Covid-19 Effects on Air Quality

An analysis of how Covid-19 shelter-in-place procedures impacted the air quality in selected cities around the world

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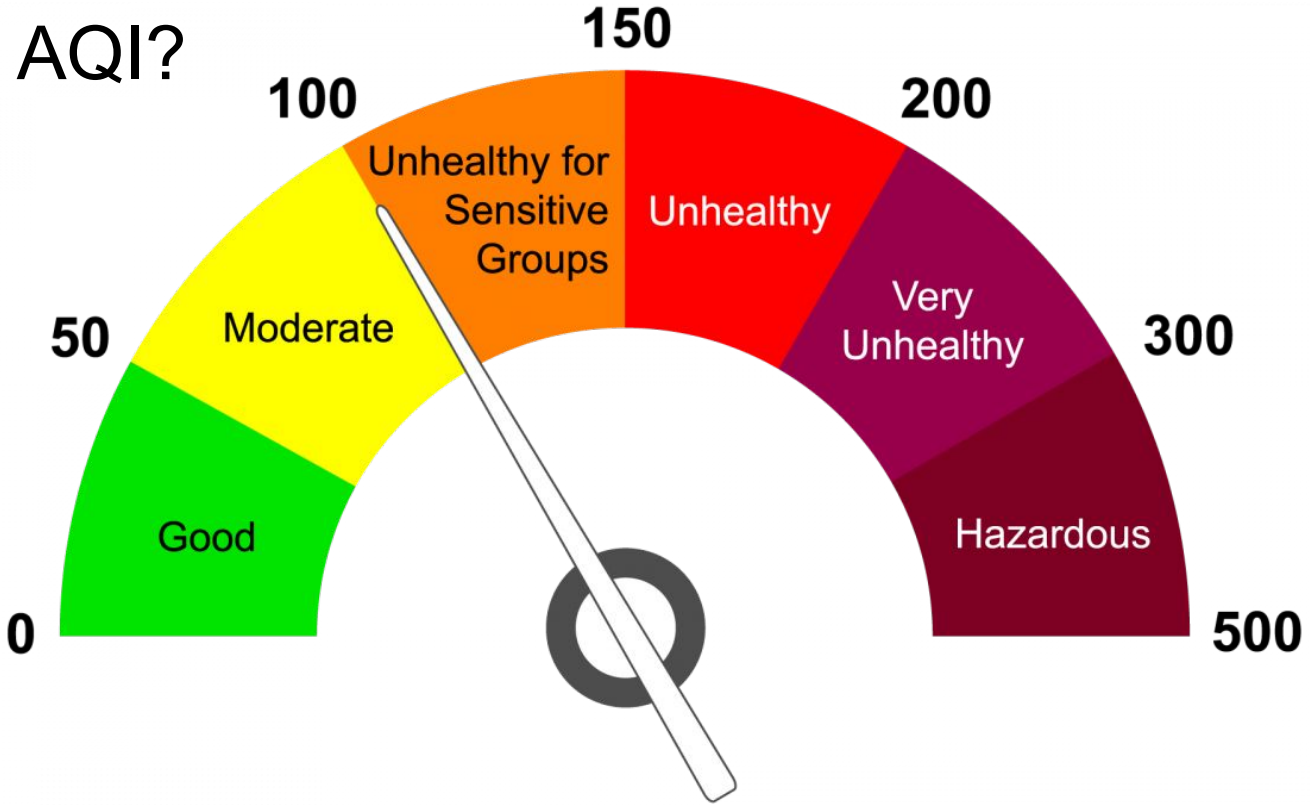
New Delhi, India - before and during lockdown

What is AQI?



<u>One scale for each of 5 pollutants:</u>

PM2.5, **Ground-level ozone (O3)**, carbon monoxide, sulfur dioxide, nitrogen dioxide

First step - getting the data

1. Downloaded CSV files
2. Selected Years
3. Cleaned Data
4. Merged Years
5. Output 2 workable CSVs

Air Quality Open Data Platform's logo:

Research Questions

1. What is the best way to measure air quality and how it changed during COVID-19 lockdowns?
2. Which of the cities examined show the largest and least reduction in PM2.5 during COVID-19 lockdown dates?
3. Looking at different types of pollutants (PM2.5 vs. O3) -- are the patterns consistent, or not, for each city?
4. Were there any other major events or factors that influenced air quality during the time period studied?

