

Comparison of Air Pollution in Delhi using open air in R

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Abstract

With an immense growth in development followed by the concept of urbanization, there is a drastic increase in the level of pollution, especially in metro cities. One such case is in Delhi where there has been a drastic increase in the pollutant level in the air causing many hazardous diseases and breathing problems. There are many sources of air pollution broadly categorized into natural sources like an eruption of Volcano, sea salts, etc. and the anthropogenic sources like emission from the industries, mobile sources mainly the vehicular emissions, etc. causing the degradation in the quality of air.

The paper consists of the comparison between the pollution level in the month of (June-July) with that of in the month of October for the year 2019 to determine the rise in the pollution level because of the bursting of firecrackers and more usage of transportation during festive days that indulges in the high emission of harmful gases. For the comparison of the data, the descriptive analysis is done using RStudio since it consists of a package that is specially designed for the calculation and representation of air pollution.

The openair is the R package that was mainly developed to analyze the air pollution measurement data and further can be used in atmospheric sciences. The package contains many tools allowing the import and manipulation of the collected data so that one can achieve a better understanding of the current status & the trend following with the quality of the air one intakes.

For the comparison of the pollution, the data of the two most polluted places out of the 35 monitoring locations in Delhi namely Anand Vihar and Mandir Marg is collected for all 10 different types of pollutants or gas concentrations (Ammonia, Benzene, Nitrogen Oxide, Nitrogen Dioxide, Oxides of Nitrogen, Ozone, P-Xylene, Sulphur Dioxide, Toluene, and Carbon Monoxide) present in the air for the period of two months (June and July) during the time slot of peak office hours when the rush is most on the streets along with the data collected for the month of October for same hours to determine the impact of festivals that causes the increase in the traffic and the impact of crackers on the environment causing many diseases.

A set of patterns and trends is extracted from the analysis. The comparison is done using the statistical tool R where many inbuilt functions help in the conversion of the numeric data and then generate the results for ease in the interpretation of the pattern followed. The representation of the results is done graphically using the openair in RStudio.

Keywords—Air Pollution, openair, regression, predictive analysis, Anand Vihar, Mandir Marg, openair.

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I. INTRODUCTION

The substance that surrounds the earth enabling everyone to breathe oxygen for survival and help all living organisms to exist on this planet Earth, is air. Unfortunately, the quality of such important and crucial substances is getting deteriorated all because of the existence of the irregular and ineffective activities performed by humans causing the problem of air pollution.

Air pollution can be defined as the presence of unwanted impurities and substances that are not the part of the natural level of the air harming environment.

According to surveys done, it was stated that Delhi is one of the most polluted city of India although being the capital of the country, the air quality of the city is very poor causing severe health and other issues in the city. Such rise in the pollution is also because of the growing population in the capital and increasing number of usage of automobiles. With such steep rise in pollution level have given many health disorders and visibility problems to people residing there such as infection in eyes, skin allergies, issues in respiration and many more.

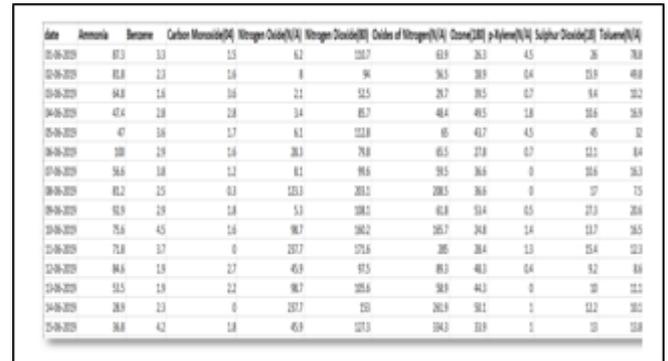
II. STUDY AREA

The data is collected for the city Delhi which has been proved to be one of the most polluted cities by the World Health Organization (WHO) according to the reports stated earlier. The level of the airborne particulate matter-PM2.5 is very high in Delhi. Also, PM 10 levels is the highest among the 11 mega cities of the world having more than 14 million inhabitants PM is considered to be the most harmful pollutants to health according to their survey. [8] In total there are 35 air monitoring stations present at different locations in Delhi. For this research, the two places Anand Vihar and Mandir Marg have been taken to determine and compare the pollution level due to their high population density and heavy vehicular movement.

