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Statistical analysis of pollutants and AQI for understanding the effect of seasonal and anthropogenic activity variations on air pollution

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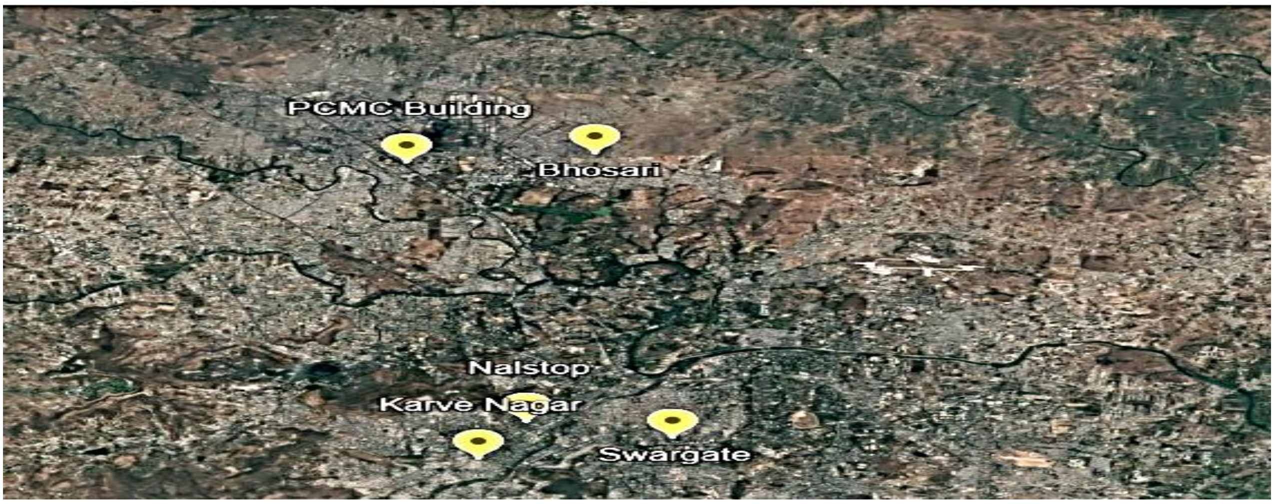
Abstract–*Air pollution is a complex phenomenon, with multiple factors affecting it. Understanding the factors influencing air pollution is a difficult task, and hence, indicators like the AQI are used for this purpose. AQI can give a comprehensive understanding of the overall pollution levels in a certain region. This study dealt with comparing the AQI and the constituent pollutant concentrations that contribute to AQI calculation using basic statistical techniques. It was aimed at understanding the effect of seasons and anthropogenic activity levels (using the pandemic lockdown as a proxy). The winter season was found to be contributing highly to AQI via an increase in RSPM and NOx values for both stations, whereas anthropogenic activities contributed to AQI via NOx increase in the residential region and via NOx and RSPM values in the industrial region. The overall pollutant levels were found to be higher in the industrial region than in the residential region. The findings suggest that a tailored approach for each region could be beneficial for mitigating air pollution in different regions.*
Keywords–*AQI, air pollution, RSPM, Nox,* SO_2

INTRODUCTION

Air pollution isn't just smoke rising into the sky or numbers on a data sheet, but a complex and deeply human issue that touches human lives in ways that are often overlooked. It's closely tied to climate change, as gases like carbon dioxide and methane trap heat in the atmosphere, leading to rising global temperatures, melting ice caps, and erratic weather patterns [1]. Understanding the drivers of air pollution isn't straightforward. It's shaped by a combination of complex natural forces and human behaviors. Wind, humidity, and temperature shifts can dramatically change pollution levels in a few hours [2]. Meanwhile, human actions ranging from daily commuting and construction work to industrial production and agricultural burning contribute in varying degrees across different areas and seasons [3]. To complicate things further, many pollutants don't stay in their original form. Once released, they react in the atmosphere to form new compounds, like secondary pollutants [4]. All these overlapping influences make it difficult to pinpoint the exact cause of pollution at any given moment. Therefore, studying air pollution requires a broader lens to understand environmental patterns and human activity.Air pollution is generally measured using various methods, including continuous monitoring stations, satellite-based remote sensing, and portable air quality sensors [5]. These tools collect detailed data on pollutant concentrations, which are then translated into a more understandable format through the Air Quality Index (AQI). AQI is a simplified and effective indicator that offers a comprehensive view of air quality by converting complex pollutant data into a single, easily interpretable value [6]. It provides a practical way to observe and analyze air quality across different times and places.Air pollution currently poses a serious threat to public health, particularly affecting individuals with compromised respiratory or cardiovascular systems [5]. The AQI consolidates multiple pollutant levels into a single indicative value. It often reflects elevated sulfur dioxide (SO_2) concentrations and nitrogen oxides (NOx) in urban environments like Pune. SO_2 is known to irritate the respiratory tract and can aggravate conditions such as bronchitis and asthma, especially in vulnerable populations such as children and the elderly [7]. Similarly, NOx—primarily released from vehicular emissions and industrial processes—can inflame the lining of the lungs, reduce immunity to respiratory infections, and contribute to the development of chronic respiratory diseases [8]. These pollutants also play a role in atmospheric reactions that increase ozone levels and fine particulate matter, indirectly worsening respiratory stress [4], [9].The AQI is generally computed by employing a normalized ratio-based method, wherein the arithmetic mean of the pollutant-to-standard concentration ratios is determined for key pollutants—namely PM_{10}, $PM_{2.5}$, NO_2, and SO_2. This mean value is subsequently scaled by a factor



of 100 to derive the AQI value [10], and aligns with Central Pollution Control Board (CPCB) guidelines for residential areas [6].Thus, AQI data over time could be used to understand and demonstrate the effect of climatic conditions and anthropogenic interventions on pollution in any region. Different residential, industrial, and commercial zones have pollution signatures shaped by local demands, land use, and everyday activities. For example, areas with heavy traffic may see higher nitrogen oxide levels, while construction-heavy zones may have more particulate matter in the air [11]. This method enables a straightforward yet effective comparative analysis of pollutant levels relative to established air quality norms, forming the basis for subsequent spatiotemporal and sectoral air quality evaluations in the study.

