Impact on Air Pollution during Covid – 19

Abstract: The COVID-19 emerged in Wuhan (China) in December 2019, and was declared a pandemic by WHO. India reported its first COVID-19 case on 30th January, when a student arrived in Kerala from Wuhan. On March 25, India ordered a 21-day lockdown to arrest spread of the coronavirus pandemic, creating world's largest lockdown, bounding 1.3 billion people in their homes. With that many people home, traffic was virtually nonexistent, factory operation was minimal, and construction came to a grinding halt, leading to a well noticed reduction in air pollution. Our earth got a lot better after the lockdown around the world, as air pollution reduced astronomically due to scaled down economic activities. With this Analysis we try to find out the difference in AQI levels from 2016 to 2020 and further analyze the impact of lockdown on air pollution during coronavirus.

Keywords: Air pollution, covid-19, AQI, Data Analysis, Lockdown

1. Introduction

Corona virus is a highly infectious disease caused by a novel virus. This disease shows very common symptoms such as runny nose, dry cough, fever, but in severe cases causes' difficulty in breathing, respiratory illness, multiple organ failure and even death. One can protect oneself by taking some precautions such as washing hands frequently, avoiding touching the face, and avoiding close contact with other people.

The COVID-19 emerged in Wuhan in December 2019, and was declared a pandemic by WHO. India reported its first COVID-19 case on 30th January, when a student arrived in Kerala from Wuhan.

Location	Confirmed	Deaths	Recovered
Worldwide	59.1M	37.8M	1.4M
India	9.18M	8.6M	134K

This disease spreads through contact with an infected person while coughing or sneezing. It also spreads through touching an object or other surfaces that are contaminated with the virus, followed by touching your face. The most common symptoms of this disease are runny nose, fever, dry cough, tiredness, but in severe cases cause difficulty in breathing, respiratory illness, multiple organ failure and even death.

Our earth got a lot cleaner after the lockdown, reaffirming the belief that it is us who hold responsibility for the present condition of earth. We pollute our environment in many ways, through the air, water, soil etc. One of the main sources of pollution comes from our factories and vehicles.

According to the World Economic Forum, India comes in top 10 most polluted cities of the world. Vehicle emits Carbon monoxide, which is a major cause of air pollution. Our vehicles that uses petrol or diesel, causes an immense amount of air pollution. These harmful chemicals are also released by manufacturing plants. Nitrogen Oxide is another name, which takes a major part through vehicles and burning coal, natural gas, cigarettes, wood-burning etc. Sulfur Dioxide is emitted from the combustion of coal and petroleum.

According to WHO, Air pollution takes millions of lives in a year. And most of the world's population lives in places where air quality exceeds WHO guideline limits. People are facing respiratory problems due to the low air quality, which causes diseases such as cancer, and several threats to our lungs and body.

On March 25, when India ordered a 21-day lockdown amid the spread of the corona virus pandemic, it created the world's largest lockdown, bound 1.3 billion people. With that many people home, traffic was virtually nonexistent, factory operation was minimal, and construction came to a grinding halt, leading to a well noticed reduction in air pollution. [1]**.**

Figure 1: Before and after the lockdown [2]

In this report, we analyze the impact of Air pollution in our lives between the time periods 2016 to 2020 and also analyze the reduction of air pollution during the corona virus pandemic.

2. Literature review

Recently, this is the most appealing topic for researchers. Many researchers worked on Impact of lockdown on air pollution. Now, we will discuss some prior work done on this topic.

Abhinav karan et al, 2020 has presented work on the impact of air pollution on the incidence and mortality of COVID-19 **[3]**. In the paper they worked on how air pollution intensified the mortality rate of covid-19 during this pandemic.

Susanta Mahato et al, 2020 has presented work on the effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, India **[4]**. In this paper they present air quality scenario during the lockdown period with special reference to Delhi.

P.Singh and Chauhan, 2020 has shown the impact of lockdown on air quality in India during COVID-19 pandemic **[5]**. In the paper, they present an analysis of air quality over India using ground and satellite observations.

