

# A Study of the Emission Dynamics during Diwali and the Inadequacies in the Current Monitoring System

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# Abstract

Every year steep spikes in the pollution levels are observed during the festival of Diwali in India. This worsens the already degraded air quality of the country. Ranked last in the Environment Performance Index 2022, India needs extensive infrastructure enhancements for proper data collection and analysis of its emissions in order to improve the current scenario. The study carries out an analysis to understand the dynamics of the pollution levels around the Diwali festivities, with a particular focus on the PM<sub>2.5</sub> air pollutants. Our analysis reveals that the northern region of India has higher pollution levels compared to other parts of India, with Delhi as the hotspot. A close correlation is observed between Delhi and its neighboring agricultural states. Further, in contrast to preconceived notions, an increase in emissions has been observed during COVID-19 pandemic despite the nationwide lockdown. The study emphasizes the lack of proper monitoring setups with only one center for 9100 km<sup>2</sup> of the country, along with the unreliability in the analysis of the air quality in places like Delhi due to the unavailability of data from more than 60% of the monitoring centers at certain times.

# Methods

**Data  
Acquisition  
(CPCB)**



**Data Cleaning**

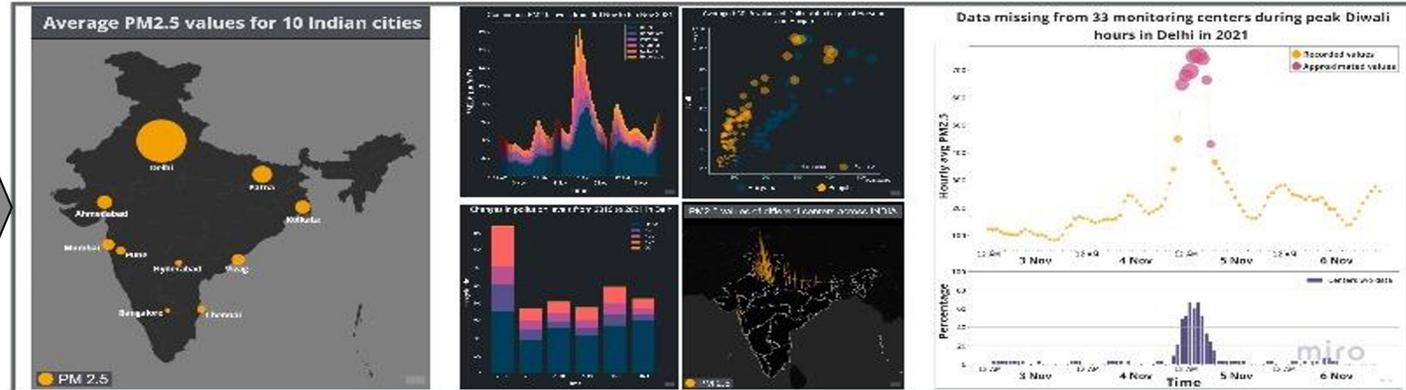


**Data Analysis  
and  
Visualization**

Step1: emission data during Diwali were collected for the study. This includes data from multiple years.

Step2: The data collected contains missing entries which were rectified using proper statistical techniques.

Step3: The study analyses the collected data and derives important insights from it.

