

ECE 143 Group 5 Project

COVID-19 Effect on Air Pollutants in California

Group Members Name: Jesus Fausto
Ruochen Liu
Shengfan Hu
Po Huang
Lawrence Yi

Motivation and Objective

This research will find out if more covid cases or lower volume traffic will reduce the air pollution in California.

1. On March 19, 2020, stay home order started. [1]
2. With the increase of COVID-19 cases, the traffic decreased according to previous research.
3. In 2035, California will ban the selling of new pure gasoline cars. [2]

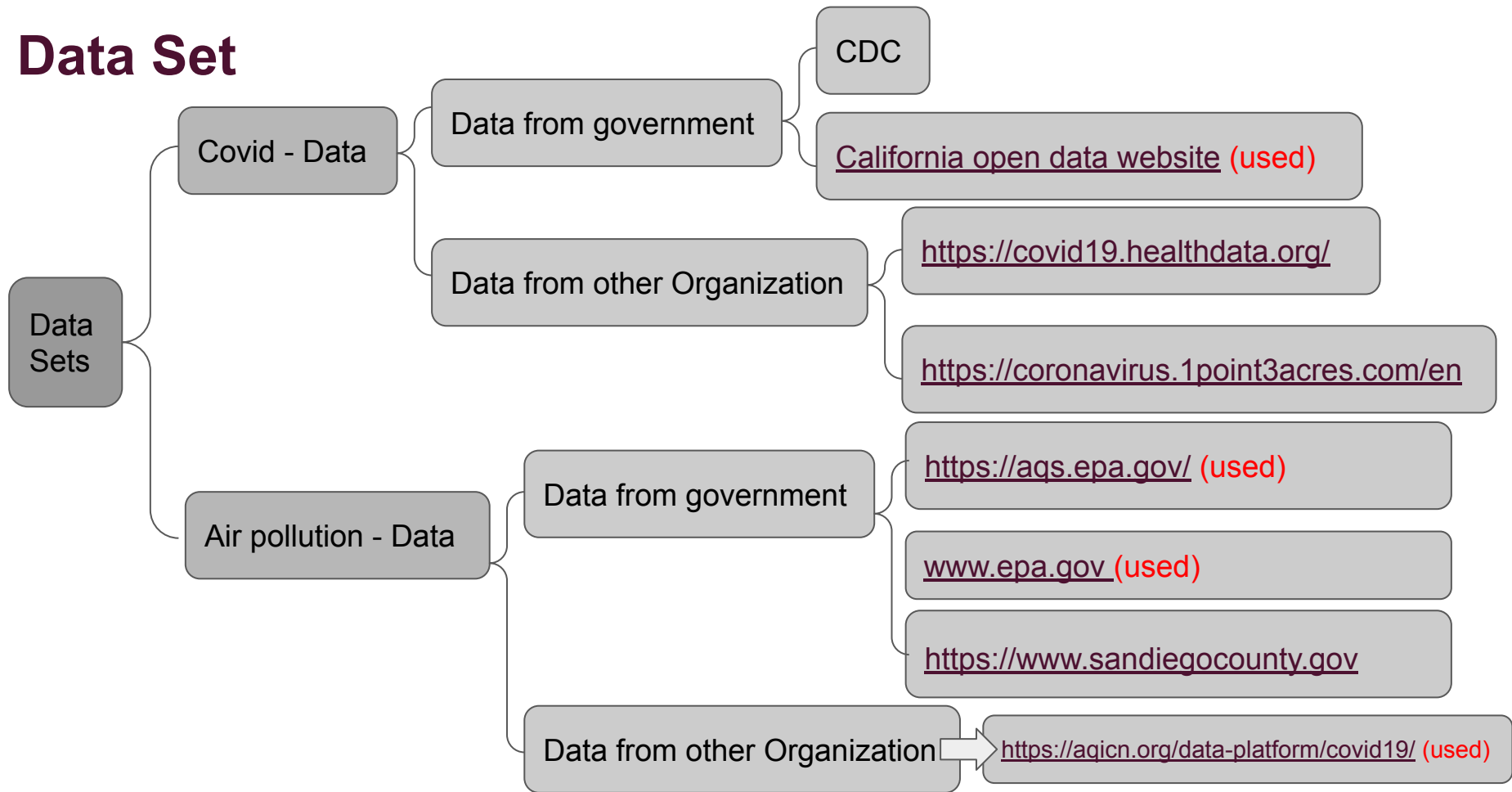
After 2035 in California...



Methodology

1. Searched and picked the available data sets.
2. Check the data and understand the unit of the data set that being used.
3. Choose the right unit to plot. If the collected data from different websites have different units we need to convert the unit.
4. Choose the graphs that we need to show our data