3. Data

This report uses dataset containing measurement of particulate matters and AQI (Air Quality Index) at daily level of various stations across multiple cities in India. The data set includes 23418 observations with 10 variables, i.e. City, Date, PM2.5, PM10, NO2, CO, SO2, O3, AQI, AQI_Bucket.

The data has been made publicly available by the Central Pollution Control Board: https://cpcb.nic.in/ [6] and at https://www.kaggle.com/rohanrao/air-quality-data-in-india [7].

4. Methodology

This report analyzes the level of AQI reported by monitoring stations of different cities in India. The Air Quality Index is based on measurement of particulate matter (PM2.5 and PM10), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Ozone (O_3) emissions.

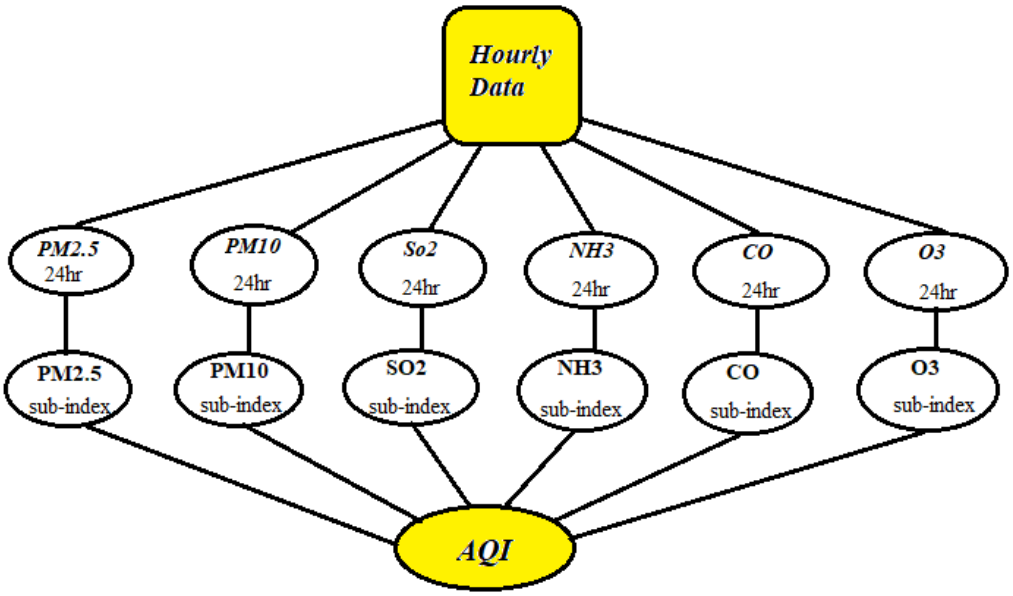

Figure 2: AQI Calculation

The AQI calculation consists of 6 measures: PM2.5, PM10, SO2, NH3, CO and O3. For PM2.5, PM10, SO2, and NH3 the average value in last 24-hrs is used. For CO and O3 the maximum value in last 8-hrs is used. Each measure is converted into a Sub-Index based on pre-defined groups [7]. Final AQI is the maximum Sub-Index with the condition that at least one of PM2.5 and PM10 should be available and at least three out of the six should be available.

Air Quality Index Categories are Good (0–50), Satisfactory (51–100), moderately polluted (101–200), Poor (201–300), Very Poor (301–400), Severe (401-500).

AQI Category (Range)	PM_{10} 24-hr	$PM_{2.5}$ 24-hr	NO_2 24-hr	O_3 8-hr	CO 8-hr (mg/m^3)	SO_2 24-hr	NH_3 24-hr	Pb 24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.6 –1.0
Moderate (101-200)	101-250	61-90	81-180	101-168	2.1- 10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10.1-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748*	17.1-34	801-1600	1201-1800	3.1-3.5
Severe (401-500)	430 +	250+	400+	748+*	34+	1600+	1800+	3.5+

Figure 3: AQI Categories [8]

In this report, we analyze the impact of Air pollution in our lives in the time period 2016 to 2020 and also analyze the impact of lockdown on air pollution during covid-19. Traffic reduced

to quite a good extent, fewer vehicles plied on the road. Fewer vehicles meant fewer accidents, reduced air pollution and reduced air pollution meant cleaner air. Due to office closure electricity demand also came down.