1. What is best way to measure air quality?

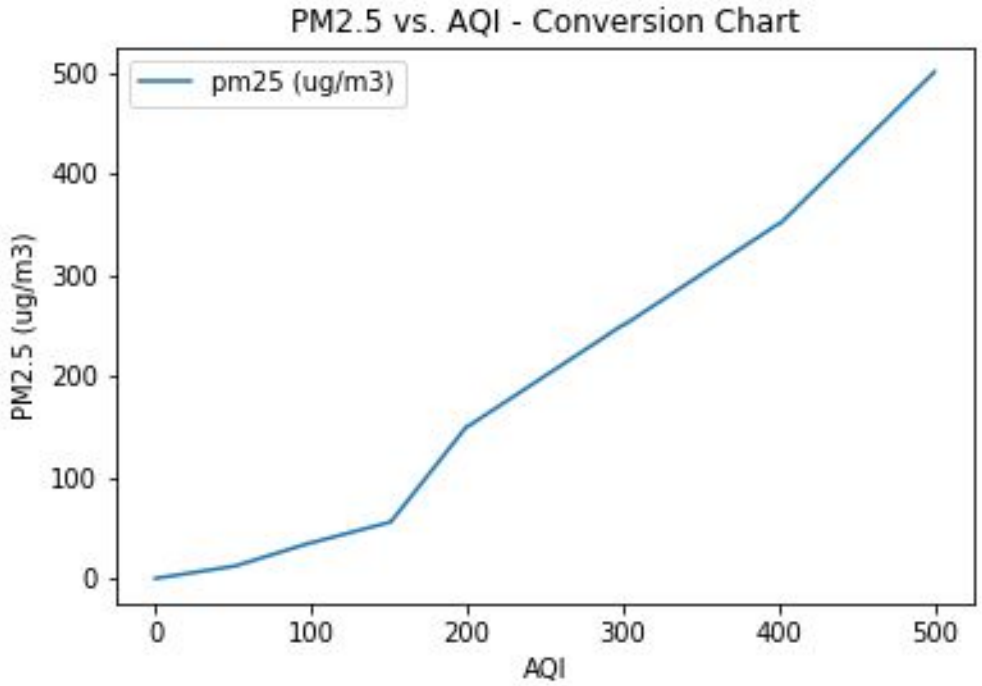
- Air Quality Open Data Platform: World Air Quality Index Project
- **Pivot!** AQI not linear; adjusted data to indicate *measurement* as opposed to the *index*
- Year-over-year data going back to 2017
- 8 cities