III. PROPOSED WORK

A. Data Set Used

The research constitutes of the dataset for two places in Delhi that are Anand Vihar and Mandir Marg for two consecutive months June and July and for a October with an motive to derive results for the change in pollution level in different months due to climate and festive season as they directly or indirectly affects the air quality. The dataset contains 10 different pollutants for each place and for each prescribed month for some time period.



Date	Aerosols	Benzene	Carbon Monoxide	Nitrogen Dioxide	Nitrogen Dioxide	Oxides of Nitrogen	Ozone	p-Axylene	Sulphur Dioxide	Toluene
01-06-2020	87.3	3.3	1.5	6.2	153.7	62.9	26.3	4.5	36	78.8
02-06-2020	85.8	2.3	1.6	8	94	56.5	38.9	0.4	23.9	49.8
03-06-2020	84.8	1.6	1.6	2.1	52.5	29.7	36.5	0.7	6.4	10.2
04-06-2020	47.4	1.8	1.8	3.4	85.7	48.4	46.5	1.8	16.6	36.9
05-06-2020	47	1.6	1.7	6.1	122.8	65	43.7	4.5	46	32
06-06-2020	100	1.9	1.6	26.3	79.8	65.5	27.8	0.7	12.1	6.4
07-06-2020	56.6	1.8	1.2	6.1	89.6	59.5	36.6	0	16.6	36.3
08-06-2020	82.2	2.5	0.3	123.3	283.1	288.5	36.6	0	17	7.5
09-06-2020	62.9	1.9	1.8	5.3	108.1	62.8	53.4	0.5	27.3	36.6
10-06-2020	75.6	4.5	1.6	96.7	362.2	363.7	36.6	1.4	13.7	36.5
11-06-2020	71.8	3.7	0	127.7	171.6	385	38.4	1.3	15.4	12.3
12-06-2020	84.6	1.9	2.7	45.9	97.5	89.3	46.3	0.4	6.2	6.6
13-06-2020	52.5	1.9	1.2	96.7	105.6	58.9	46.3	0	10	12.1
14-06-2020	28.9	1.3	0	127.7	120	262.9	36.1	1	12.1	10.1
15-06-2020	36.6	4.2	1.8	45.9	127.3	194.3	13.9	1	10	12.8

Fig 1: Sample Dataset

B. Proposed Approach

The data is been collected from the DPCC website that provides the complete details of pollution for every hour, for each day of the year for around 35 monitoring locations in Delhi. The data is categorized into 10 pollutants and wind speed. This experiment contains the data for 2 places only for all 10 pollutants for 3 months which requires data pre-processing. The process of descriptive analysis is used to determine the result with the help of openair package in R.

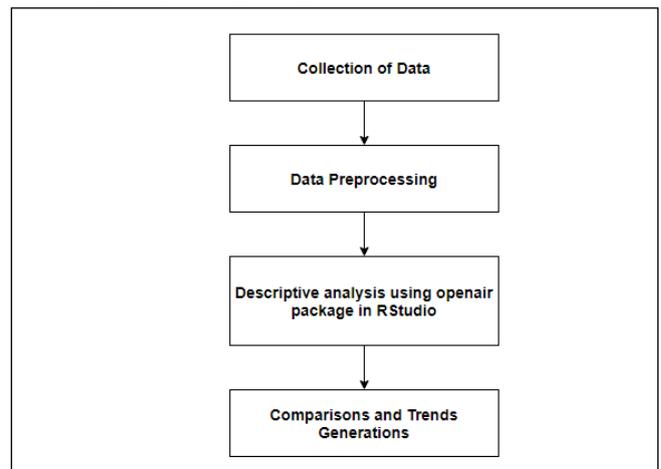


Fig 2: Process Followed

C. openair Package in R

openair is basically an R package that was built with an idea of providing a mechanism to study air pollution measurement data and provide help in the study of atmospheric sciences.

The package consists of many methods to import and manipulate data and undertakes a wider range of analyses to increase comprehension of air pollution data. Further, it provides an interactive way for the demonstration of the air quality, wind quality, finding the trends and analysis of the data provided for months or several years. The package consists of many inbuilt functions like corPlot, polarPlot, windRose, trendLevel, smoothTrend to name a few, that provides a variety of representation techniques

adding more knowledge to the existing data. The package allows to determine the trend followed from the pollutants mentioned and other constraints affecting air pollution. This experiment uses two functions of the openair package that are timePlot and corPlot.