Another major reason of air pollution is factories, which were mostly closed or were working with reduced staff due to covid-19 guidelines. This led to much reduced air pollution. No harmful chemicals being released in water and air made environment much cleaner, greener and ecologically vibrant.

5. Result and discussion

The world's largest lockdown meant all factories, markets, shops, and places of worship remained closed, most public transport suspended and construction work halted, as India asked its citizens to stay home and practice social distancing. So far, India has more than 9.18M confirmed cases of Covid-19, including 8.6M deaths.

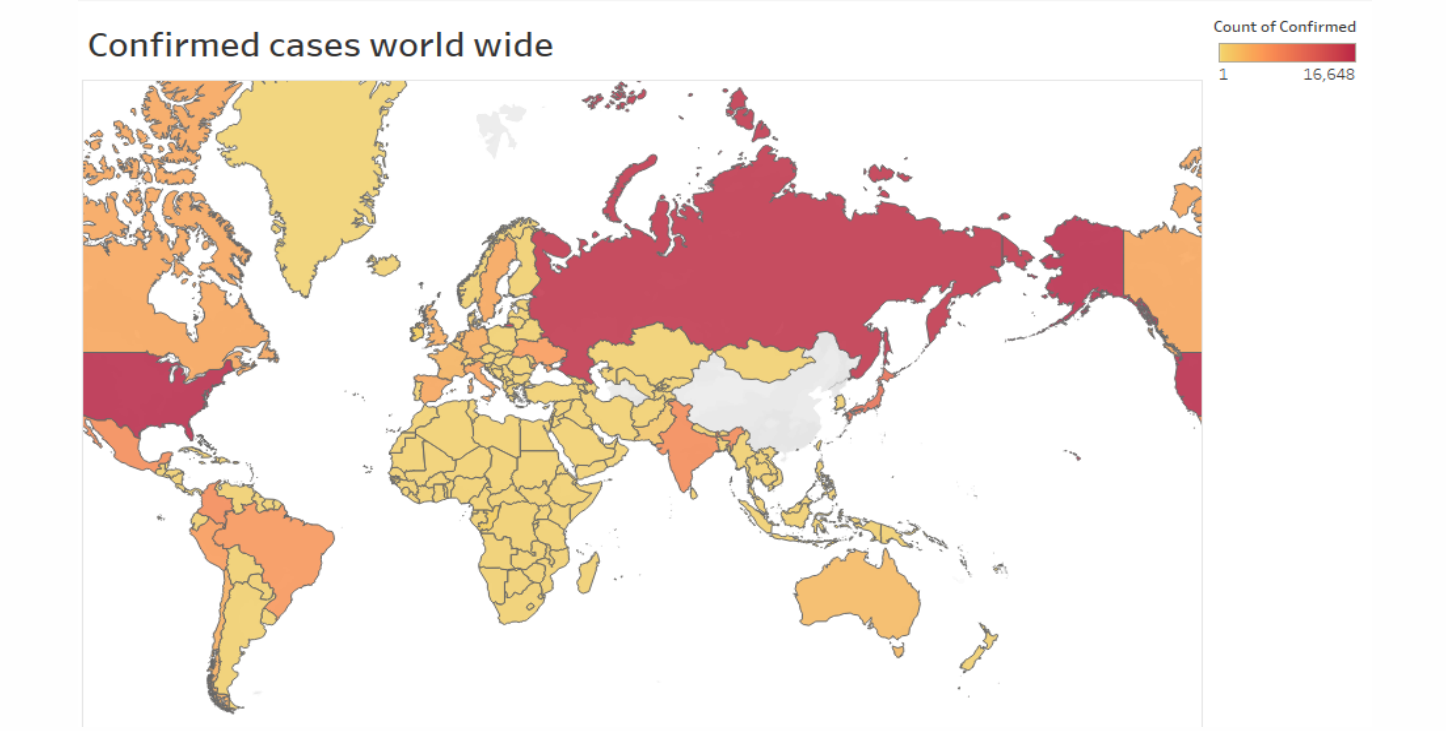

Figure 4: Total Confirmed cases worldwide

Already, data shows that the main cities were recorded much lower levels of harmful microscopic particulate matter known as PM 2.5, PM10 and of nitrogen dioxide, which is released by vehicles and power plants.

