

Coronavirus (COVID-19) Pandemic Impacts on Air Pollution: Comparison of Ground-level Ozone (O₃) and Particulate Matter (PM_{2.5}) in Rural San Joaquin Valley to Urban Areas in California



to Urban Areas in California
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INTRODUCTION

During the Coronavirus (COVID-19) pandemic, shelter in place orders were enacted across California on March 19, 2020. As a result, air pollution was reduced from the traffic sector. For this study, we used the available data from the California Air Resources Board (CARB) to analyze and quantify the changes in concentrations of the secondary pollutants including: ground-level ozone (O₃) and particulate matter 2.5 (PM_{2.5}) in the San Joaquin Valley from years 2017 to 2020 and compared it to urban air basins including the South Coast Air Basin, Sacramento Valley Air Basin, and San Francisco Bay Air Basin. We recommend that the rural Central Valley's air quality be further observed, and additional studies should be conducted on the highest emitting pollutant activities.

METHOD

- Literature review of Coronavirus impacts on ground-level ozone and particulate matter 2.5 in the Central Valley.
- RStudio was used to create the graphs of the data for both ground-level ozone and particulate matter 2.5. Data was obtained from the California Air Resources Board (CARB).
- RStudio was used to take ANOVA statistical analysis tests for the months displaying normal distributions from the data obtained from the California Air Resources Board (CARB).
- RStudio was used to take Kruskal-Wallis statistical analysis tests for the months not displaying normal distribution from the data obtained from the California Air Resources Board (CARB).

DISCUSSION

• Ground-level ozone can lead to respiratory illnesses in people including irritated and inflamed throats, coughs, chest tightness and a worsening in asthma ⁴

• Some of the worst air quality in the San Joaquin Valley is due to large concentrations of particulate matter pollution. ⁵

• In the San Joaquin Valley, the primary sources of PM_{2.5} are car and truck emissions which makes up half of the sources, while the other half is from causes like wood smoke and dust. ⁵

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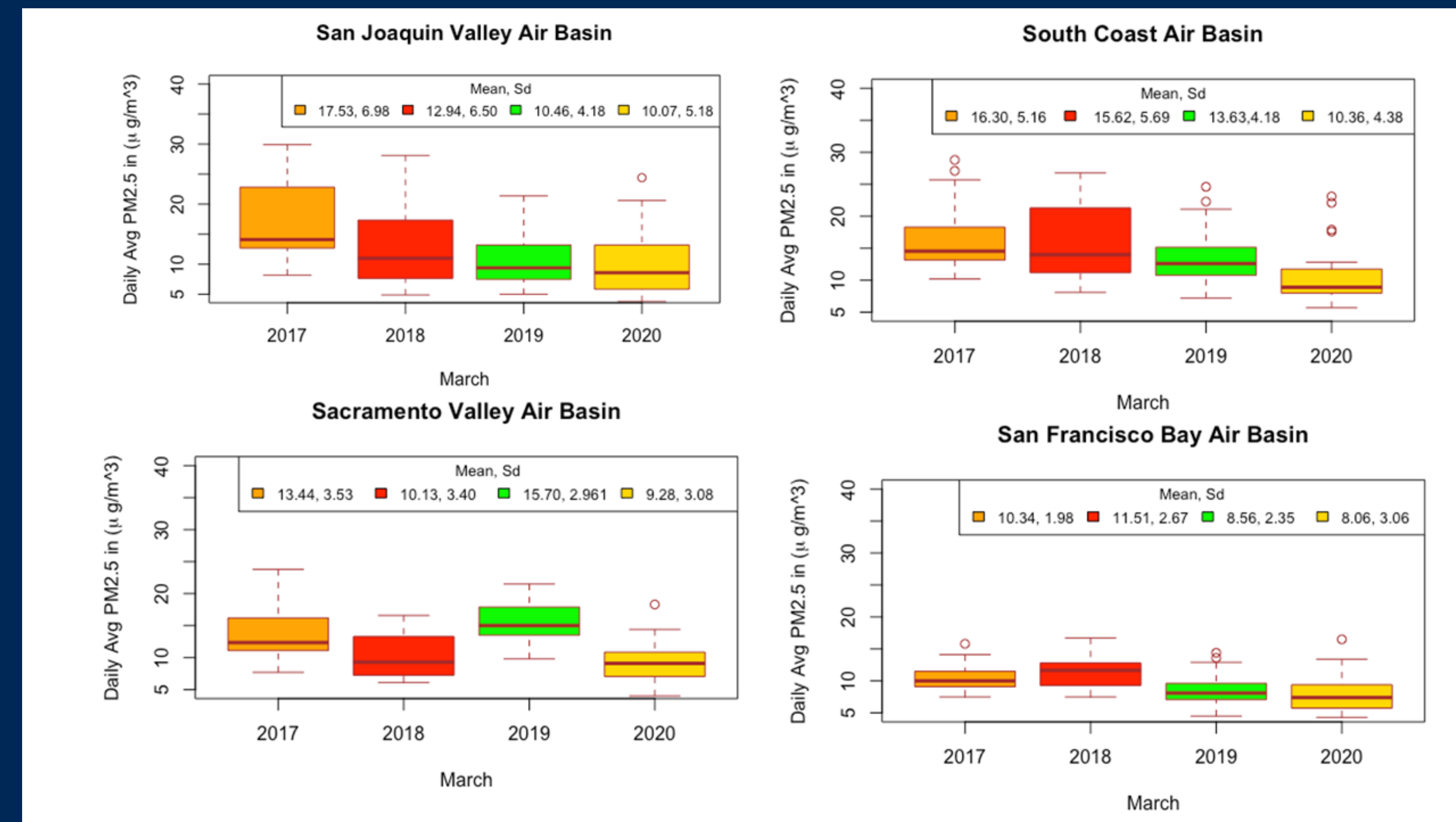


Figure 1: Boxplots depict the mean value and standard deviation of the PM_{2.5} concentrations from different cities in the month of March from years 2017-2020.

