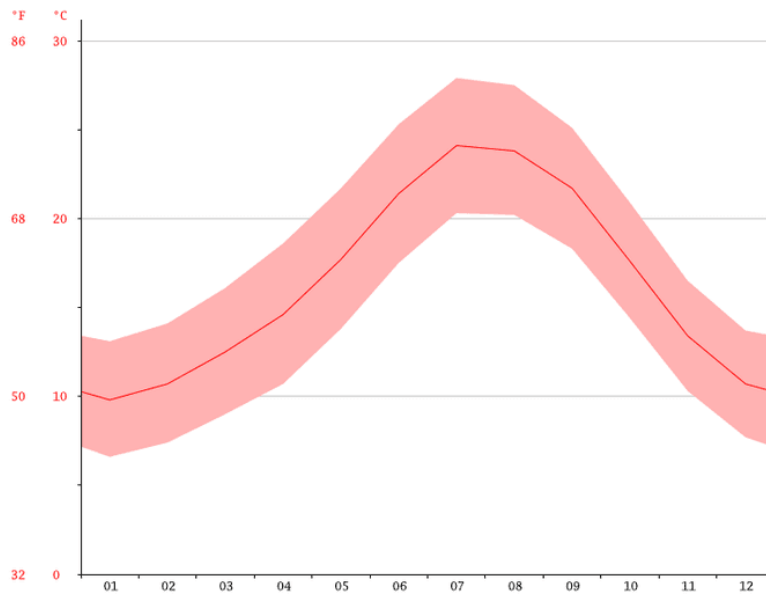
	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	4	5.6	10.5	16.8	22.3	26.4	29.4	29.4	24.3	18.6	12.3	6.3
Min. Temperature (°C)	0.3	2	6.4	12.5	18	22.4	25.6	25.4	20.2	14.5	8.2	2.4
Max. Temperature (°C)	7.8	9.3	14.6	21.1	26.6	30.4	33.3	33.4	28.5	22.8	16.5	10.3

(c) Italy (Rome)



	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	7.7	8.9	10.8	13.7	17.7	21.7	24.4	24.3	21.3	16.8	12.3	8.9
Min. Temperature (°C)	3.8	4.5	6.1	8.5	12.2	15.9	18.3	18.4	15.9	11.7	8	5
Max. Temperature (°C)	11.7	13.3	15.5	18.9	23.3	27.5	30.6	30.2	26.7	21.9	16.7	12.9

(d) Spain (Barcelona)



	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	9.8	10.7	12.5	14.6	17.7	21.4	24.1	23.8	21.7	17.6	13.4	10.7
Min. Temperature (°C)	6.6	7.4	9	10.7	13.8	17.5	20.3	20.2	18.3	14.4	10.3	7.7
Max. Temperature (°C)	13.1	14.1	16.1	18.6	21.7	25.3	27.9	27.5	25.1	20.9	16.5	13.7

These are some countries where spread of c-19 and rate of its spread is more as compared to other countries. The melting point of nitrogen dioxide is $-9.3\text{ }^{\circ}\text{C}$ and the boiling point is $21.15\text{ }^{\circ}\text{C}$. The max temperature of these countries from last few months is less than $16.1\text{ }^{\circ}\text{C}$ except for few months resulting the nitrogen oxide to remain near ground level causing to weaken the respiratory track of citizens of these countries.

2. RESULT

Covid-19 is a respiratory virus which infect respiratory track of humans. Nitrogen dioxide causes short term diseases to human bodies like Asthma and lung diseases and shortens the life if exposed for a long time. Covid-19 virus attacks on person with weak respiratory track. People who are breathing nitrogen dioxide have weak respiratory track. The main producer of nitrogen dioxide are vehicles all over world which burn fossil fuel like diesel, petrol, etc. for running their engines. The emissions of vehicles is dropped from last few years because of advance emission system and emissions are dropped significantly since the lockdown in many countries obtained by the data from Sentinental-5P satellite. After studying the behavior of nitrogen dioxide, it is noticed that at lower temperature it stays near ground level affecting respiratory tracks of citizens. So, nitrogen dioxide also can be a reason in countries like China, Spain, Italy and in New York as these are one major nitrogen dioxide producer with having maximum temperatures lower than $16.1\text{ }^{\circ}\text{C}$ except for few months.

3. CONCLUSIONS

Nitrogen dioxide is one of factor which is not yet taken seriously which is supporting spread of Covid-19.

- Concentration of nitrogen dioxide is lowered in many countries because of lockdown, people will have a stronger respiratory track as nitrogen dioxide do many short-term effects like Asthma and lung diseases.
- Once the lockdowns are removed people will again start to use vehicles and industries will again start to produce nitrogen dioxides which will again start to support spread of Covid-19.
- The restrictions on vehicles are needed to enforced or modifications in emissions are needed to be done urgently in order to keep low concentration of nitrogen dioxide.
- In India there is wide range of temperatures in different areas. So, precaution is needed to be taken to decrease risk to emission of nitrogen dioxide in low temperature time.

4. REFERENCES

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