The present study focuses on Pune, which is located in the state of Maharashtra, India. As of 2025, Pune has an estimated population exceeding 7.8 million, making it the second-largest city in the state and one of the country's most rapidly expanding urban centers. While the city is known for its educational institutions, IT hubs, and cultural heritage, it has also faced a steady decline in air quality over recent years. Based on data obtained from the CPCB and the Maharashtra Pollution Control Board (MPCB), Pune has experienced frequent exceedances of permissible pollution levels, especially for particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2) [12], [13]. These trends are particularly prominent during the post-monsoon and winter seasons. Increasing vehicular density, ongoing construction, and growing industrial activities have emerged as key contributors [14]. Given these conditions, Pune provides a relevant and pressing case study for analyzing urban air pollution and developing localized, data-driven mitigation strategies.This study examined the freely available AQI data from official websites using simple statistical analysis in an attempt to compare the pollution characteristics for two specific stations in Pune, Maharashtra, India. The primary aim of this paper was to study the available data for a period of 5 years using simple statistical analysis and then compare the obtained data on the basis of the effect of seasonal variation and the presence or absence of a pandemic (lockdown). The pandemic period had decreased anthropogenic activities and hence served as a good proxy for the effect of the level of human activities on pollution. The study aims to not only compare the data for the selected regions but also demonstrate the utility of freely available pollution data and simple statistical tools to understand trends in pollution on the basis of AQI levels.

I. METHODOLOGY

A. *Selection of the region of study*

The growing metropolitan region of Pune was selected for this study because of its fast-paced growth and the presence of both industrial, commercial, and residential zones. The data for collection centers for Pune was also freely available on the MPCB and CPCB websites. There were a total of 7 stations for the collection of the AQI data, among which 2 stations- namely Bhosari and Karve Nagar were chosen. Bhosari has a fast-growing industrial region, whereas Karve Nagar is predominantly residential and commercial. The contrast provided a good background for comparison.

Pune's annual air quality trends, as analyzed by the Urban Emissions Air Pollution Knowledge Assessment (APnA) program, were recently published. This research shows that Pune's air quality is still a serious public health concern. Pune currently has 15 air pollution surveillance stations, which are run by three different systems [15].

B. Data availability and analysis

The data was obtained from MPCB's official website using the search option. The data for AQI, SO2, NOx, and RSPM for dates between Jan 2019 and Dec 2024 were asked for on the website. However, the data till Feb-2024 and Mar-2024 were available for Bhosari and Karve Nagar, respectively. The data was arranged and sorted appropriately using MS Excel (Microsoft Corporation). Moreover, Karve Nagar had the highest number of data points available, and Bhosari was the station having a significant industrial region.

Primary statistical analysis for the mean, median, standard deviation, coefficient of variation, range, maximum and minimum values, interquartile range, skewness, etc., was performed using Python programming. The skewness values were used to decide the preferable measure of central tendency for performing further analysis.

C. Seasonal and Pandemic Comparison

The effect of seasonal variation was analyzed by first dividing the months on the basis of Indian seasons: November to February as Winter, March to May as Summer, and June to October as Monsoon. A similar preliminary statistical analysis was performed for each season to understand the skewness of the data. After deciding upon the median as the preferred measure of central tendency, the median values were used for comparison. The Mann-Whitney U test that compares the medians of two independent groups for continuous but not normally distributed data was used after the preliminary analysis of the data.

A similar scheme was used to compare the pandemic and non-pandemic data by assigning the period from March 2020 to December 2021 as the pandemic (lockdown period). Statistical analysis similar to the one for seasonal comparison was then performed using Python programming.

The statistical analysis of the data and plotting of the graphs was done using Python programming run on Google Colab (Google Corporations Ltd.).

II. RESULTS AND DISCUSSION

A. Primary statistical analysis

Primary statistical analysis was performed for the data from the two stations to understand the way in which the data points are distributed. It is evident from the data (Table 1) that the distribution for all four parameters - AQI, NOx, SO2, and RSPM is skewed towards the right. The skewness for all the parameters for both stations is greater than 0.5, except for AQI and RSPM in Karve Nagar. However, the skewness values for these two parameters are also close to 0.5 (o.41 and 0.48, respectively). For skewed data, the median is the preferred measure of central tendency. The data is skewed for season-wise and pandemic vs non-pandemic distributions, with most skewness values being more than 0.5 (Tables 2 and 3). Hence, the median was used as the preferred measure of central tendency in the study, except for the monthly comparison of the parameters, where the mean was used from the point of view of comparing the preliminary data.