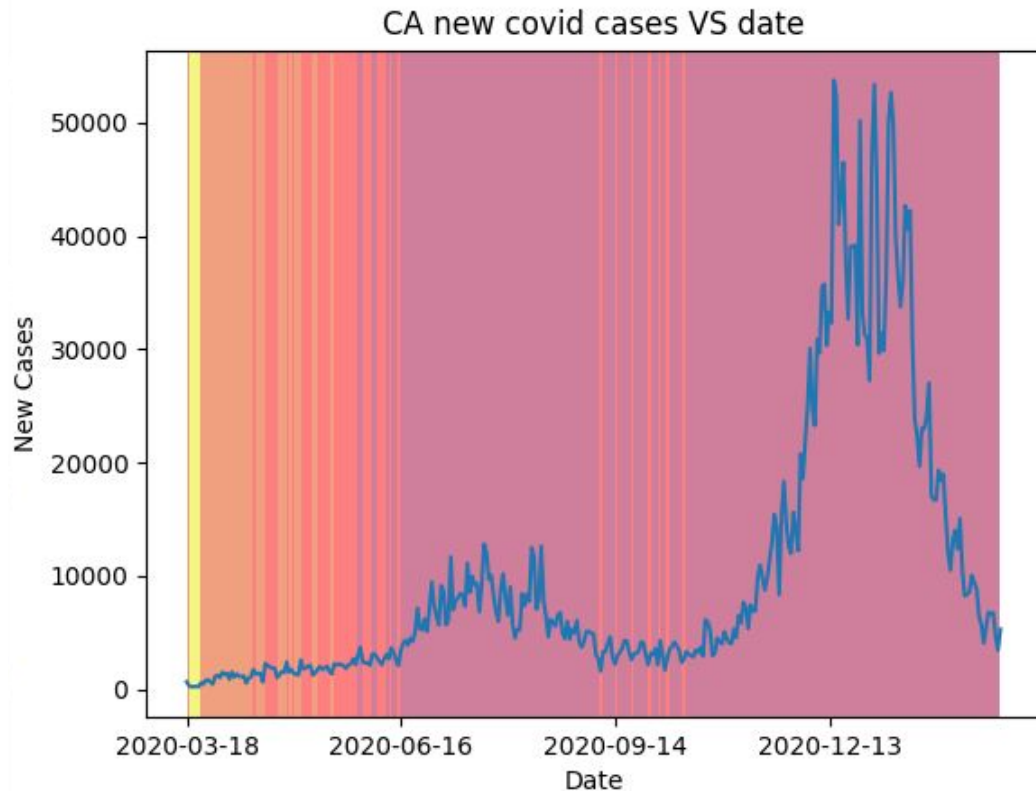
Data Set



Unit explanation & COVID cases(until 02/24/2021)

County risk level	New cases
WIDESPREAD Most schools are closed to in-person instruction, unless they meet certain conditions	More than 7 daily new cases (per 100k)
SUBSTANTIAL Schools can reopen for in-person instruction after they have remained in the red tier for 14 days	4 - 7 daily new cases (per 100k)
MODERATE Schools can reopen for in-person instruction based on state and county guidance	1 - 3.9 daily new cases (per 100k)
MINIMAL Schools can reopen for in-person instruction based on state and county guidance	Less than 1 daily new cases (per 100k)

[3]



Unit explanation & air pollutants

PPM and PPB

Percent = parts / 10^2

ppm - parts per million

ppm = parts / 10^6

ppb - parts per billion

ppb = parts / 10^9

1 ppb = 1000 ppm

AQI - Air Quality Index

AQI Level	Numerical Value	Ozone	PM2.5	Carbon Monoxide
Good	0-50	0-59 ppb	0-15.4 $\mu\text{g}/\text{m}^3$	0-4.4 ppm
Moderate	51-100	60-75 ppb	15.5-35.4 $\mu\text{g}/\text{m}^3$	4.5-9.4 ppm
Unhealthy for Sensitive Groups	101-150	76-95 ppb	35.5-65.4 $\mu\text{g}/\text{m}^3$	9.5-12.4 ppm
Unhealthy	151-200	96-115 ppb	65.5-150.5 $\mu\text{g}/\text{m}^3$	12.5-15.4 ppm
Very Unhealthy	201-300	116-375 ppb	150.5-250.4 $\mu\text{g}/\text{m}^3$	15.5-30.4 ppm
Hazardous	>300	>375 ppb	>250.5 $\mu\text{g}/\text{m}^3$	>30.5 ppm

