Air Quality and Weather Factors

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Introduction

Air quality is an integral part of the wellbeing of a society and to device effective preventative measures against air pollution a thorough analysis of the contributing factors should be conducted first. In this research temperature as a weather factor is analyzed for impact on concentrations of ground level ozone (O_3) and nitrous dioxide (NO_2).

Methods

The distributions of nitrous dioxide, ground level ozone and the temperature are used to get an overall perspective on the concentration of the pollutants and the temperature throughout the time of measurement as well as spot patterns. Then using more specialized plots, those patterns can be verified and lastly checking whether a regression model can have good predictions on the concentrations given a certain a temperature.
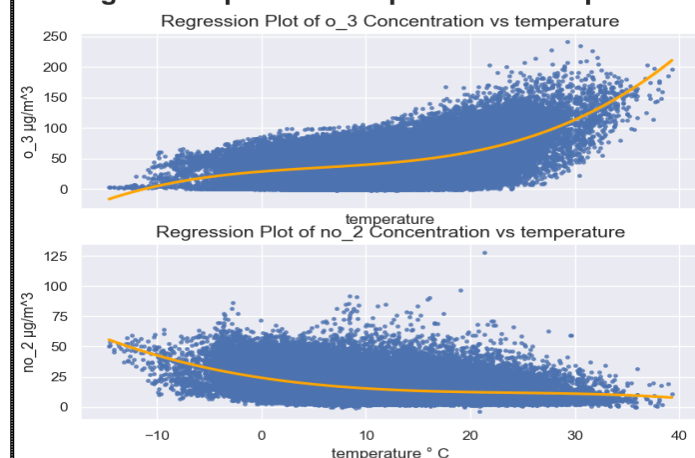
Results
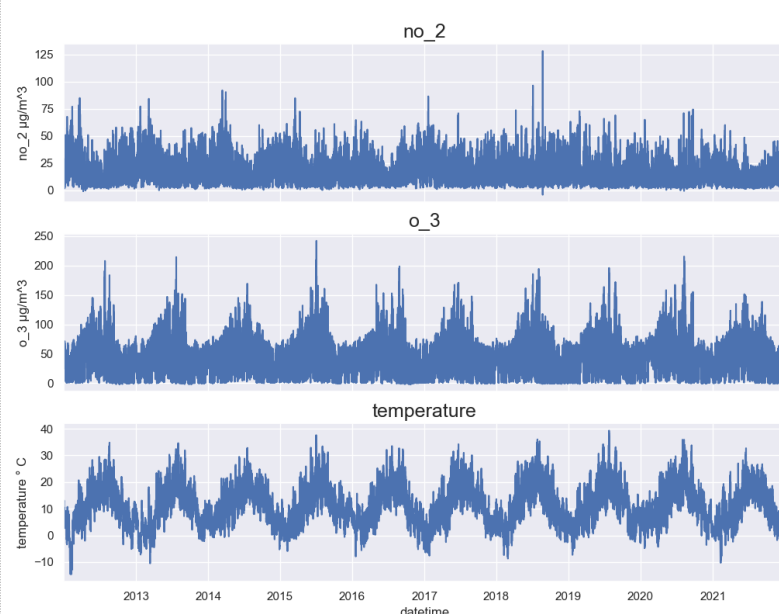
In this graph it can be observed that whenever there is a relation between the distributions of O_3 and temperature. Whenever there is peak in the temperature graph, there is also a peak in the O_3 graph. While it is harder to see here whether there are any correlation between NO_2 and temperature, there is a slight negative correlation between them.

From the previous graph we also noticed an annual pattern to the distributions. To verify them graphs of the monthly averages are used. Throughout 2017-2022 the distributions are similar. In particular, O_3 and temperature have peaks between June and August, while NO_2 has a dip. However, the dip of NO_2 can be because O_3 is formed from the reaction of NO_2 with organic compounds when there is heat.
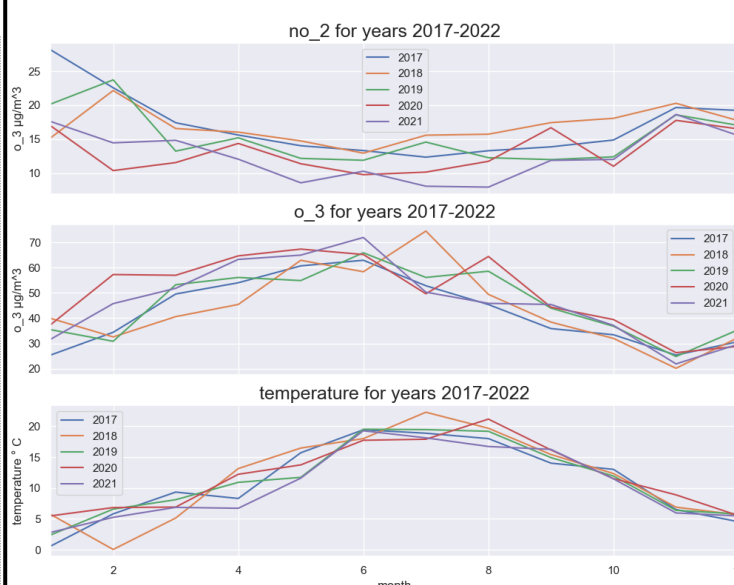
Now to see whether the temperature and the two compounds are correlated, we use regression plots. In the graphs, although, a lot of the datapoints are away from the line of best fit, it is true that when the temperature is higher, the concentrations of O_3 are higher while the concentrations of NO_2 are lower.

Discussion

First having the distribution plots of the three distributions, a pattern is concluded which then was further affirmed with the monthly average graphs. Lastly, with the regression it is verified that there is a correlation between temperature and the chosen air pollutants. However, this is just a univariate analysis, and it may not give an accurate representation of all the factors of air quality. The research might be improved if other factors of air quality were also considered. In that way the impact of weather can be more accurate.

Conclusion

In this research the impact of temperature on air quality was verified. From what it is known about the formation of O_3 and the results of this research it can be concluded that whenever the temperatures are high, the concentration of O_3 is also high while during the same time the concentration of NO_2 is low.