NO_2 analysis Report

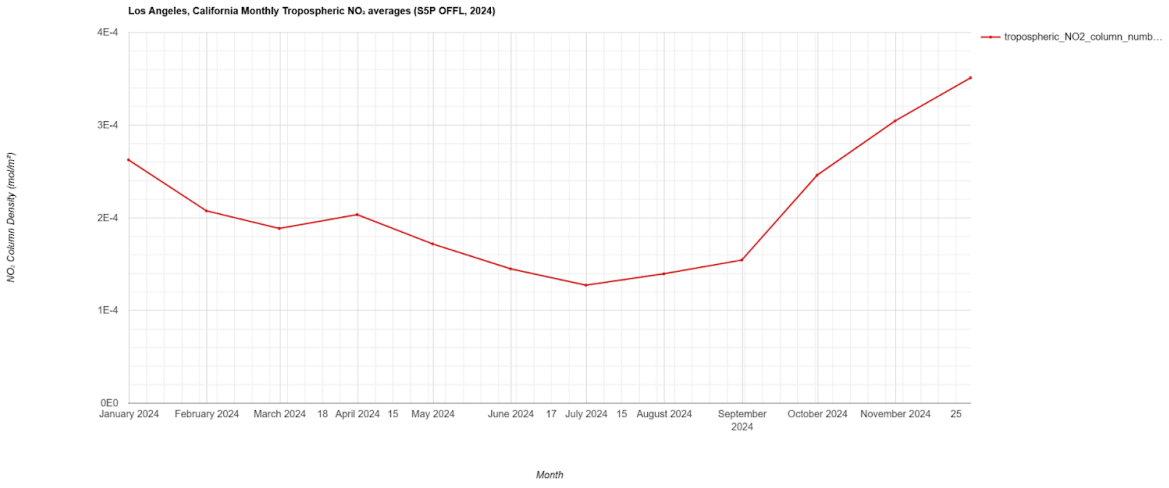
Introduction

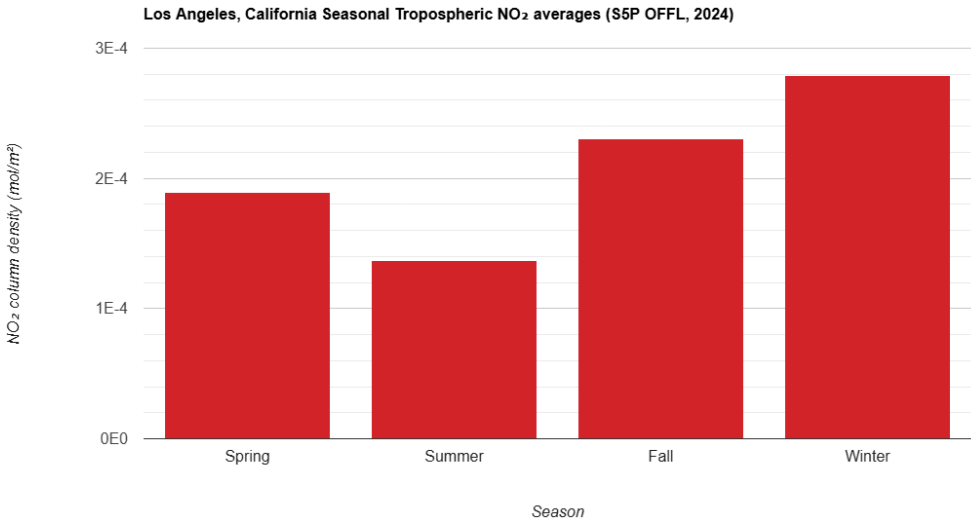
The selected study area is Los Angeles, California, USA, with latitude 34.0522° N and longitude -118.2437° W. This area is a location with high levels of human activity. Nitrogen dioxide (NO_2) pollution can originate from a variety of sources such as from vehicle exhausts, industrial and powerplant emissions, residential heating, and other sources of high-combustion burning. Moreover, the increasing population in Los Angeles sustains continuous vehicle emissions of NO_2 and other air pollutants, accelerating the decrease in local air quality. The objective of this research is to understand and identify the connections between pollution spikes and their potential causes, whether they arise from seasonal variation, industrial activity, sensor errors, or a combination of these factors.

Methods

The Sentinel-5P TROPOMI dataset is obtained from a passive grating imaging spectrometer that can capture a spatial resolution of 3.5x5.5 km with daily global coverage. For the first analysis, monthly NO_2 column densities were calculated by averaging the Sentinel-5P TROPOMI data collected for the month. For the second analysis, seasonal NO_2 column densities were calculated by averaging the monthly data for the meteorological seasons. The year 2024 was selected for both analyses due to its recency.

Results





In 2024, the data suggests that the month with the highest NO_2 was December with 0.00035 mol/m^2 and the lowest was July 0.00013 mol/m^2. In 2024, the season with the highest averaged concentrations of NO_2 was winter of 0.000279 mol/m^2 and the lowest was Summer 0.000138 mol/m^2. The months encompassed for the winter season were December, January, and February. The months encompassed for the summer season were June, July, and August. The seasonal variations between the amount of NO_2 in winter versus summer could be caused by the colder air in winter and hotter air in the summer.

Discussion and Conclusion

The seasonal variations between the amount of NO_2 in winter versus summer could be caused by the colder air in winter being more dense, thus, emissions from vehicles and heating units are more easily trapped at the ground level. In contrast, during summer, the hotter air causes convection where heated air rises above ground level, thus dispersing pollutants such as NO_2 to upper air masses. The findings of high levels of NO_2 in winter corresponds to known NO_2 sources and patterns in Los Angeles. Due to the higher levels of NO_2, the population in Los Angeles may have higher risks of respiratory and cardiovascular issues and diseases due to prolonged exposure. The Sentinel-5P TROPOMI dataset is simple to extract from and use for NO_2 monitoring. Due to lower air quality, robust masking and air filtration measures need to be implemented to improve health outcomes Los Angeles, California.