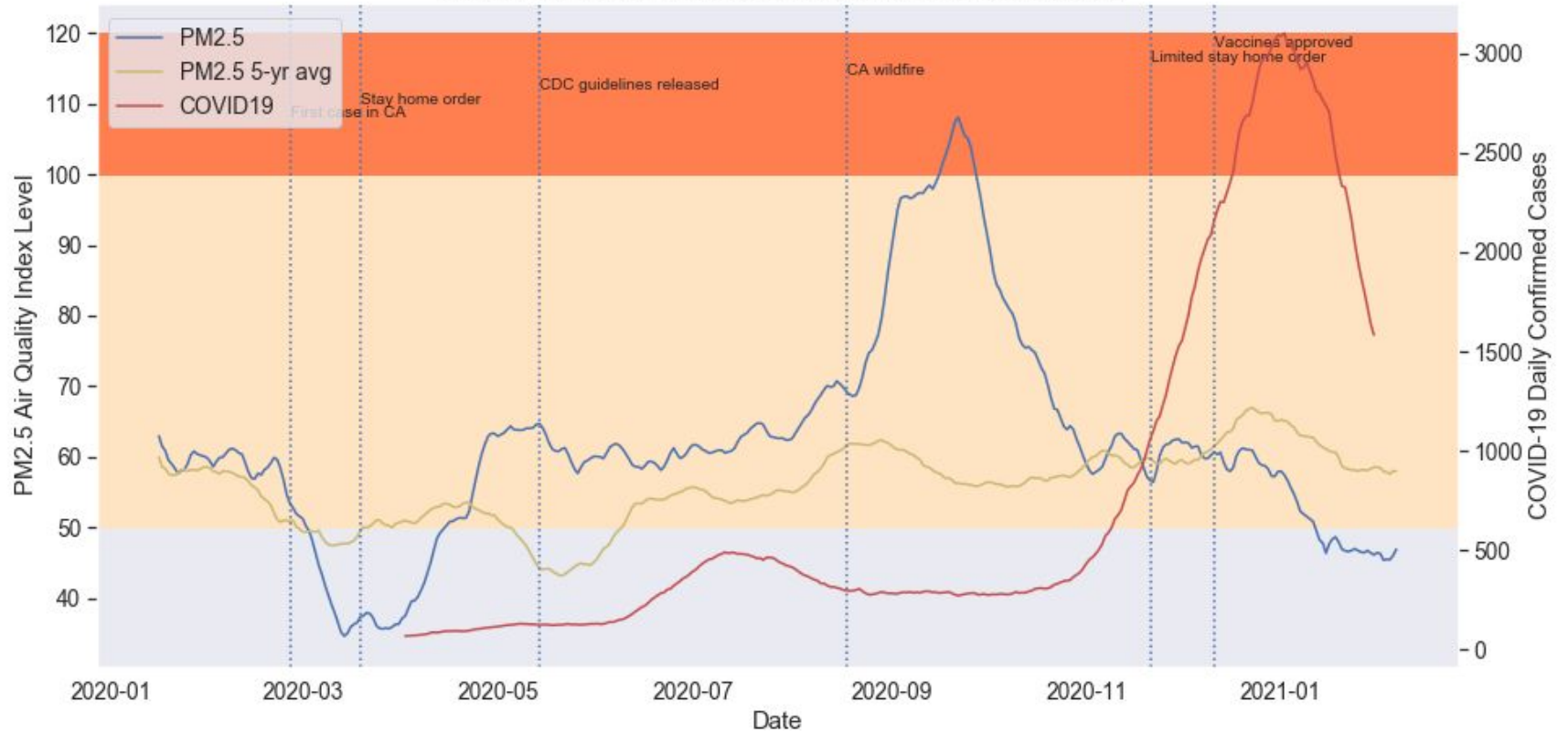
AQI Concentration Ranges **[4]**

For example, if we know today's Ozone AQI in La Jolla is 46.

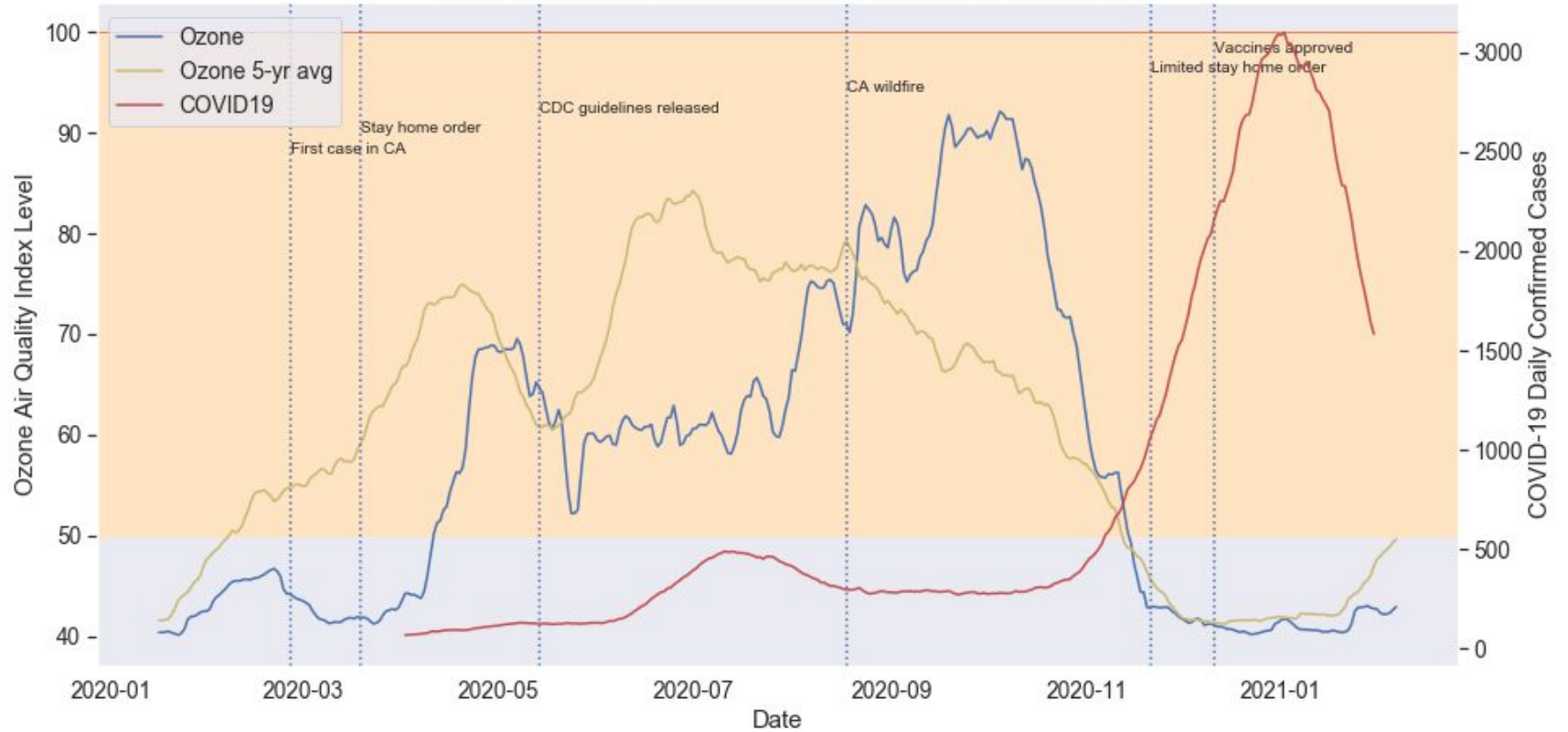
We can calculate that Ozone value in numerical is 54.2 ppb.

