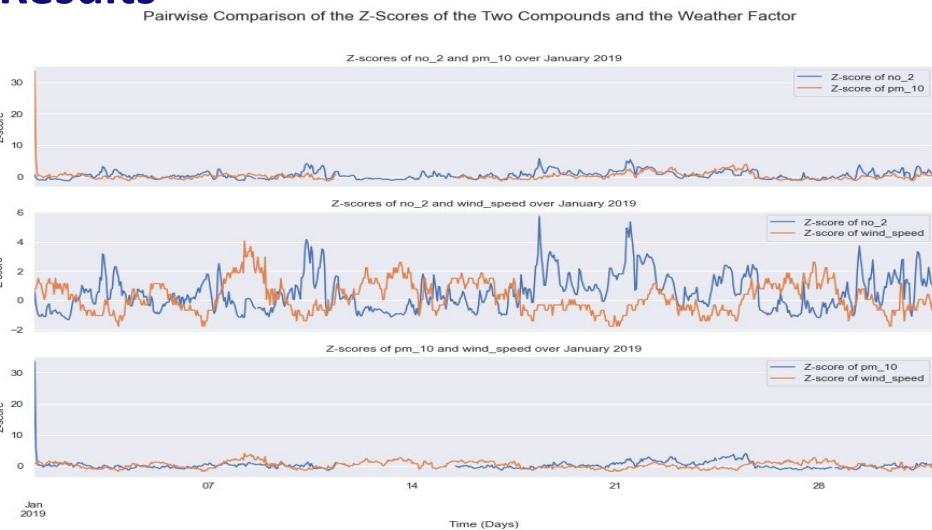# How Weather Affects Air Quality
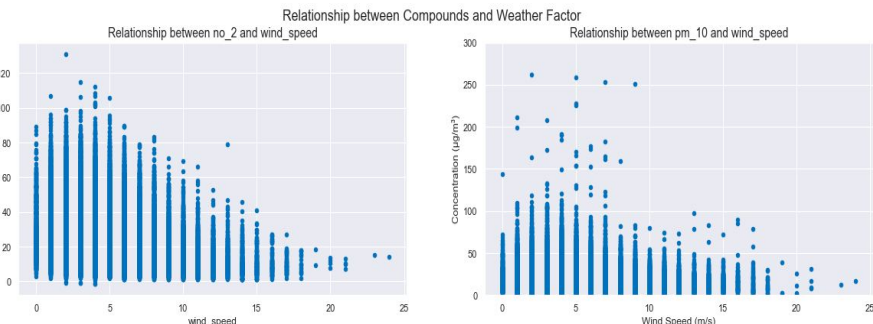
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Introduction

Air pollution is a significant issue that affects both public health and the environment. In this study, we investigate the impact of weather on air quality using NO_2 and PM_{10} compounds as indicators measured by station: 240, 7 km away. Specifically, we analyze the relationship between wind speed, temperature, rainfall, and air quality to determine how these factors influence NO_2 and PM_{10} concentrations. This study is motivated by the need to understand the extent of weather-related effects on air quality and to identify potential mitigation measures to improve public health. By answering this question, we aim to provide insights into the complex interplay between weather and air quality, which can inform policy decisions and public health interventions.

Methods

Next, created weekly line graphs to visualize consistent trends over time and used a scatter plot to examine the direct correlation between wind speed and compound concentrations without considering time. Developed two residual models using wind speed and temperature as independent variables and NO_2 as the dependent variable. These models were trained and tested with a dataset, showing a direct correlation between the two variables and forming final hypothesis. Finally, a bar chart was created to showcase a surprising finding of rainfall and NO_2 correlation validated by another regression model to disprove information from the internet and other researchers. These chosen methods provided interesting insights into the impact of weather on air quality.

Results

Pairwise Comparison of the Z-Scores of the Two Compounds and the Weather Factor

Daily Average Concentration of NO2 due to Wind Speed and Temperature

Lower wind speed, higher concentration. On day to day basis. And direct correlation further proven through scatter plots below.

Higher Wind Speed/Temperature Lower daily average concentration produce an accurate residual plots with error of 6.5 when excluding the years 2020 and after. With Both coefficients negative. -2/-0.9. Confirmed by a regression model.

Relationship between Compounds and Weather Factor

Amount of times no_2 concentration was above average in 2019

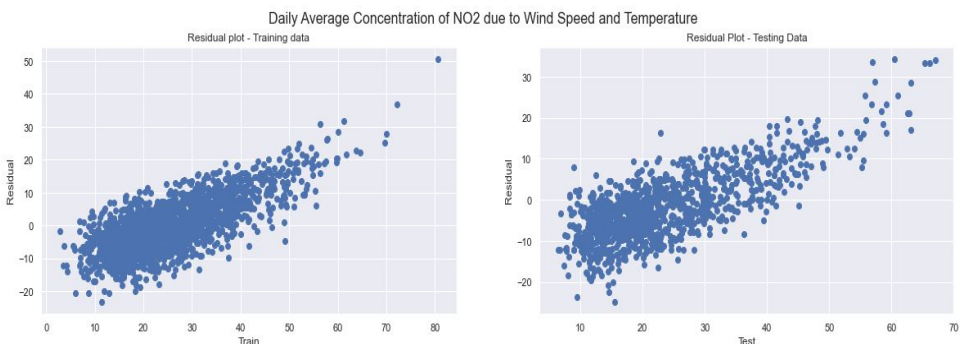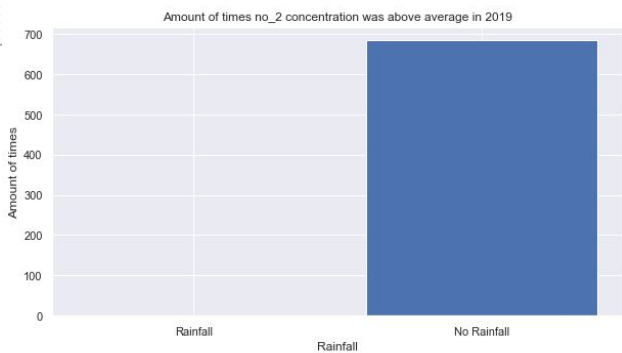NO_2 concentration on daily basis lower than average for all days during rainfall.

Discussion

Our methods provided insights into the impact of weather on air quality, particularly the correlation between wind speed and NO_2/PM_{10} concentrations. Regression models showed strong negative correlation with wind speed and weaker negative correlation with temperature. Surprisingly, rainfall had a opposite impact on air quality contrast to research papers, highlighting the importance of considering other weather factors. Limitations include limited concentration variability and one measurement location. Future studies should expand the dataset and explore additional locations.

Conclusion

In conclusion, the findings confirm our hypothesis that increase in wind speed, temperature and rainfall have positive impact on air quality by reducing the concentration of NO_2/PM_{10}. The use of regression models showed strong negative correlation with wind speed and weaker negative correlation with temperature, while rainfall had a surprisingly positive impact on air quality. Future studies should consider expanding the dataset and measurement locations to gain a more comprehensive understanding of the impact of these weather factors on air quality.