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Station	Parameter	Mean	Median	Standard Deviation	Variance	Minimum	Maximum	Skewness	Kurtosis	Range	IQR	Data Points	Preferred Central Tendency
Karve Nagar	AQI	114.76	117	38.8	1505.73	26	282	0.48	1.27	256	47	418	Mean
Karve Nagar	SO2	17.9	14	12.88	166.02	6	74	1.47	2.2	68	17	418	Median
Karve Nagar	NOx	63.24	57	38.73	1500.23	9	262	1.47	3.39	253	48	418	Median
Karve Nagar	RSPM	113.03	116.5	47.77	2282.31	7	294	0.41	0.32	287	66	418	Mean
Bhosari	AQI	141.69	141	71.28	5080.59	31	755	3.42	22.38	724	65.25	280	Median
Bhosari	SO2	19.86	15.5	16.11	259.45	6	92	1.9	4.27	86	17.25	280	Median
Bhosari	NOx	71.45	68.5	41.97	1761.81	10	281	1.44	3.74	271	54.25	280	Median
Bhosari	RSPM	155.18	150	80.76	6522.92	31	714	2.01	9.49	683	98.5	279	Median

Table 1 Basic statistical parameters for all the pollutants from both stations

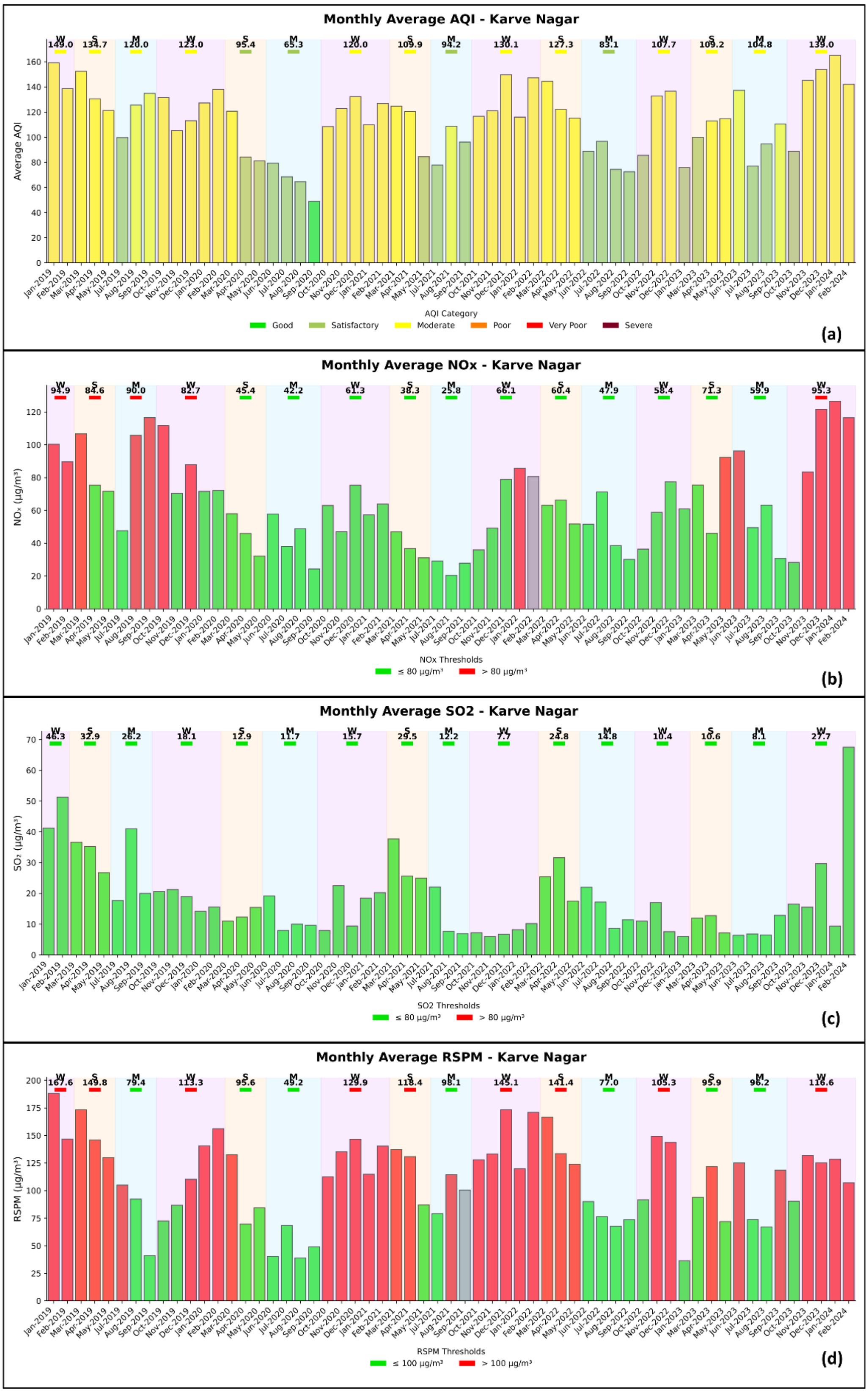

Fig. 2 Monthly mean values for Karve Nagar station. The colors of the bars show the category of pollutant levels. The backgroeund colours depict seasons; a) AQI, b) NOx, c) SO2, d) RSPM