There will be 54.2g of Ozone in 10^9g of air in La Jolla.

San Diego PM2.5 vs COVID19 Cases 30-Day Moving Average

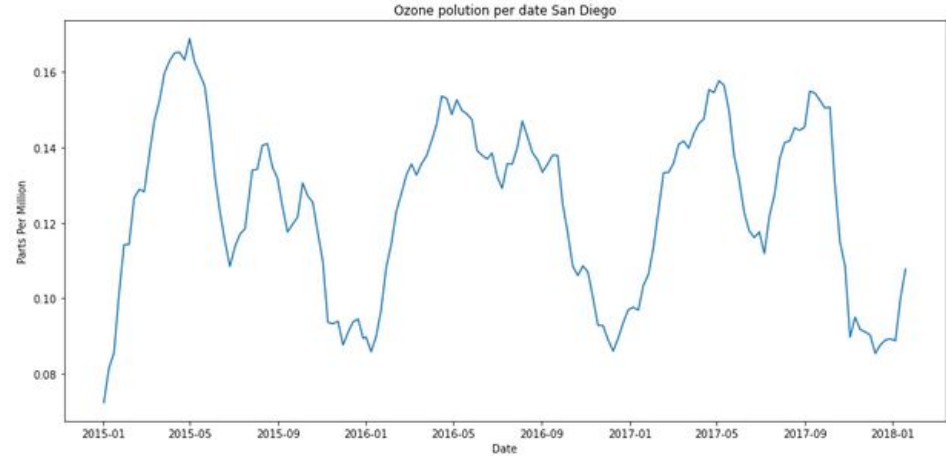


San Diego Ozone vs COVID19 Cases 30-Day Moving Average

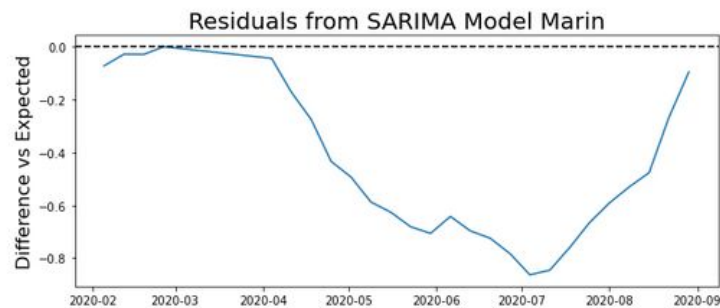
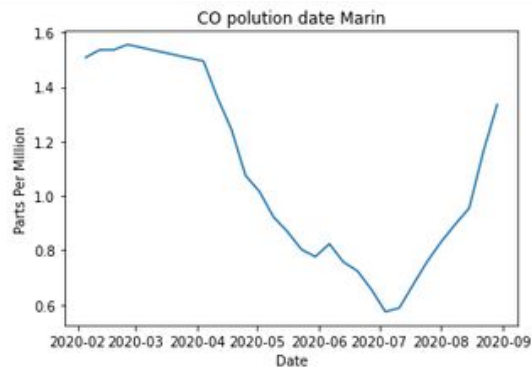
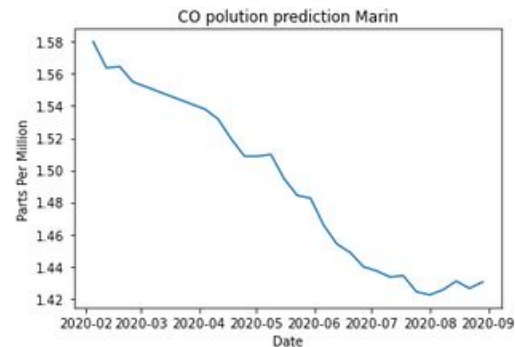
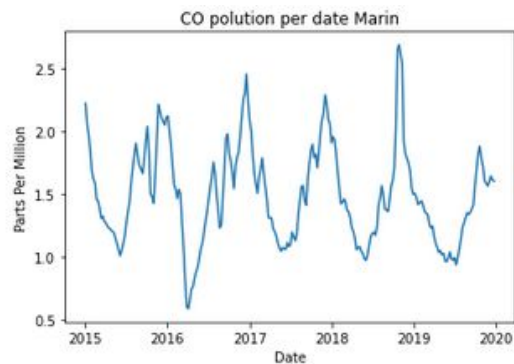


