

Abstract

Thesis: Impact of the COVID-19 Lockdown on Air Quality : A Case Study on Three US Cities

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An unknown disease, which we now know as COVID-19, was detected in Wuhan, China in December of 2019 and has spread to more than 200 countries, classifying it as a global pandemic and causing many countries, states, and cities to lockdown. This study has two objectives: (1) use time series forecasting methods to analyze how the COVID-19 lockdown impacted sulfur dioxide, carbon monoxide, and ozone emissions in Portland, Maine (ME), New York City, New York (NY), and Omaha, Nebraska (NE) by means of univariate and multivariate analysis and (2) use multivariate analysis on observed data to compare the change in the concentration of emissions from Portland, ME and New York City, NY, with Omaha, NE. Using the forecasted values from two groups, before lockdown and after lockdown, we applied a nonparametric univariate and multivariate analysis with the goal of making an inference about what impact the lockdown had pollutant emissions. Because of the lack of variability within the forecasted data, this resulted in a computational error, making our results unreliable. Using observed values, we wanted to compare Portland and NYC emissions, who had a stay-at-home order, with that of Omaha, who did not have a stay-at-home order. Using MANOVA, we found that ozone emissions decreased from 2019 to 2020 in Omaha, whereas Portland and NYC had no difference in ozone levels. Because assumptions were not met for some tests, we used a Mann-Whitney U test and found that carbon monoxide and sulfur dioxide emissions were significantly different in Portland. In NYC, only carbon monoxide emissions were significantly different. We also found that in addition to ozone, sulfur dioxide emissions were significantly different in Omaha.