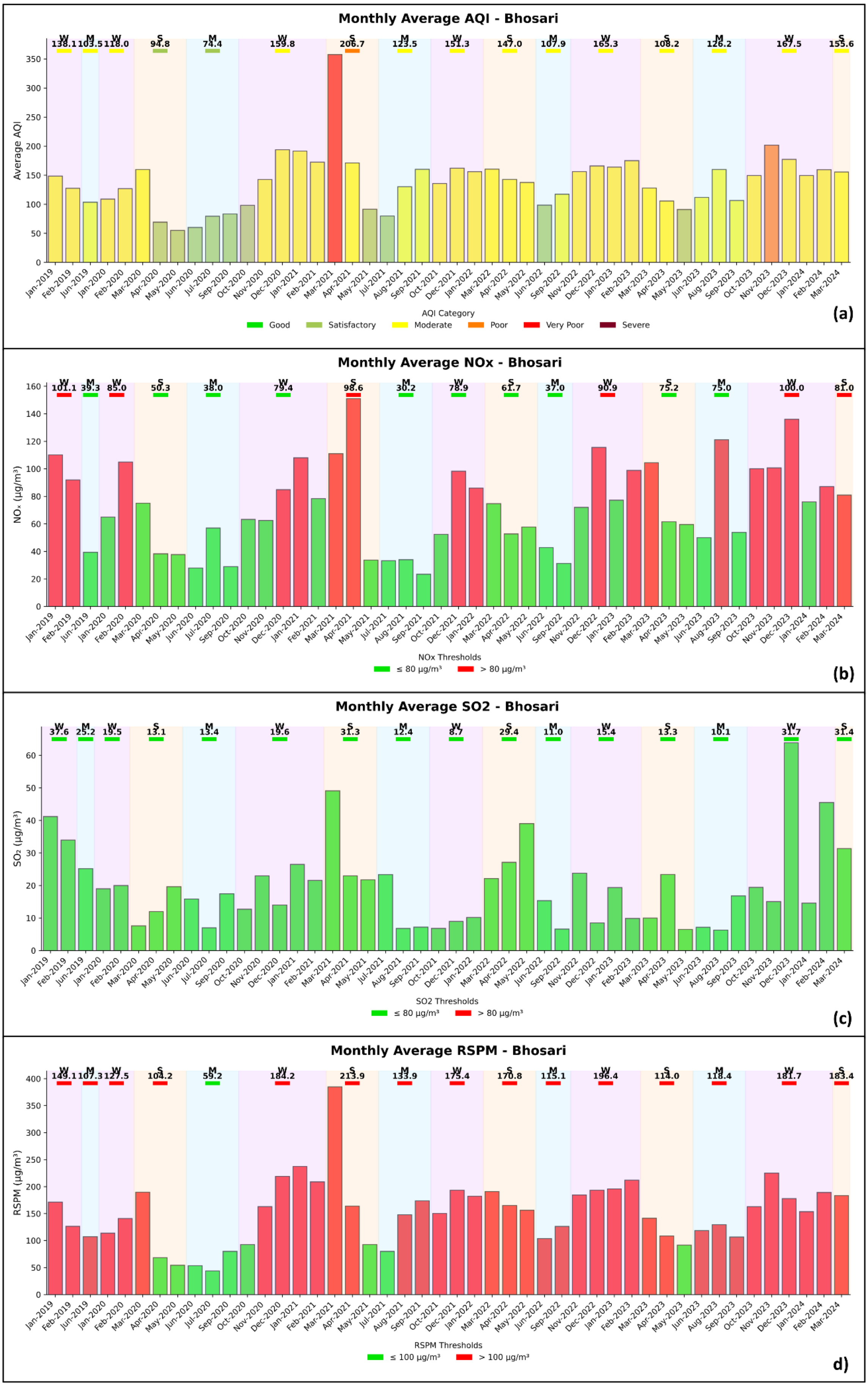
Monthly Average AQI - Bhosari
Average AQI
AQI Category
Good
Satisfactory
Moderate
Poor
Very Poor
Severe
(a)
Monthly Average NOx - Bhosari
NOx (µg/m³)
NOx Thresholds
≤ 80 µg/m³
> 80 µg/m³
(b)
Monthly Average SO2 - Bhosari
SO₂ (µg/m³)
SO2 Thresholds
≤ 80 µg/m³
> 80 µg/m³
(c)
Monthly Average RSPM - Bhosari
RSPM (µg/m³)
RSPM Thresholds
≤ 100 µg/m³
> 100 µg/m³
d)

Fig. 3 Monthly mean values for Bhosari station. The color of the bars show the category of the pollutant levels. The background colors depict seasons; a) AQI, b) NOx, c) SO2, d) RSPM *The coefficient of variation for all the parameters for both stations was considerably high, indicating a dispersed nature of the data. Highly variable data for the parameters could be a result of a lesser number of data points, especially more so for the Bhosari station, which had only 280 data points as compared to 418 for the Karve Nagar station. Nevertheless, the CV values for Karve Nagar station were also considerably high, indicating the variable nature of air pollution, probably because of it being a function of multiple factors.*

B. ***Mean monthly pollutant levels and AQI:***

Fig. 2 (a-d) shows the monthly mean AQI, NOx, SO2, and RSPM values for Karve Nagar station, and Fig. 3 (a-d) shows the same for the Bhosari station. The top portions of the graphs show the seasonal average for summer (S), Monsoon (M), and winter (W), respectively. The AQI values were never in the 'Good' category for both stations, except for the month of September 2020 for Karve Nagar. The AQI for the Bhosari station also was in the poor category in November 2023 and very poor in March 2021. Barring these exceptions, the AQI in all other months was either 'moderate' or 'satisfactory' for both stations.

It is also clearly visible from the bar graphs (Fig. 2a & 2a) that the AQI in the winter season was always higher than the AQI in summer or monsoon for both stations. Similar trends were observed for RSPM values for both stations. Probably because AQI values are calculated using the PM 2.5 and PM 10 values, a strong correlation between the RSPM and AQI trends seems to exist. RSPM values were also more frequently exceeding the permissible limit in Bhosari as compared to Karve Nagar, which could be a result of high industrial activity in Bhosari.

The average monthly SO2 values for both stations were below the prescribed limits of the CPCB. However, the same was not true for NOx values, as the monthly average values frequently exceeded the permissible limit (80 μg/m3) for both stations. The months with higher than permitted NOx values and also RSPM values were more in percentage for Bhosari station as compared to the Karve Nagar station. Now, NOx is emitted from both residential and industrial regions. However, the quantum of NOx from industrial regions could be significantly high due to the scale of operations. Bhosari being an industrial area (with adjoining residential areas), could be the contributing factor for a higher frequency of high NOx in the monthly averages.