Predictive model analysis

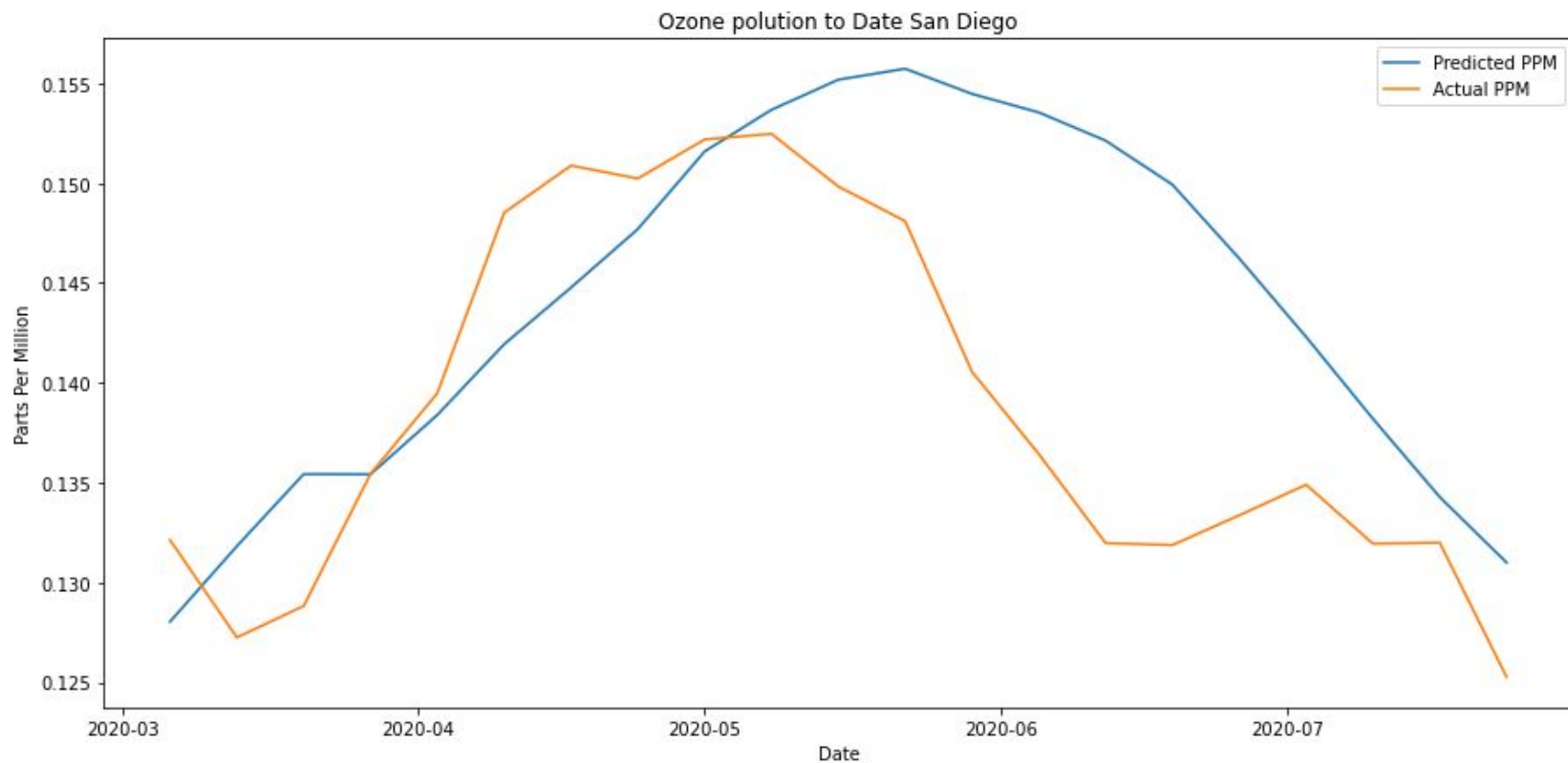
- Pre-Model Filtering
 - Extract data from EPA website
 - Filter data for counties in California
 - Take 7 day rolling average
 - Take 1 sample a week
- SARIMAX:
 - ARIMAX: predictive model using built in expression
 - S: takes into account seasonal component