- timePlot: Plot time series
- corPlot: corrgram plot with conditioning

IV. RESULTS

The results for stations Anand Vihar and Mandir Marg are presented and compared for the month of June-July and October considering the 10 pollutants.

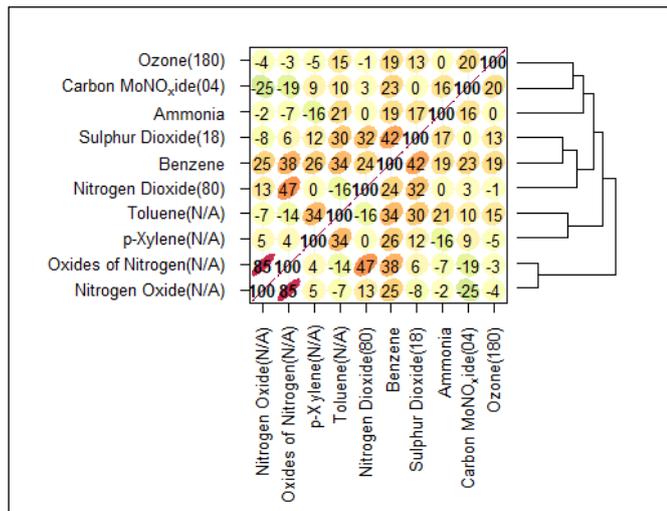


Fig 3: CorPlot of Anand Vihar for month of June-July

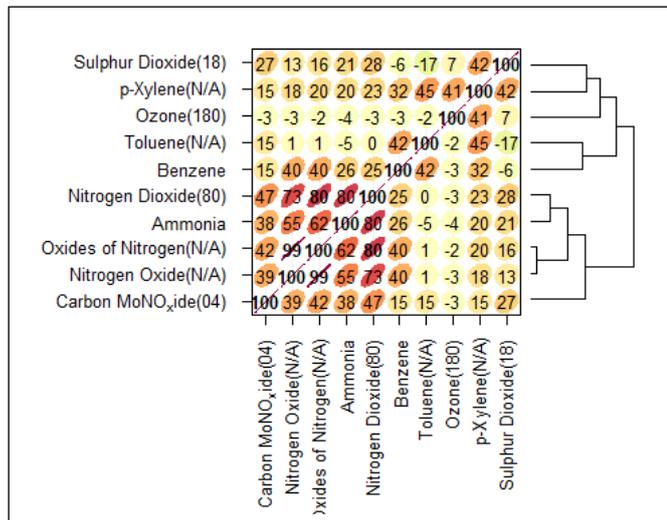


Fig 4: CorPlot of Anand Vihar for month of October

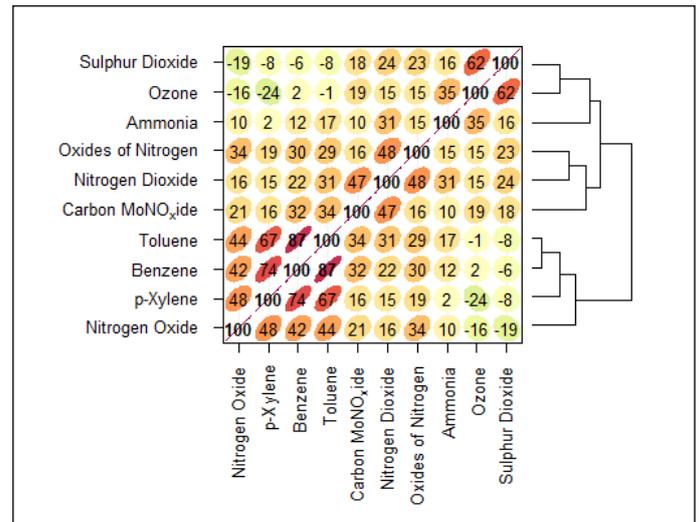


Fig 5: CorPlot of Mandir Marg for month of June-July

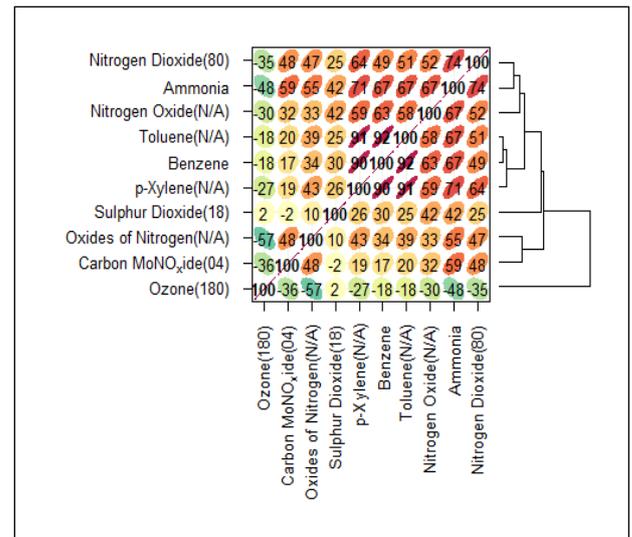
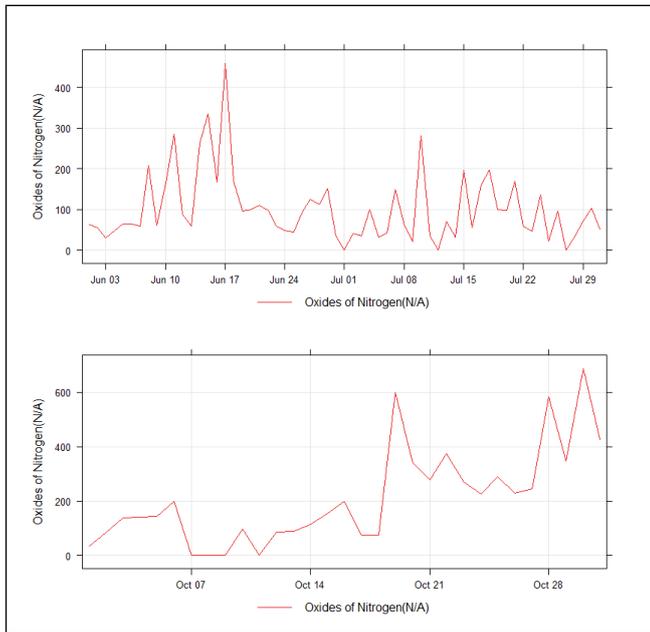


Fig 6: CorPlot of Mandir Marg for month of October

The above corrgraph stated that there was quite a high rise in the pollution level from the month of June and July to the