C. ***Bhosari station has higher overall pollutant levels***

Fig. 4 shows the comparison of overall mean values for all the parameters. Except for SO2, the mean values for AQI, NOx, and RSPM were significantly higher in Bhosari as compared to Karve Nagar. Also, the overall median values (see Table 1) for all the pollutants were significantly higher in Bhosari as compared to Karve Nagar station. The existence of an industrial area in Bhosari (Bhosari MIDC) could be a possible reason for the higher overall mean for three of the four pollution indicators (parameters).

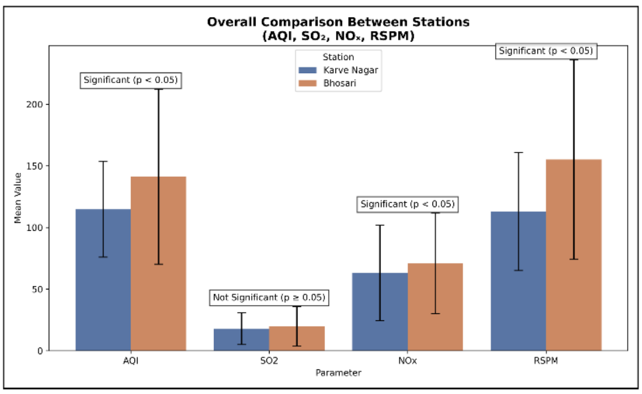

Fig. 4 Comparison of mean values for AQI, SO2, NOx, and RSPM for both stations

D. ***Effect of seasons on pollution levels***

Climate has a significant impact on the state of pollutants in the air. Generally, winters are known to trap pollutants, increasing their residence time in the air due to the denser climate in winters. Conversely, monsoons are known to reduce the amounts of pollutants from the air by washing them away. These two characteristics are specifically true for particulate matter; hence, AQI has contributions from PM 2.5 and PM 10. Therefore, the effect of seasons on the concentrations of SO_2, NO_x, and RSPM in the air and the level of AQI were tested by comparing the median values for both stations.

Firstly, the yearly median values for all the pollutants are higher in Bhosari station as compared to Karve Nagar in all the cases (Table 1). The same is true for all three seasons, including all the pollutants and the AQI (Table 2). Fig. 5 (a-d) shows the comparison of medians for the Karve Nagar station, and Fig. 6 (a-d) shows the same for the Bhosari station. In the case of AQI, it is significantly higher in winters than in both summers and monsoons for both stations. In the case of Karve Nagar, the AQI for all three seasons differs significantly. However, for the Bhosari station, the AQI for the summer and monsoon seasons does not differ significantly. So, more than the monsoon alleviating the pollution levels, the winters exaggerate it in this case. The RSPM median levels also follow a similar trend for both stations and understandably so, as RSPM contributes a major part to the calculation of AQI. Overall, the presence of particulate matter in the air is more prevalent in winter than in the other two seasons, as shown in other studies [16], [17].

In the case of NO_x levels, winters lead to a significantly higher NO_x level for both stations. The monsoon values are the lowest for both stations. It is known that NO_2 is split photochemically to form ozone ultimately. The rate of this reaction increases with temperature. Hence, summers generally show low NO_x levels [18]. NO_x is released due to anthropogenic activities, and hence, increased heating requirements and relatively stagnant winds in winter are possibly the contributing factors for higher levels, as shown by some other studies [19], [20].

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Table 2 Basic statistical parameters for both stations and all three seasons

Season	Station	Parameter	Mean	SD	Variance	Median	Min	Max	N	skewness	range	IQR	Preferred Central Tendency
Monsoon	Karve Nagar	AQI	97.26	39.21707	1537.979	95.5	26	274	150	0.936973	248	47.75	Median
Summer	Karve Nagar	AQI	113.7568	32.74675	1072.349	117	33	199	111	-0.03876	166	46	Mean
Winter	Karve Nagar	AQI	132.1975	34.62092	1198.608	128	56	282	157	0.948661	226	34	Median
Monsoon	Karve Nagar	SO2	13.76	9.659074	93.29772	9	6	48	150	1.413112	42	13.5	Median
Summer	Karve Nagar	SO2	22.88288	13.02985	169.7771	22	6	63	111	0.863601	57	19	Median
Winter	Karve Nagar	SO2	18.32484	14.16397	200.6182	15	6	74	157	1.724639	68	14	Median
Monsoon	Karve Nagar	NOx	53.42	40.3753	1630.165	39	11	254	150	1.90678	243	41.5	Median
Summer	Karve Nagar	NOx	57.65766	31.2295	975.2817	54	9	161	111	1.222327	152	38.5	Median
Winter	Karve Nagar	NOx	76.56688	38.36503	1471.875	72	9	262	157	1.412363	253	35	Median
Monsoon	Karve Nagar	RSPM	84.44	40.53708	1643.255	78	7	211	150	0.676151	204	56.25	Median
Summer	Karve Nagar	RSPM	118.3964	42.8066	1832.405	124	33	249	111	0.320989	216	67	Mean
Winter	Karve Nagar	RSPM	136.5605	43.30724	1875.517	134	25	294	157	0.609938	269	46	Median
Monsoon	Bhosari	AQI	115.3295	52.01077	2705.12	111	31	403	88	2.262364	372	50.75	Median
Summer	Bhosari	AQI	137.1341	101.4244	10286.91	120	40	755	82	3.588707	715	84.5	Median
Winter	Bhosari	AQI	166.1818	44.93281	2018.957	160	83	465	110	3.004056	382	39.5	Median
Monsoon	Bhosari	SO2	12.70455	7.584253	57.5209	8	6	38	88	1.068159	32	9.25	Median
Summer	Bhosari	SO2	22.91463	16.99978	288.9926	20	6	92	82	1.715437	86	20	Median
Winter	Bhosari	SO2	23.30909	18.52187	343.0595	18	6	91	110	1.487265	85	22	Median
Monsoon	Bhosari	NOx	52.94318	38.25425	1463.388	43	10	225	88	2.069814	215	32	Median
Summer	Bhosari	NOx	62.9878	30.56282	934.0863	59	17	151	82	0.528001	134	39	Median
Winter	Bhosari	NOx	92.55455	43.21518	1867.552	88	16	281	110	1.60571	265	30.5	Median
Monsoon	Bhosari	RSPM	117.2273	62.82099	3946.476	107.5	31	432	88	1.992839	401	66.5	Median
Summer	Bhosari	RSPM	150.5366	106.7103	11387.09	130	40	714	82	2.563578	674	111.5	Median
Winter	Bhosari	RSPM	189.3119	52.01205	2705.254	188	82	482	109	1.509192	400	58	Median