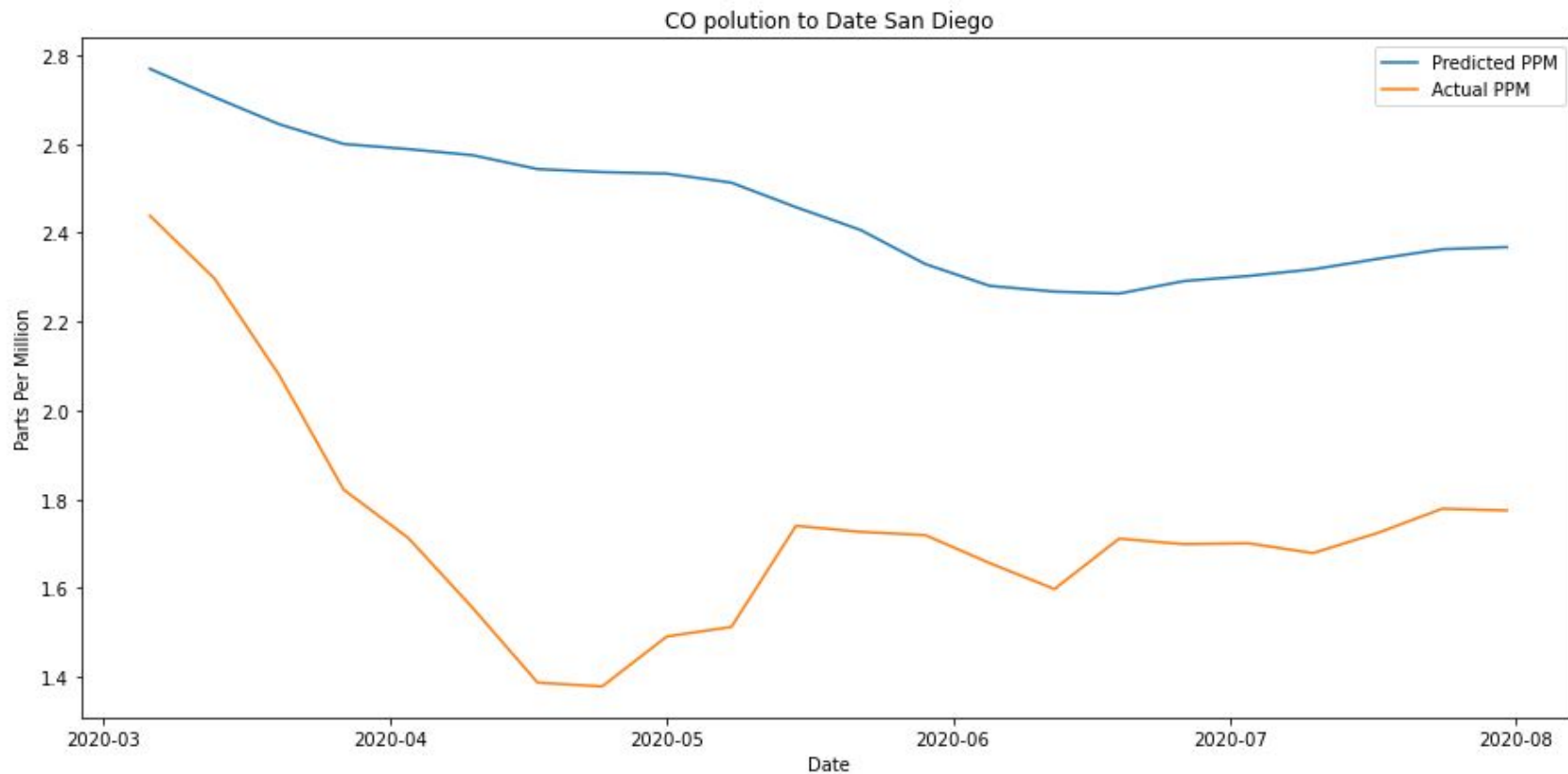
Marin Model Carbon Monoxide



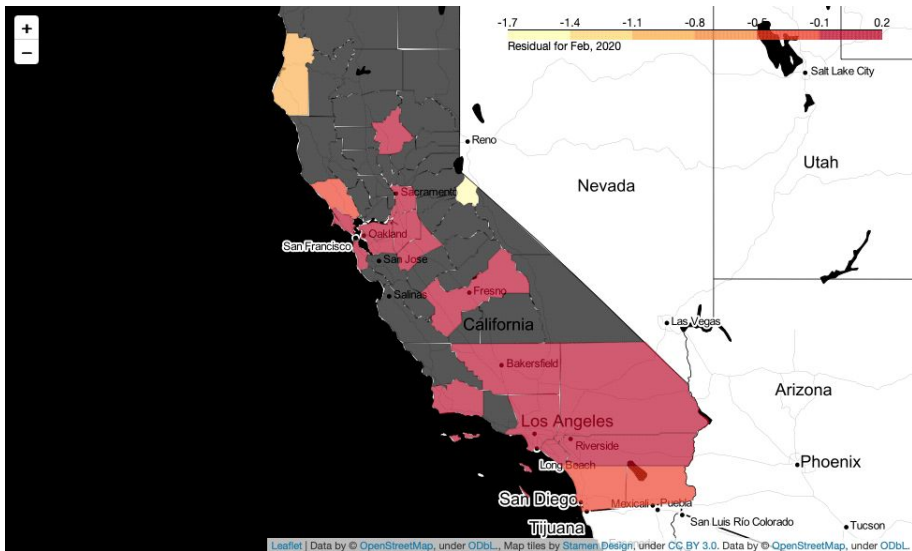
San Diego Ozone Model



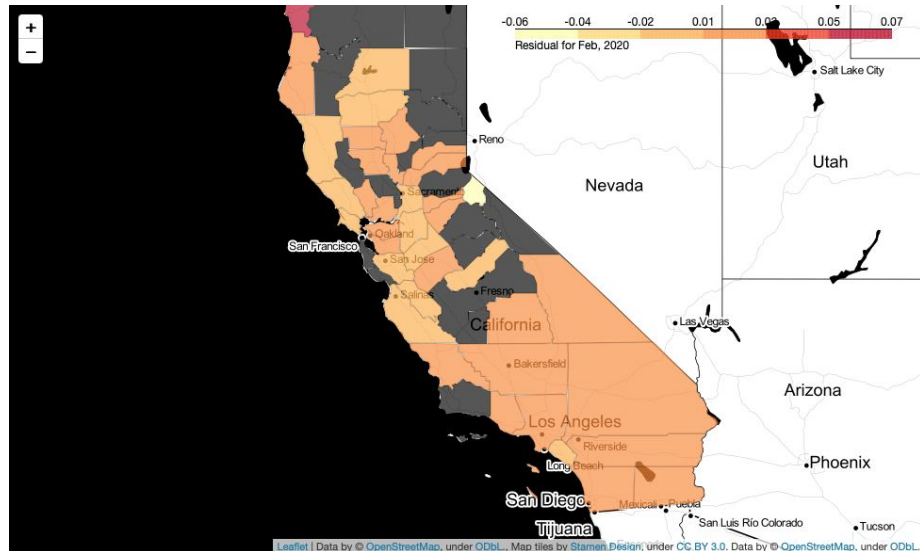
San Diego CO Model



Choropleth Map of Difference between Actual and Predicted PPM