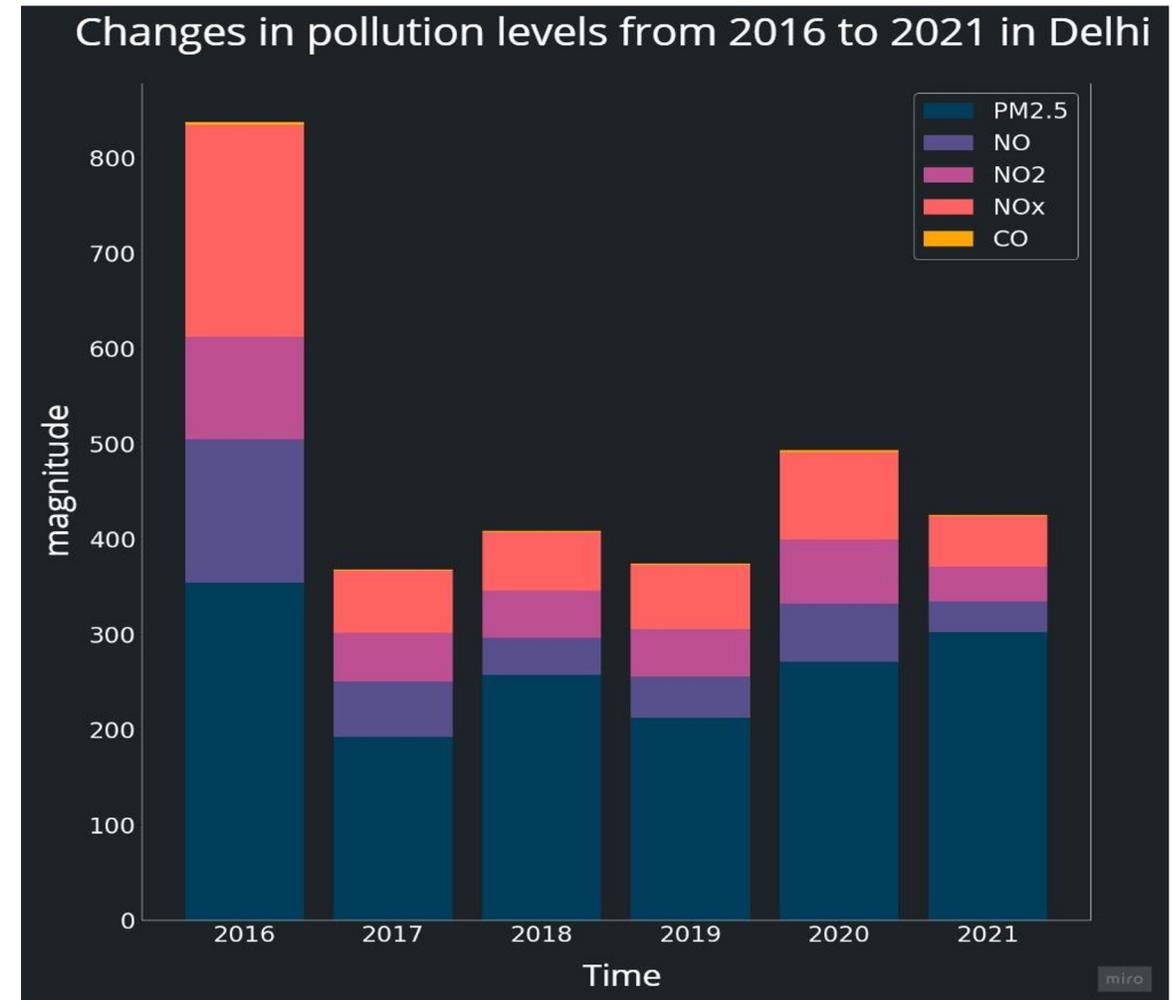


# Figure 1. Changes in pollution levels of different air pollutants in Delhi around Diwali festival during 2016 - 2021

For 2021 the PM2.5 levels were higher than the past four years.

The trend is not same and true for all the pollutants.