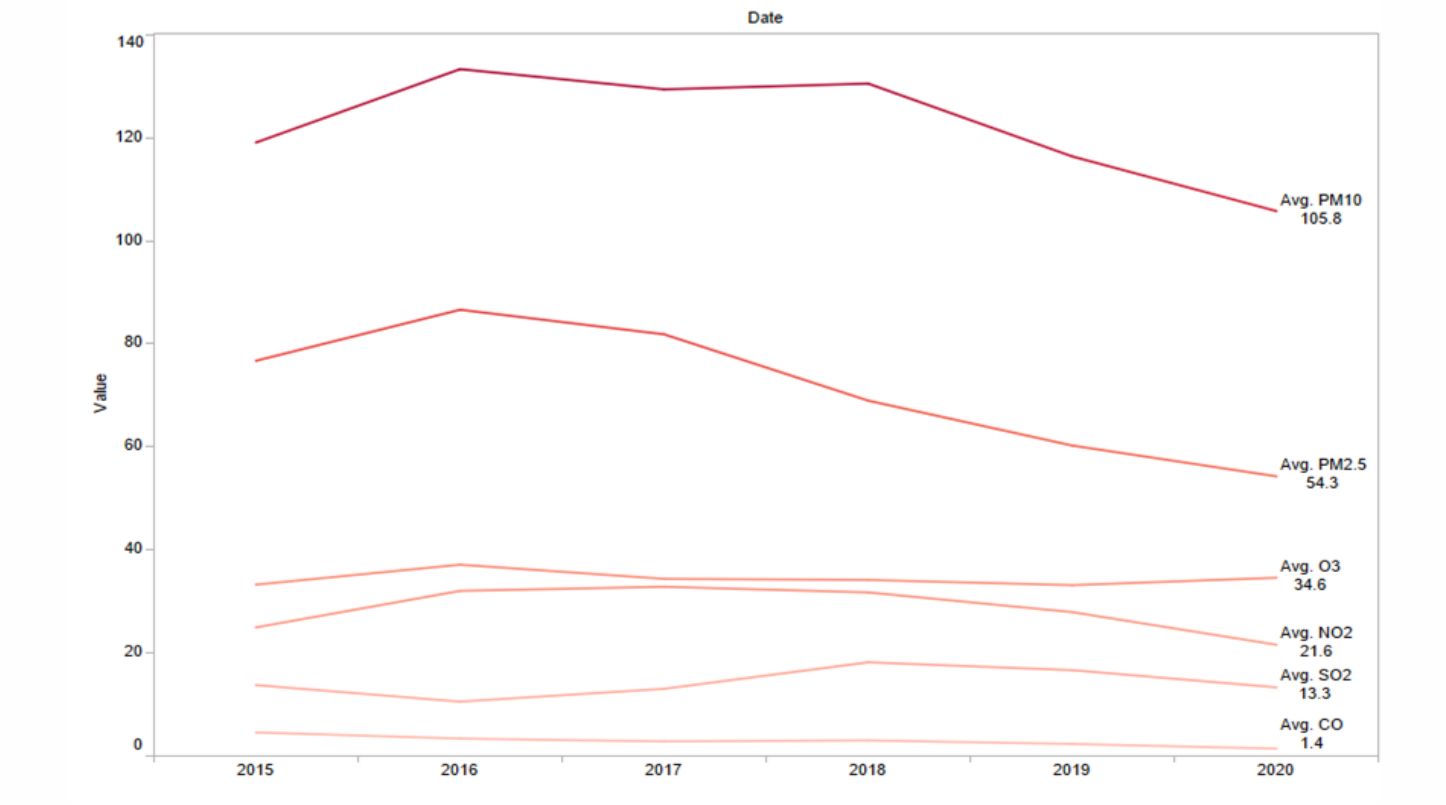

Figure 5: Pollutants level in several years

The rapid reduction in pollutants and the following clear skies signal a sudden shift for India which has 21 of the world's 30 most polluted cities.