month of October. The major increase was seen in the level of Nitrogen and Sulphur dioxide in the air from that of two consecutive months to that of October. There is quite increase seen in the Nitrogen dioxide, nitrogen oxide and oxides of nitrogen level that caused a degradation in the quality of air. Presence of such gases in air causes smog leading to low visibility and causing acid rain as well leading to severe health issues.

On other hand there is a steep rise in Sulphur dioxide in month of October and specially during the festive week because of the emission of gases from the bursting of crackers.



for month of June-July and October

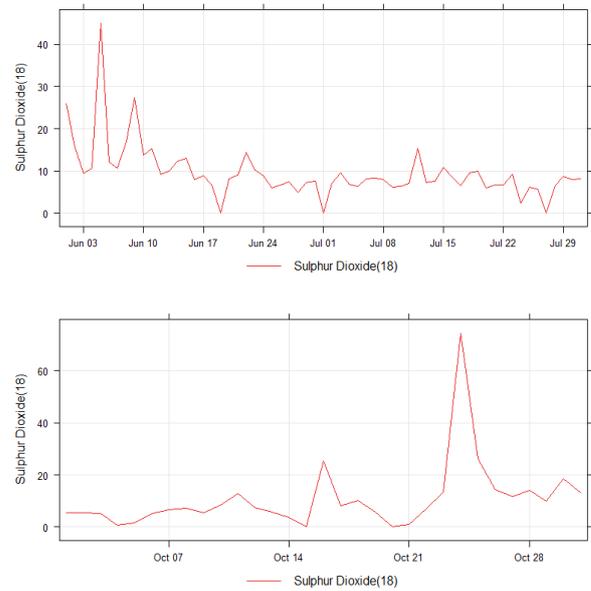


Fig 9: Time Plot of Sulphur Dioxide for Anand Vihar for month of June-July and October