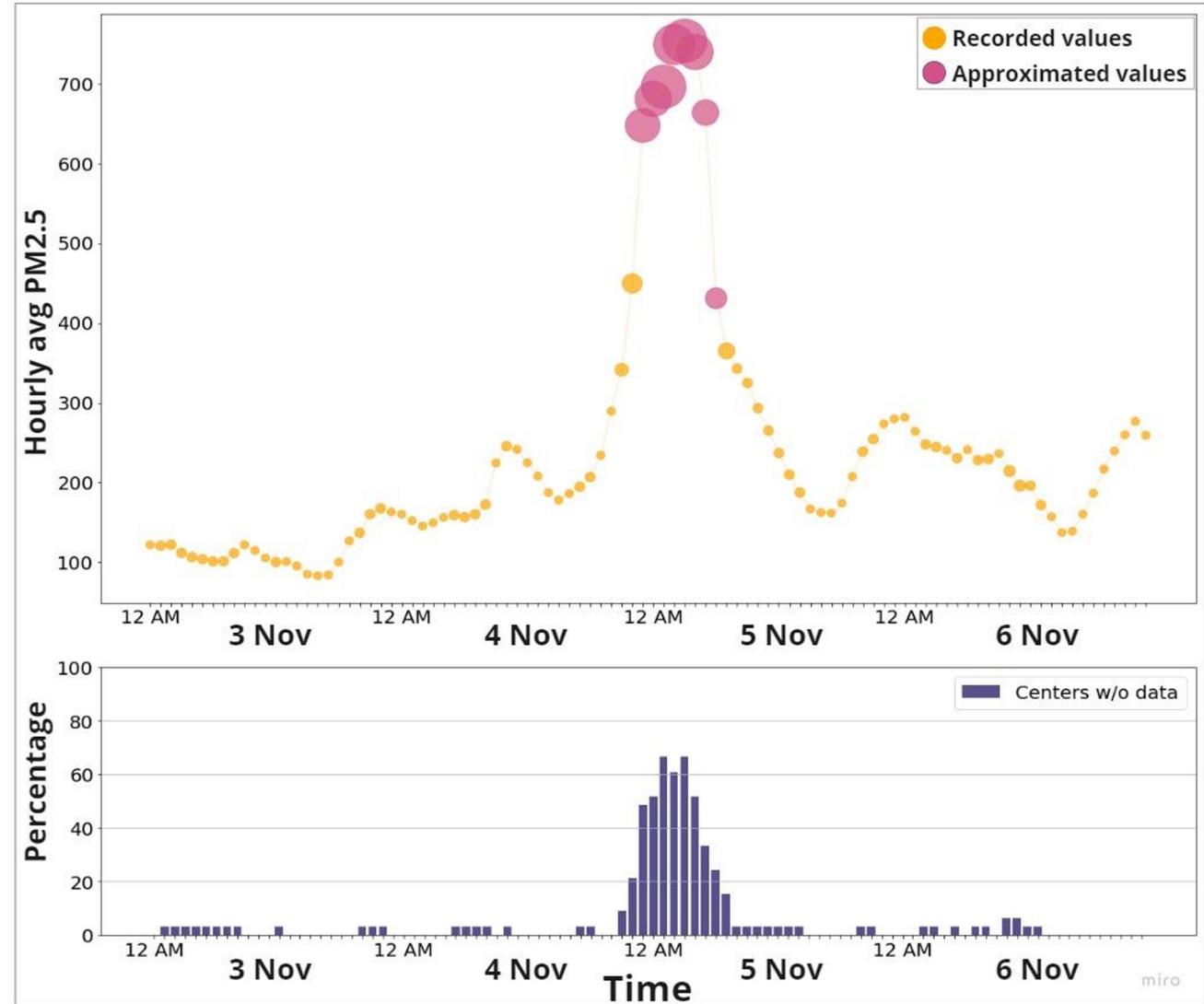
Despite the lockdown due to COVID-19 in the year 2020, a spike in the pollution levels has been seen in a few parameters compared to the year 2021.