As we can see that AQI level in 2016 and 2017 is much higher than during the months March to May, the average AQI levels declined by 40-50% in many cities. This happened because of the lockdown.

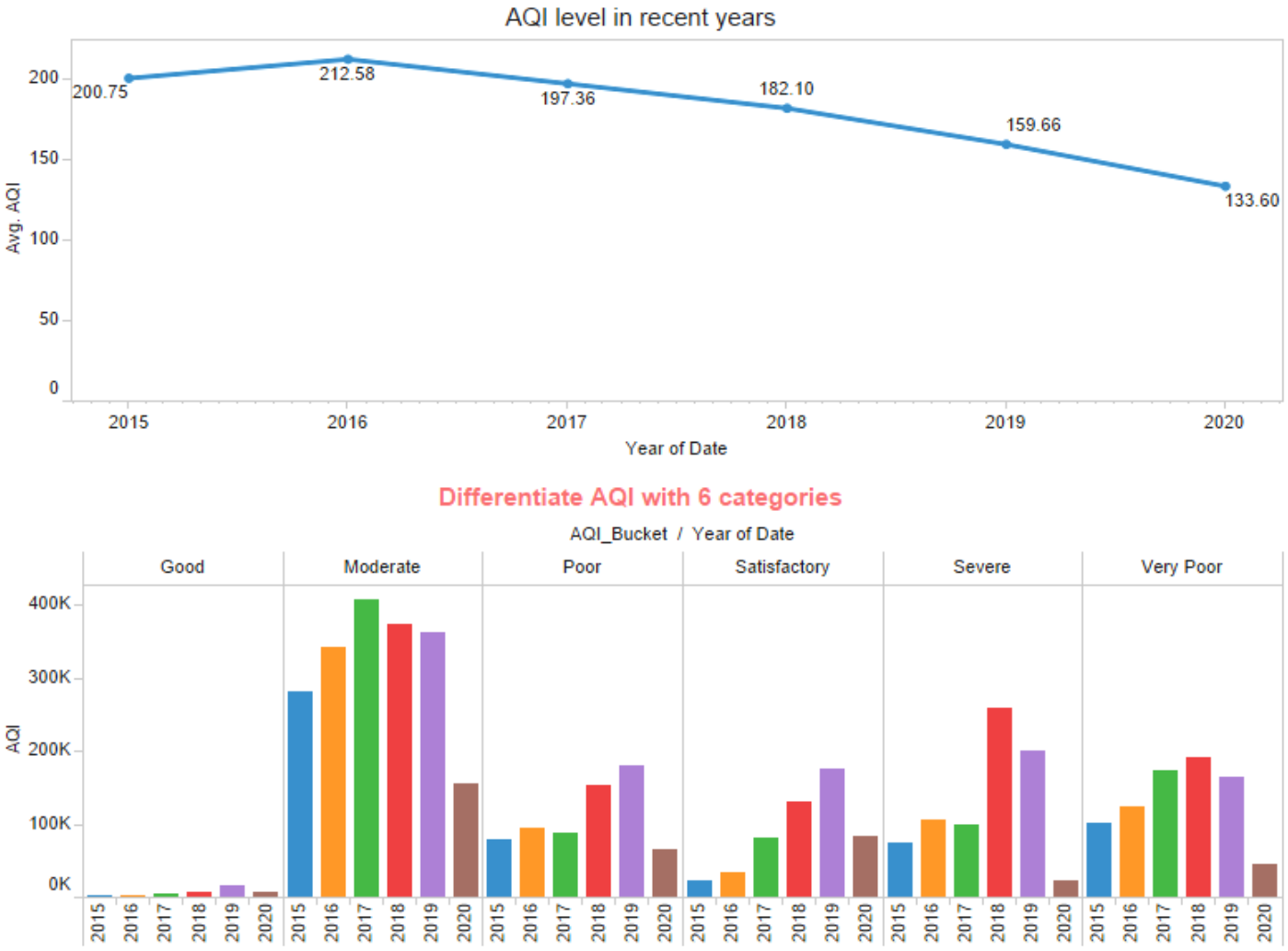

Figure 6: AQI Level in recent years

Many cities experienced their best April air quality on record in 2020 (88.52 µg/m³ AQI respectively), while May 2020 was also the best May on record.