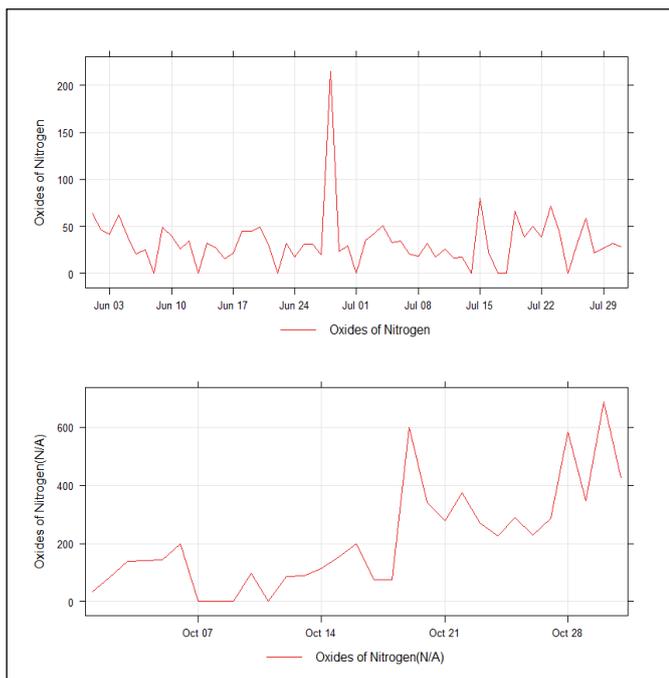


Fig 8: Time Plot of Oxides of Nitrogen for Mandir Marg for month of June-July and October

V. CONCLUSION AND FUTURE SCOPE

From the experiment it was clearly seen that there is a hike in the pollution level from the data of two consecutive months to the data of that collected in October for the monitoring stations. This increase was seen for every pollutant which is very hazardous leading to different health diseases and also degrading the environment affecting plants as well as animals also. This increase is because of the following reasons:

- The month of October contains an Indian festival called Diwali that provokes people to step out of their houses more for shopping, visiting their relatives i.e., there is more usage of transportation sources causing more usage of vehicles leading to more pollution which is clearly seen in the increase of Nitrogen oxide level in the last week of October month.
- The increase in Sulphur dioxide was due to crackers at the time of Diwali. Bursting of crackers emit high level of Sulphur dioxide which is harmful, causing irritation in nose, throat, shortage in breath etc.
- As the winter season sets in, the atmosphere is unable to move dust particles and contaminants. These contaminants are trapped in the air due to stagnant winds and impact weather conditions, contributing to smog.

The future scope of this research is that to compare large amount of data to get more precise results along with using techniques to forecast the level and also determine the trends that have been followed till now. Along with

gas concentration we can use the particulate concentration and meteorological condition to have more clear analysis.

REFERENCES

1. Nidhi Sharma, Shweta Taneja, Vaishali Sagar, Arshita Bhatt
2. "Forecasting air pollution load in Delhi using data analysis tools",
3. International Conference on Computational Intelligence and Data Science (ICCIDS 2018) Procedia Computer Science 132 (2018) 1077–1085
4. Ms.Aishwarya Paradkar¹, Ms.Rutika Nanivadekar², Mr. Prathamesh Gharad³
5. " Research report on Delhi air pollution" ,
International Journal of Science Technology and Management, Vol.No.5, Issue No.03, March 2016
6. Realtime ambient air quality data of Delhi, DPCClink:
<http://www.dpccairdata.com/dpccairdata/display>
7. Rizwan SA, Nongkynrih B, Gupta SK. (2013) "Air pollution in Delhi: Its Magnitude and effects on health." Indian J Community Med38 (1):4-8
8. RStudio. (2018) [Online] Available at:
<https://www.rstudio.com/products/rstudio2/>
9. Central Pollution Control Board MoEF & CC " Air Pollution in Delhi- An analysis ", Envis Center CPCB
10. David C. Carslaw , Karl Ropkins
"openair- A R package for air quality data analysis"
Environmental Modelling & Software 27-28 (2012) 52e61
WHO's Urban Ambient Air Pollutiondatabase Update 2016
http://www.who.int/phe/health_topics/outdoorair/databases/AP_database_summary_results_2016
11. <https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/top-8-main-causes-for-air-pollution-in-delhi/articleshow/61626744.cms>