# Figure 2. Data Analysis Time Period

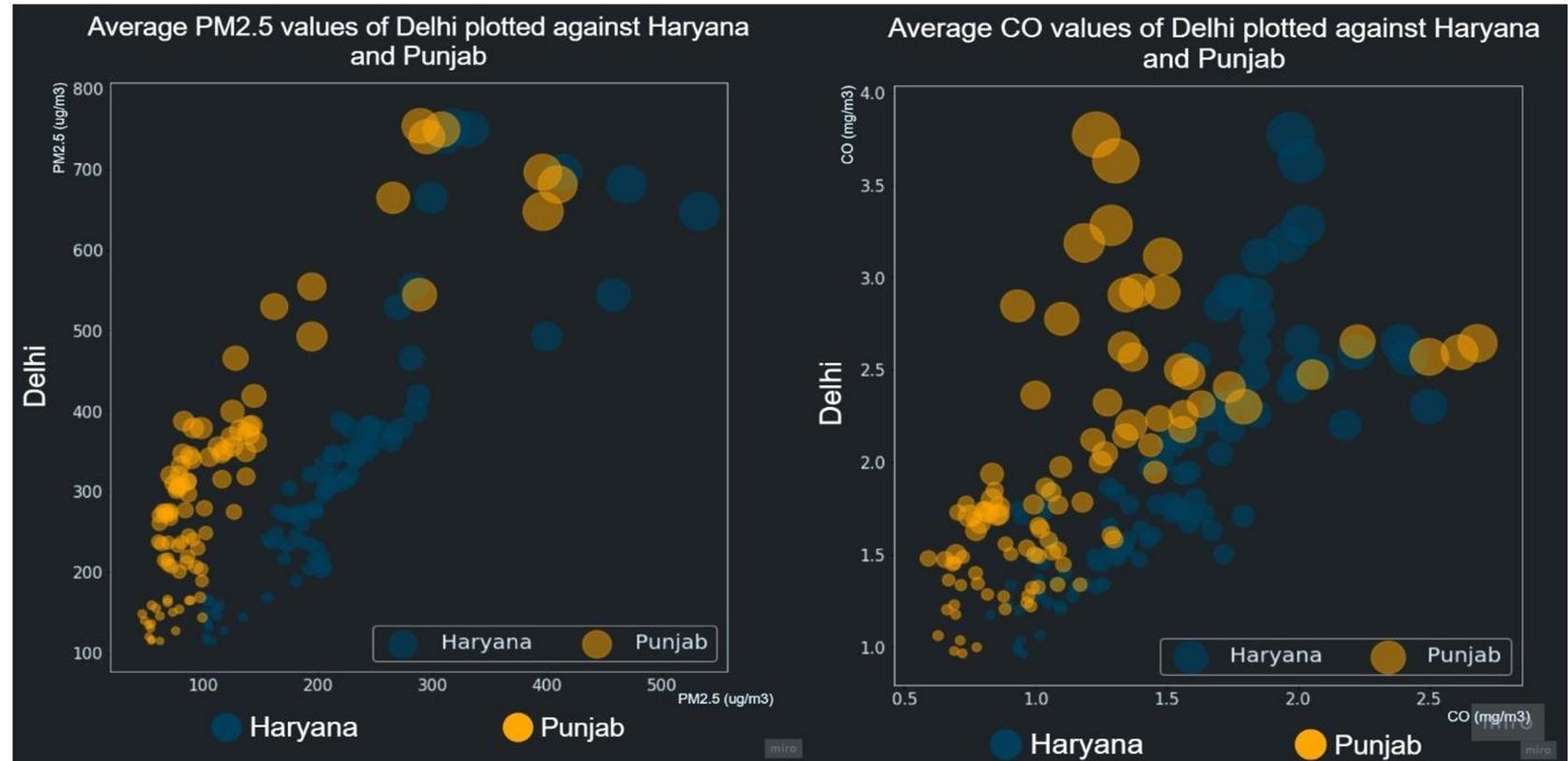
- We analysed hourly PM2.5 data from Nov 3 to Nov 6 for 2021 available from the Central Pollution Control Board.
- We observed that the pollution data during the Diwali peak festival hours were missing from the pollution control board measurements.
- Therefore, we gap filled the missing data points.
- Our aim was to understand if Diwali festivities is the main reason for heightened Delhi Pollution

Data missing from 33 monitoring centers during peak Diwali hours in Delhi in 2021