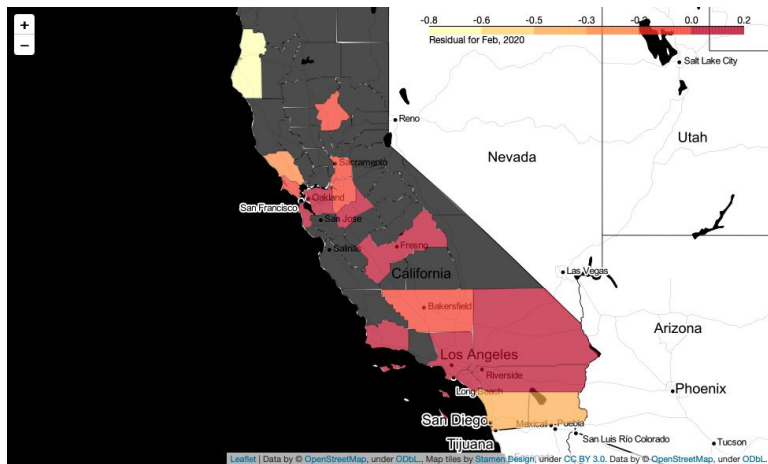


CO

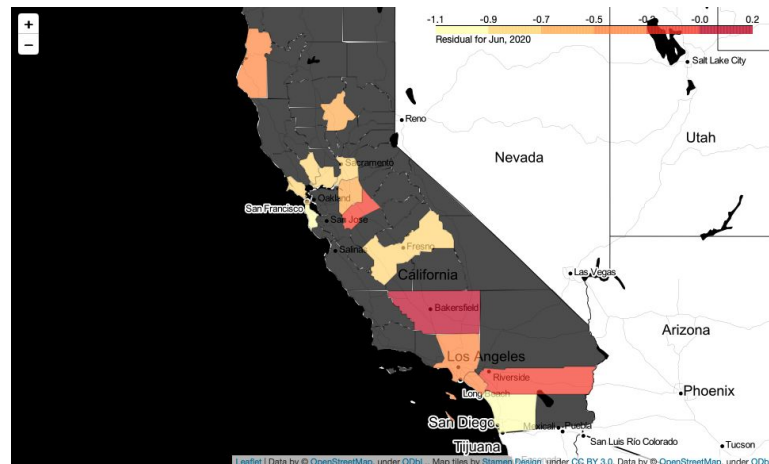


Ozone

- From February to June, 2020
- Positive error (darker red) indicates more pollution than predicted, and vice versa.
- Missing data for gray areas.

