

# Relation between NO<sub>2</sub> levels, traffic and weather

George Condos, 1531409

## Introduction

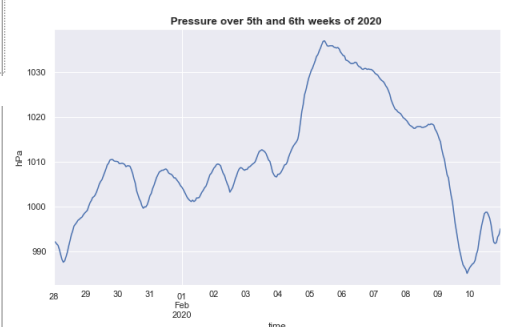
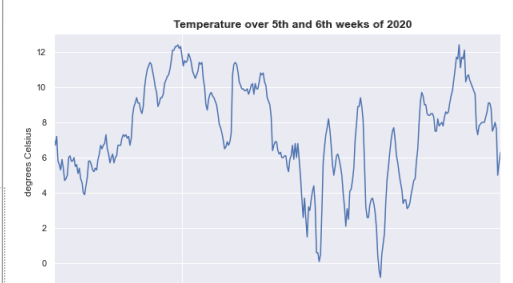
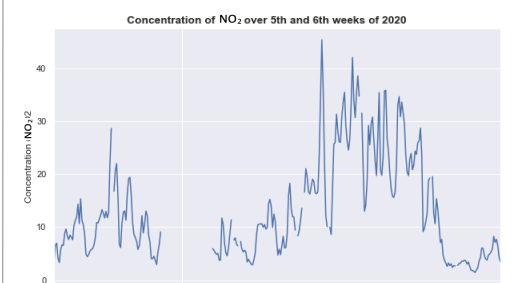
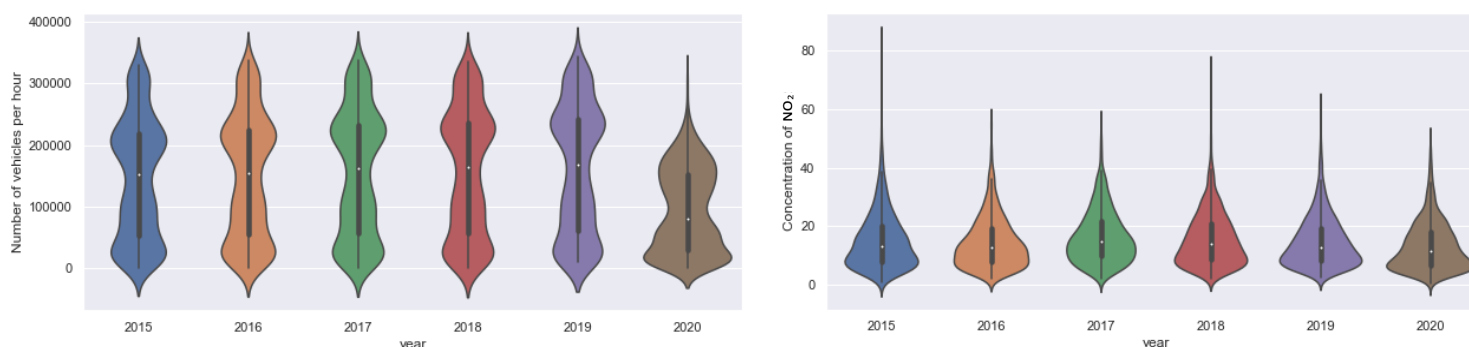
During the lockdown period, which came into force in 2020, an improvement in air quality was observed. As people had to stay in their homes, the amount of vehicle traffic was reduced. It is logical to correlate this with the improvement of air quality in the atmosphere. But does higher number of vehicles really mean higher nitrogen dioxide in the atmosphere? This study examines nitrogen dioxide levels during 2020 and the impact that the significant reduction of number of vehicles during the lockdown and other meteorological data had on it. The data were collected from the air quality measurement station in the Posterholt-Vlodropweg area in the Netherlands.

## Methods

In order to find the relation between NO<sub>2</sub> and vehicles, graphs were made using different time scales and types of graphs. The violin plots were made to compare the distribution and the median of the two values each year in the period when the lockdown happened in 2020. Scatter plots were also made to investigate any possible correlation between the values and line charts were constructed to look into the relation between NO<sub>2</sub> and the number of vehicles in the period before and during the lockdown in 2020 and the same period in 2019. Finally, more line charts were made to examine the influence of weather on the concentration of NO<sub>2</sub>.

## Results

Number of vehicles and concentration of NO<sub>2</sub> in the year of 2015-2020 during the period 12/03 - 11/05



In the violin plots the mean number of vehicles in the initial lockdown period in 2020 is clearly much lower than previous years. Contrariwise, the mean concentration of nitrogen dioxide remained almost the same in the same period in 2020 as in the same days in the previous five years.



In the line charts above despite the significant drop of vehicles in the beginning of the lockdown in March of 2020 the distribution of NO<sub>2</sub> concentration over the same period in 2020 and 2019 is almost the same. In the scatterplot above there is no evidence of higher number of vehicles resulting in higher NO<sub>2</sub> concentration, and vice versa, in any of the years.

In the line charts above there is indication of relation between the concentration of NO<sub>2</sub> in the atmosphere and the temperature and pressure. When pressure spikes up and temperature goes down NO<sub>2</sub> spikes up as well.

## Discussion

The chosen methods clearly show that the number of vehicles and NO<sub>2</sub> are unrelated without misleading the reader. Although the results from the graphs, relative to the number of vehicles, agree with each other the scope of the research is small enough to allow for the possibility that the results is a random coincidence. Additionally, the research did not extend long after the lockdown, ensuring that NO<sub>2</sub> did not slowly decreased without being visible in the beginning. Furthermore, the concentration of NO<sub>2</sub> in the atmosphere is also influenced by other factors, such as emissions from industrial zones, that could also change the conclusion of the research. So, for future research additional factors and a longer period before and after an event will be considered.

## Conclusion

From the results, it can be concluded that NO<sub>2</sub> is not influenced by the number of vehicles in circulation on the roads. Nitrogen dioxide did not reduce even with the massive decrease of vehicles due to the lockdown in 2020. On the contrary weather is a factor of the concentration of NO<sub>2</sub> in the atmosphere. When pressure is high NO<sub>2</sub> is also high. Pressure is also associated with other weather measurements such as wind and temperature that could be the primary factors in the amount of NO<sub>2</sub> in the air.