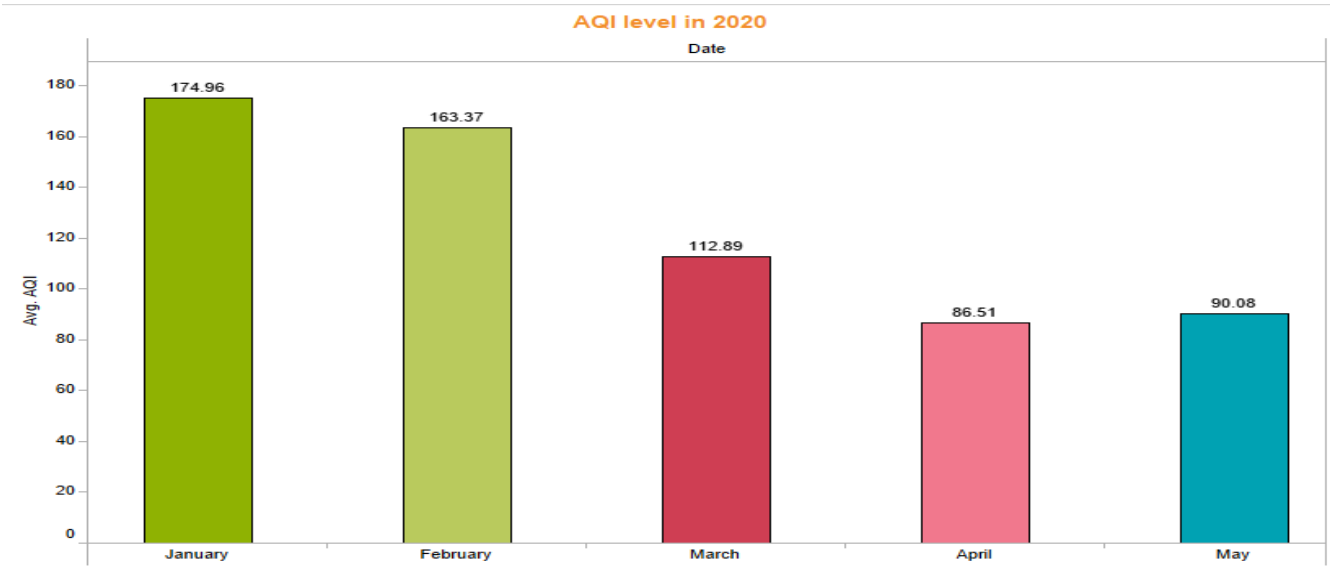

Figure 7: AQI level in 2020

The average AQI level in 2020 of different cities i.e. Aizawl, Chennai, Chandigarh, Amritsar, Hyderabad, etc were in range of 0-100 which is satisfactory, while cities like Delhi, Jaipur, Kolkata, Bhopal, etc experienced AQI range between 100-200 which is moderate.