Pandemic	Station	Parameter	Mean	SD	Variance	Median	Min	Max	N	skewness	Range	IQR	Preferred Central Tendency
Non-Pandemic	Karve Nagar	AQI	120.1292	40.02065	1601.653	118.5	33	282	240	0.669444691	249	44.5	Median
Pandemic	Karve Nagar	AQI	107.5281	35.95857	1293.019	113	26	227	178	0.046839647	201	49.25	Mean
Non-Pandemic	Karve Nagar	SO2	19.75833	14.63131	214.0752	14.5	6	74	240	1.156501864	68	22	Median
Pandemic	Karve Nagar	SO2	15.38764	9.540947	91.02968	14	6	63	178	1.848838458	57	11.75	Median
Non-Pandemic	Karve Nagar	NOx	74.475	41.97907	1762.242	68	9	262	240	1.359634651	253	44.5	Median
Pandemic	Karve Nagar	NOx	48.08989	27.43977	752.941	40	14	152	178	1.016002392	138	39.5	Median
Non-Pandemic	Karve Nagar	RSPM	113.2542	48.25765	2328.801	117.5	7	294	240	0.400924461	287	66.5	Mean
Pandemic	Karve Nagar	RSPM	112.736	47.24695	2232.275	114.5	23	277	178	0.420793432	254	66.25	Mean
Non-Pandemic	Bhosari	AQI	147.6115	46.58982	2170.611	147	59	465	157	2.11672739	406	51	Median
Pandemic	Bhosari	AQI	134.1382	93.49106	8740.579	121	31	755	123	3.319391613	724	87.5	Median
Non-Pandemic	Bhosari	SO2	22.03185	18.61431	346.4926	14	6	92	157	1.541603693	86	24	Median
Pandemic	Bhosari	SO2	17.08943	11.68157	136.4591	16	6	78	123	2.343131341	72	14	Median
Non-Pandemic	Bhosari	NOx	81.96815	41.12184	1691.005	77	20	243	157	1.425638021	223	42	Median
Pandemic	Bhosari	NOx	58.01626	39.27436	1542.475	48	10	281	123	1.845374533	271	50.5	Median
Non-Pandemic	Bhosari	RSPM	162.7308	58.51929	3424.508	162.5	51	482	156	1.056274932	431	83.25	Median
Pandemic	Bhosari	RSPM	145.6016	101.7227	10347.5	130	31	714	123	2.231758077	683	120.5	Median

Table 3 Basic statistical parameters for both stations in pandemic and non-pandemic periods

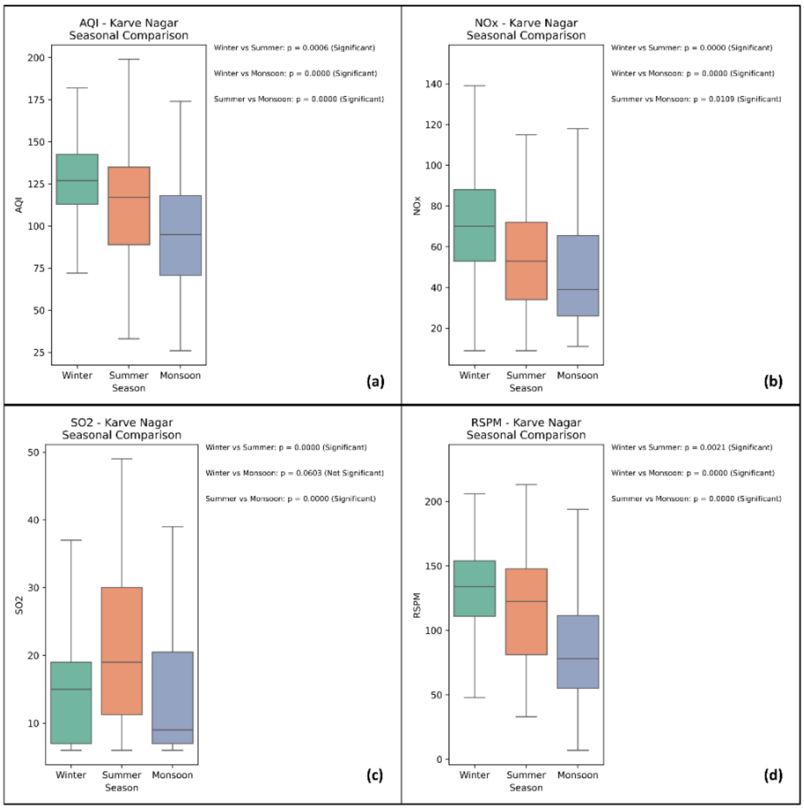

Fig. 5 Box plots comparing seasonal median values for Karve Nagar station; a) AQI, b) NOx, c) SO2, d) RSPM