# Figure 3. PM2.5 and CO relationships between Delhi vs. Haryana and Punjab during Nov 3-6, 2021

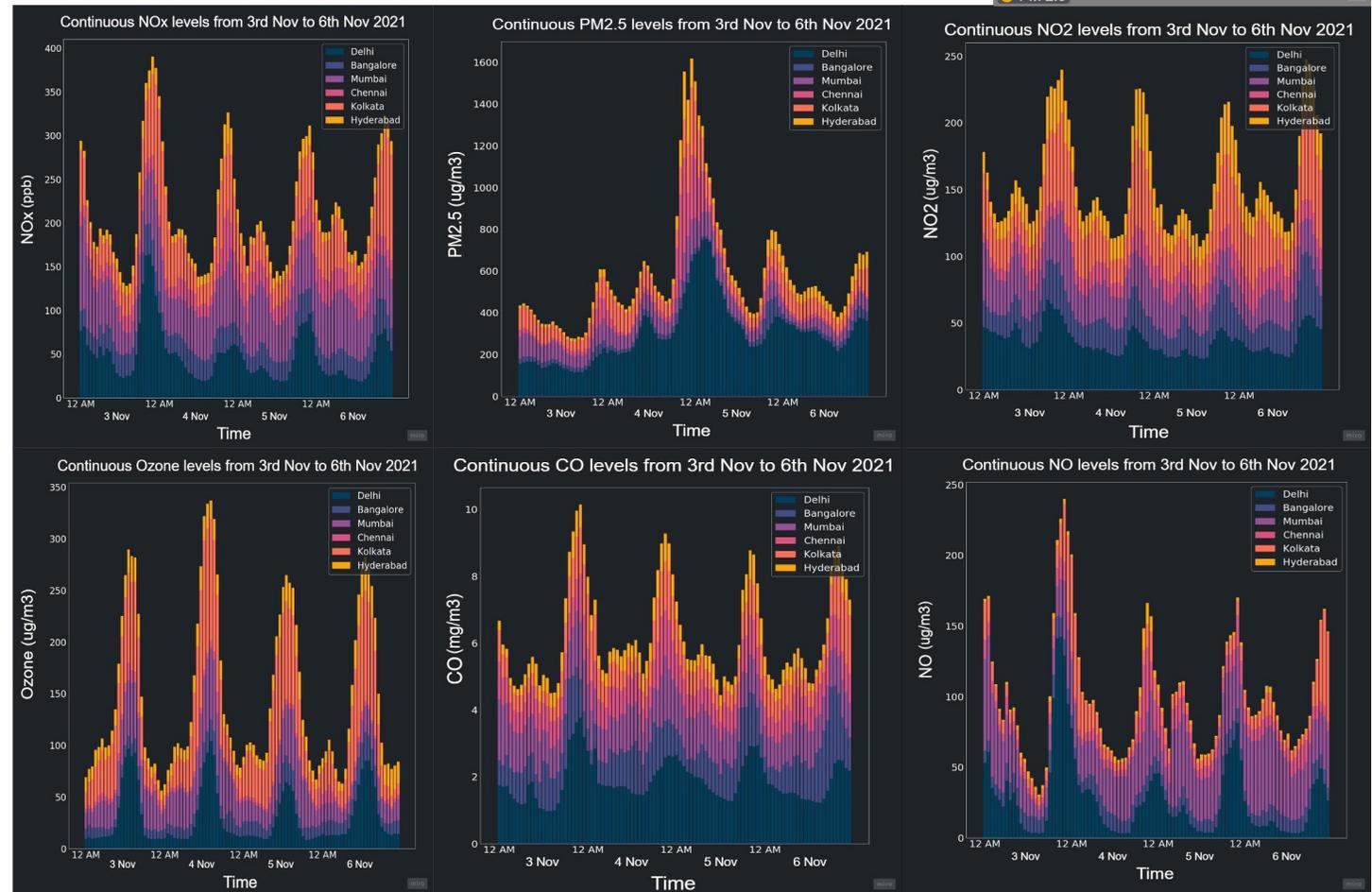
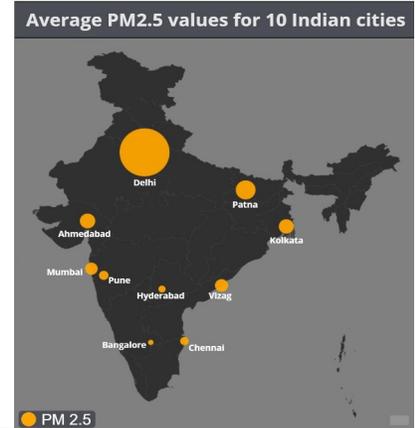
- We correlated the PM2.5 and CO levels of Delhi with two neighbouring states i.e. Haryana and Punjab.
- Haryana and Punjab shows high level of these air pollutants during this time for agricultural stable burning practices.
- Our analysis showed that Delhi pollution follows closely to the levels of Haryana and Punjab.



# Figure 4: Air Pollution Trends in Major Indian Cities

It can be seen that the northern regions of India have relatively higher pollution levels compared to the southern regions during the period of Diwali.

Contribution of pollution levels in Delhi is the most among all the Indian major cities.



# Conclusion

Our analysis revealed that:

- Air pollution levels in Delhi during Diwali time is strongly correlated to the pollution levels in the neighboring agricultural states, mainly driven by stubble burning.
- Therefore, Diwali festival cannot be solely responsible for Delhi air pollution during this time as highlighted in the national and international media.

Interesting Observations:

- During the peak hours Diwali festival celebration of 2021 (i.e. between time between 4<sup>th</sup> and 5<sup>th</sup> November), 60% of the data from the monitoring centers to be missing.
- India has one monitoring station for every 9100 Sq. Km of the country.

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