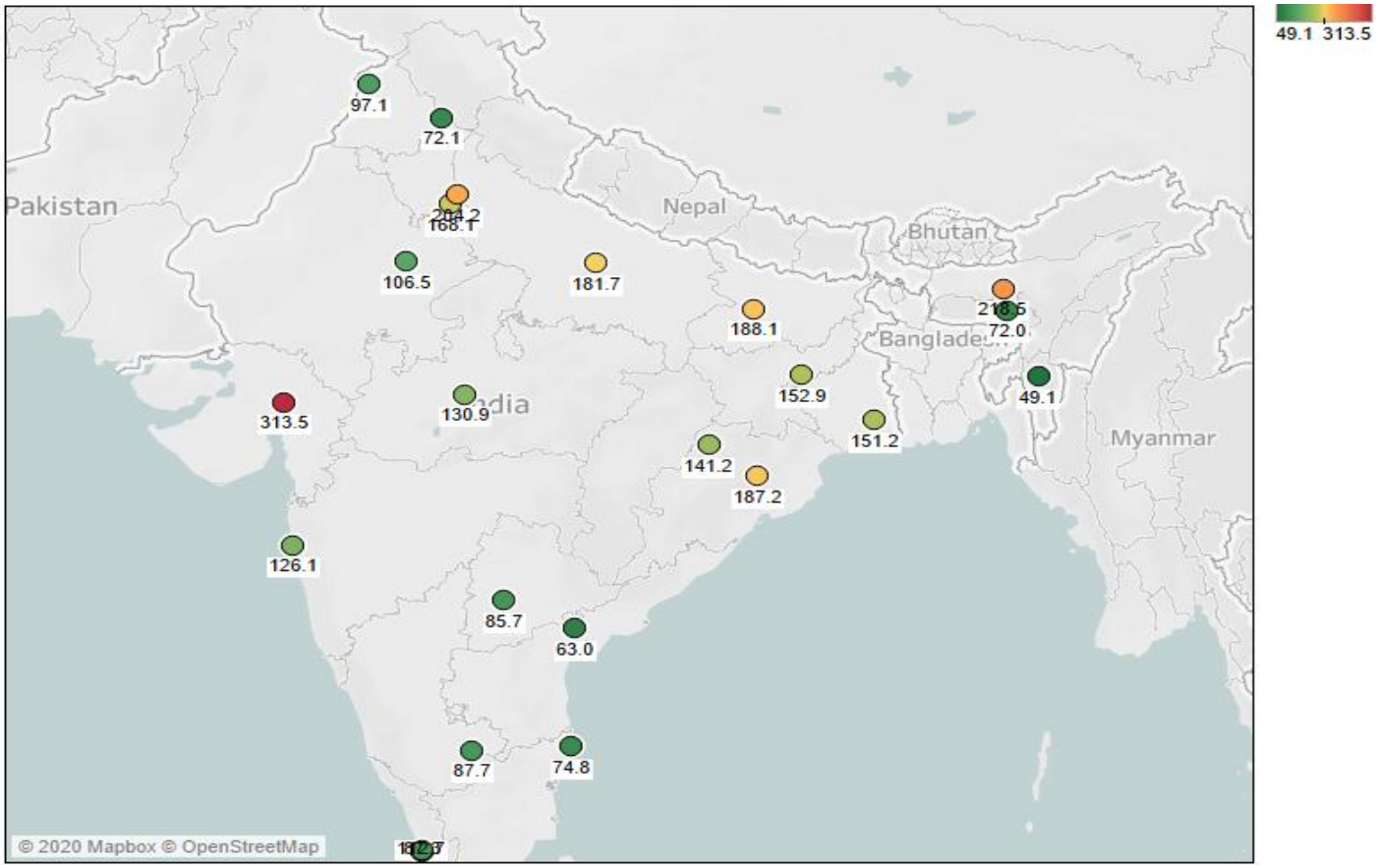

Figure 8: AQI level in different cities

6. Conclusion

Due to the coronavirus spread world faced the largest lockdown ever known to mankind, which led to the shutdown of many businesses and reduced traffic. As lesser vehicles were on roads and many factories closed, lesser harmful chemicals were being released helping in reduced discharge of harmful pollutants in the air. This analysis of the impact of air pollution in our lives during the lock down period clearly brings forth, that the lockdown resulted in reduced AQI level by 30 to 40% which is a good sign and hopefully will also result in reduced health issues among children and elderly in the long run. Most of the cities in India are below the range of 101-200 AQI respectively. But while the earth is healing during the lockdown many researchers believe that it will not last for long. We see that right after the lockdown there is a drastic change in pollution. The AQI rate is increasing day by day. We need to find a better solution for all the methods that are causing damage to our nature. After the lockdown, we need to take necessary measures to avoid an increase in air pollution and care for our surroundings. We should not squander away the environmental gains made during lockdown, because we paid a heavy price for them.

7. **References**

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