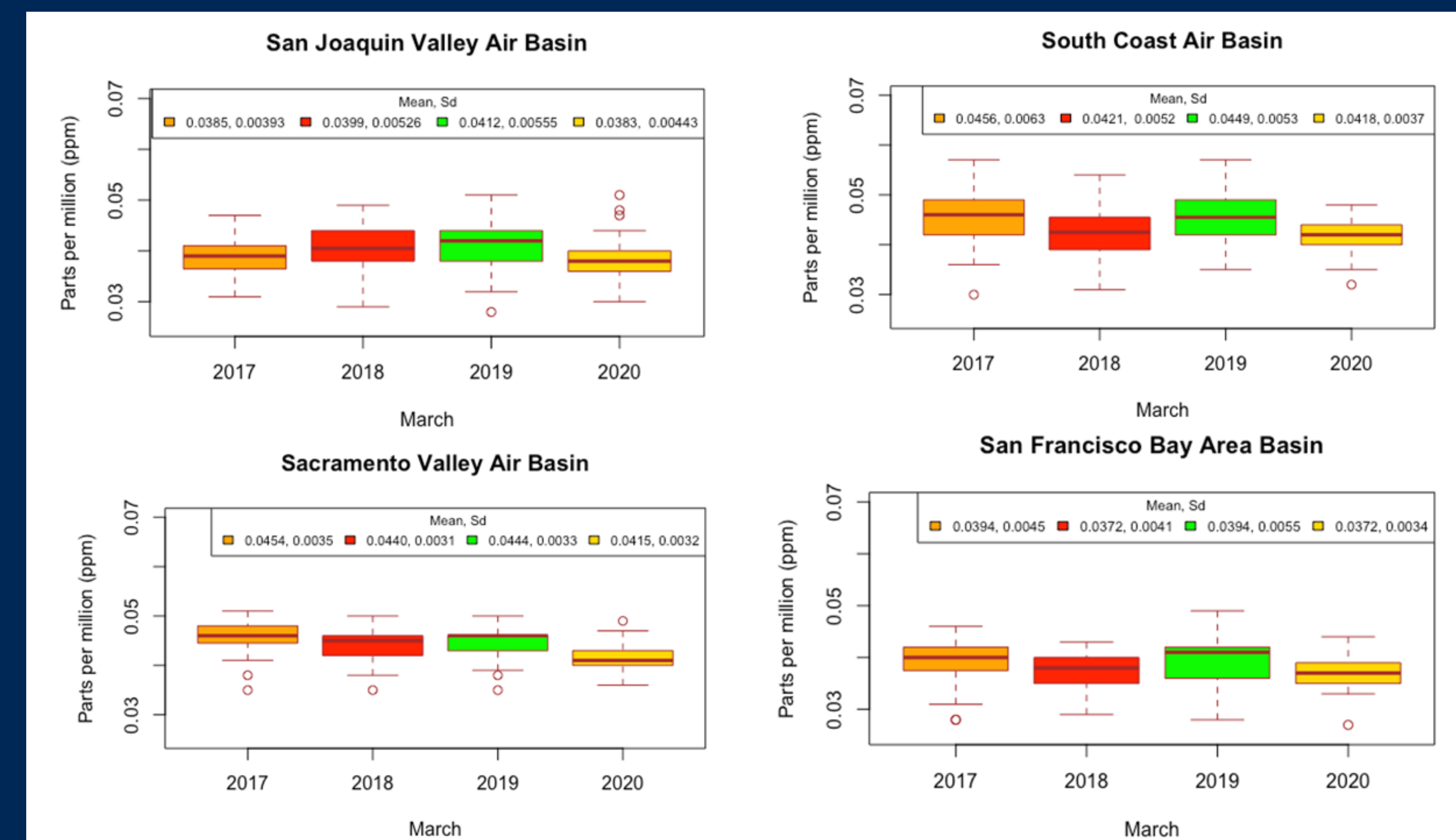


Figure 2: Boxplots depict the mean value and standard deviation of the Ground-level Ozone concentrations from different cities in the month of March from years 2017-2020.

RESULTS

- The mean concentration levels of the pollutant O₃ showed that there were statistically significant (p<0.05) changes throughout the first four months of the year in rural San Joaquin Valley from 2017-2020. However, in months May and June the mean concentrations failed to reject the null hypothesis and the means remained consistent
- There were statistically significant (p<0.05) differences in the mean concentration levels of the pollutant PM_{2.5} in the months following the stay at home orders in rural San Joaquin Valley from 2017-2020. However, the results show that the biggest difference in mean concentrations come from year 2017 and 2020.
- Ground-level ozone and PM_{2.5} concentration levels were shown to have decreased in the rural San Joaquin valley, but not as drastically as hypothesized. A reason could be that car traffic may not be the biggest polluter. On the other hand, heavy duty transportation like trucks have remained on the roads, importing goods to stores and businesses.
- Cities located in the Sacramento Valley (85% rural) Air Basin region had the greatest significant (p<0.01) PM_{2.5} changes in March and April amidst the COVID-19 lock in orders
- The response to COVID-19 shelter at home orders has led to many cars off the road, resulting in lower secondary pollutant emissions throughout the state of California.

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