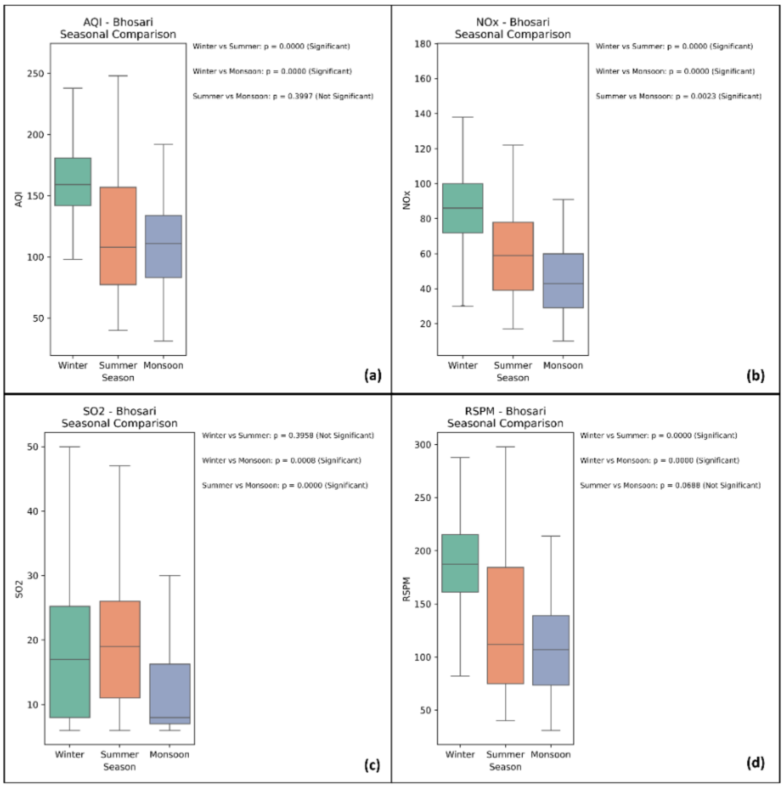

Fig. 6 Box plots comparing seasonal median values for Bhosari station; a) AQI, b) NOx, c) SO2, d) RSPM

The SO2 levels were always below the prescribed higher limit for both stations. However, the median SO2 levels in summer were the highest among the three seasons for both stations, differing significantly, especially from the monsoon. Some studies state that the SO2 levels do not differ significantly between dry and rainy seasons [21], whereas some studies indicate higher levels
during dry seasons [17]. The statistical analysis in our case indicates slightly higher median SO2 levels during the dry season for both an industrial and a residential region.

Overall, in the case of the selected stations, winters seem to contribute to higher AQI levels via increased RSPM and NOx levels, which is in agreement with the existing studies. A statistical analysis of AQI and pollutant data over a longer time span can thus help us understand trends with pollutant levels and causes.

*E. **Effect of COVID pandemic on levels of pollutants***

The COVID-19 pandemic led to a considerable decrease in anthropogenic activities. Hence, an attempt was made to compare the AQI and pollutants data between pandemic and non-pandemic periods. As with the seasonal data, the skewness was high; hence, the median was chosen to compare.

Fig. 7 (a-d) and Fig.8 (a-d) show the median levels of the three pollutants and AQI during the pandemic and non-pandemic periods for the Karve Nagar and Bhosari stations, respectively. The median values for all the pollutants were less than the corresponding non-pandemic values. However, the difference was not always statistically significant. The median AQI value for pandemic periods was significantly lower than the respective non-pandemic value for both stations. This hints that the lockdown during the pandemic likely led to a decrease in both industrial and domestic activities.

It is, however, interesting to note that for the Bhosari station, both NOx and RSPM were significantly differing in their median values. In contrast, only the NOx values were significantly different for the Karve Nagar station. The RSPM values for Karve Nagar didn't differ significantly between the pandemic and the mon-pandemic periods. This could be because the lockdown led to decreased activities that lowered NOx release rather than RSPM. Now, NOx is released heavily by both domestic and industrial activities, whereas RSPM is predominantly released by industrial activities and transport. Karve Nagar, a predominantly residential area, did not significantly change the RSPM values. In contrast, Bhosari being an industrial area, and industrial activities taking a hit during the lockdown led to a significant decrease in the median RSPM values in Bhosari.

The median SO2 activities did not show significant change between the pandemic and non-pandemic periods. The inherently low SO2 values (lower than the maximum permissible) could be a reason that SO2 didn't differ significantly between the two periods. However, the maximum SO2 values recorded during pandemic and non-pandemic periods were significantly different for both stations (Table 3). The maximum non-pandemic value for SO2 at the Bhosari station was 92, as opposed to a maximum of 78 during the non-pandemic months. Similarly, the maximum non-pandemic SO2 value at Karve Nagar was 74,z as opposed to a maximum of 63 during the pandemic. This hints towards the fact that abnormally high SO2 emissions were more probable during the non-pandemic period. A similar case is observed for NOx values for the Karve Nagar station (max. non-pandemic value of 262 vs. max. pandemic value of 152). Therefore, the pandemic probably also decreased the incidents of abnormally high SO2 and NOx release due to a decrease in anthropogenic activities.