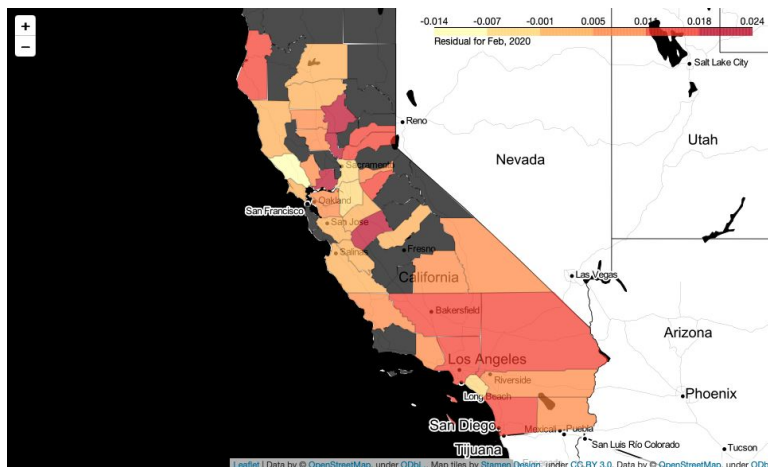


CO

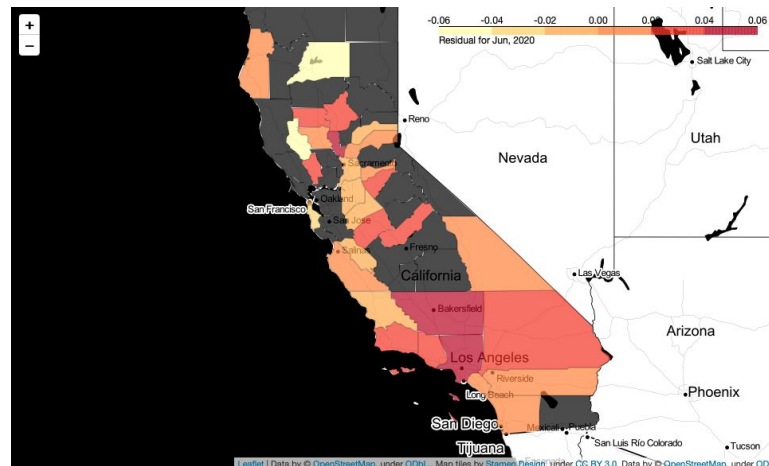


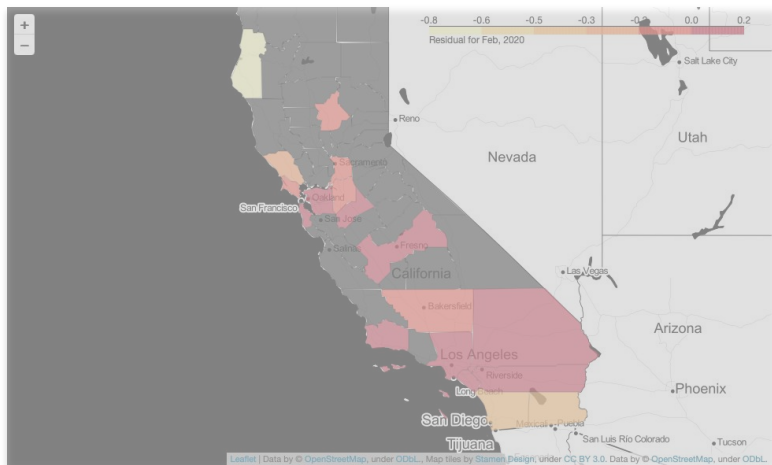
Feb, 2020

Jun, 2020

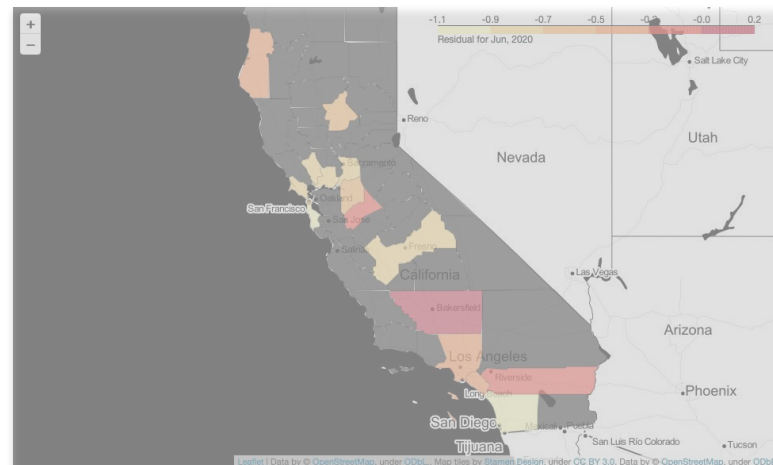


Ozone



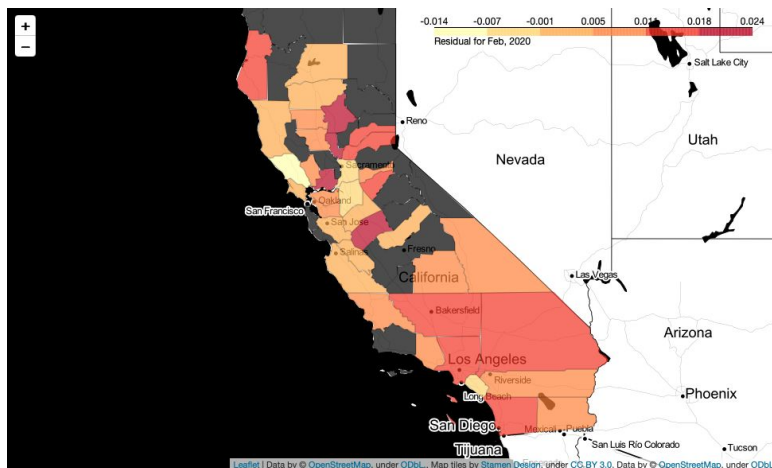


CO

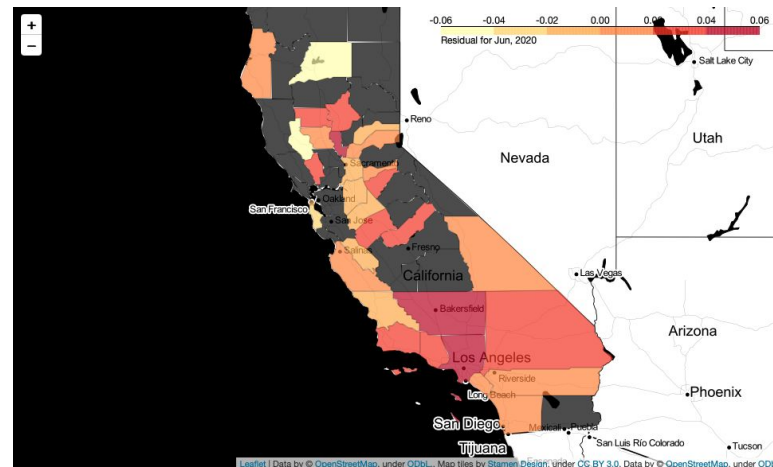


Feb, 2020

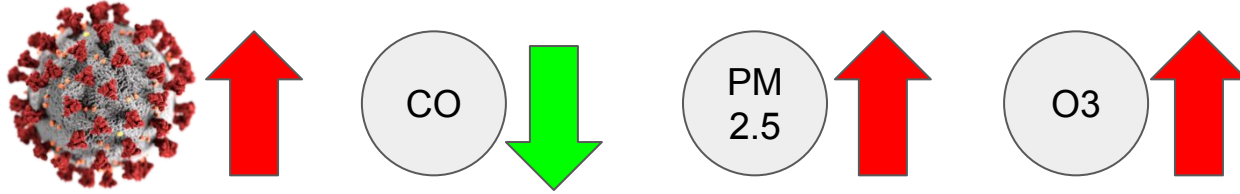
Jun, 2020



Ozone



Conclusion



We speculate:

CO - less traffic (less gasoline cars can help to protect the environment)

O3 - radiation could be the major factor / warm, dry weather is more conducive to ozone formation (wildfires, California weather)

PM2.5 - result of California wildfires

In Conclusion:

We observed less CO as COVID-19 increases, which is directly linked to emissions from traffic. There is an increase of other air pollutants, as there are other factors that are impacting air pollutant levels and therefore more data and more research is needed.

Reference

[1]

<https://covid19.ca.gov/stay-home-except-for-essential-needs/>

[2]

<https://www.gov.ca.gov/2020/09/23/governor-newsom-announces-california-will-phase-out-gasoline-powered-cars-drastically-reduce-demand-for-fossil-fuel-in-californias-fight-against-climate-change/#:~:text=Following%20the%20order%2C%20the%20California,percent%20improvement%20in%20oxides%20of>

<https://www.sandiegouniontribune.com/business/story/2020-12-11/california-has-banned-the-sale-of-new-gasoline-powered-vehicles-by-2035-can-it-get-there>

[3]

<https://covid19.ca.gov/safer-economy/>

[4]

<https://www.miamidade.gov/environment/library/reports/epa-air-quality-index.pdf>

<https://www.airnow.gov/aqi/aqi-calculator/>