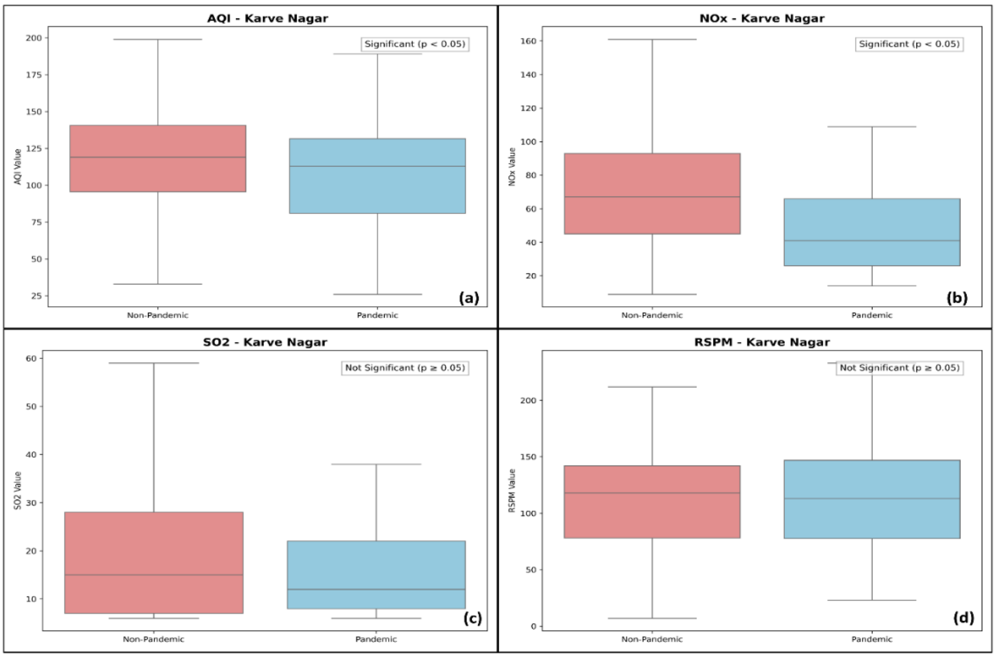

Fig. 7 Box plots comparing pandemic vs non-pandemic median values for the Karve Nagar station; a) AQI, b) NOx, c) SO2, d) RSPM

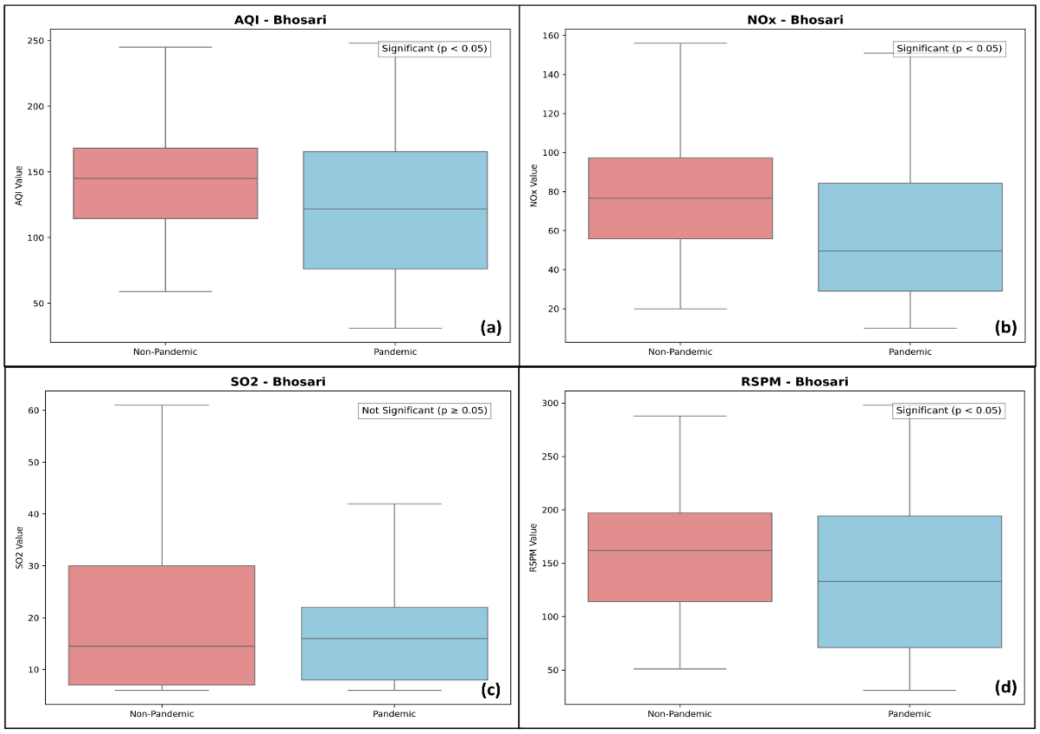

Fig. 8 Box plots comparing pandemic vs non-pandemic median values for the Bhosari station; a) AQI, b) NOx, c) SO2, d) RSPM

CONCLUSIONS

Statistical analysis of available pollutant concentration data and AQI levels could be performed using data obtained from MPCB. Interesting trends and correlations could be observed, and the impact of seasonal changes and the presence/absence of anthropogenic activities could be studied. The results were in agreement with the existing knowledge and trends. The mean and median values for all the pollutants and hence the AQI were higher in an industrially active region (Bhosari) as compared to a residential and commercial area (Karve Nagar). The presence of winter was the impactful factor for an increase in AQI levels via an increase in both NOx and RSPM levels. MOnsoons

led to an overall decrease in the level of pollutants. The pandemic, and hence reduced anthropogenic activities, led to decreased AQI levels -via an increase in both NOx and RSPM in the industrially dominated region and via only NOx in the residential region. The selected region has low SO2 levels, and dry seasons showed slightly elevated SO2 levels. Though the overall SO2 levels didn't differ significantly in the lockdown, the lockdown was influential in lowering the maximum SO2 values in both regions. Overall, simple statistical analysis of AQI data was instrumental in understanding some trends related to the effect of seasons and anthropogenic activities on the pollutants and the way in which they contributed to the AQI.
Because both regions have slightly different trends and contributive factors to the AQI, tailored approaches to tackle pollution would be fruitful in the efficient and focused removal of air pollutants in the future.

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