1. What is best way to measure air quality?

AQI 50: 12 ug/m3

AQI 100: 35.4 ug/m3

AQI 200: 150.4 ug/m3



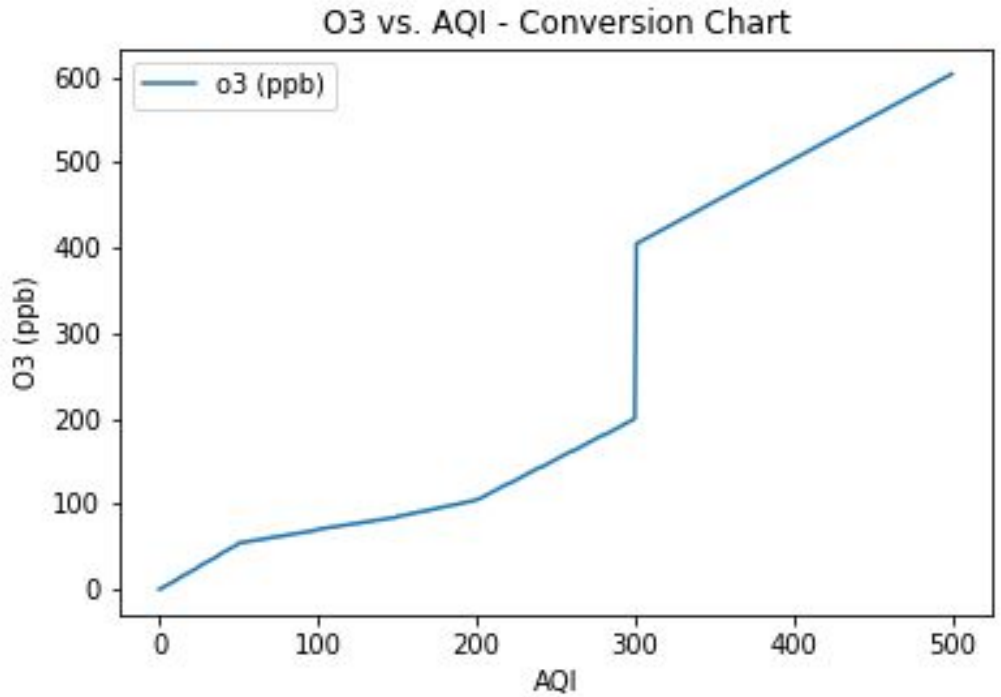
Converting Indices to measurable data

Measuring contaminants - conversion of O3

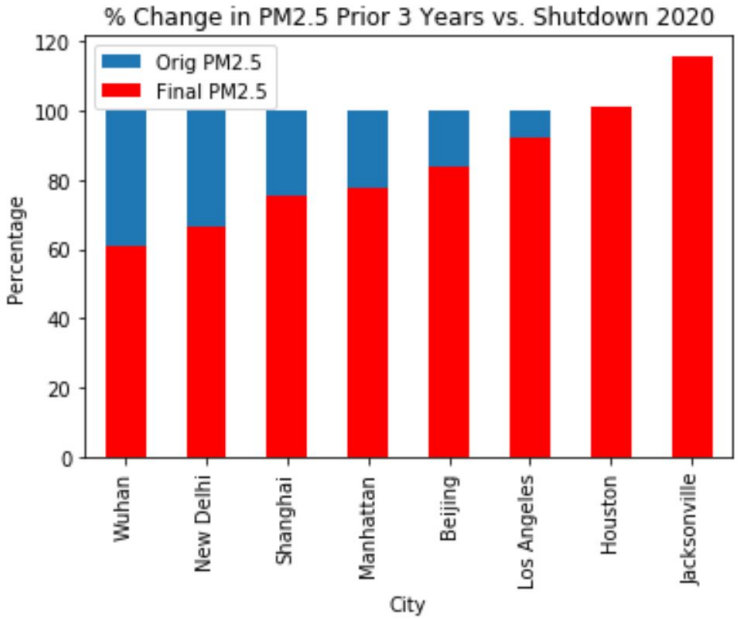
AQI 50: 54 ppb

AQI 100: 70 ppb

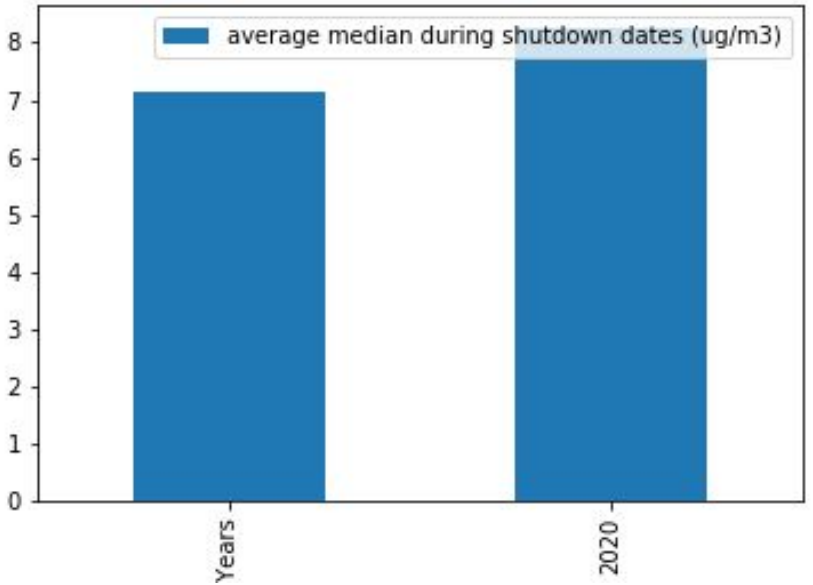
AQI 200: 105 ppb



2. Which cities examined show the largest and least reduction in PM2.5 during COVID-19 lockdown?



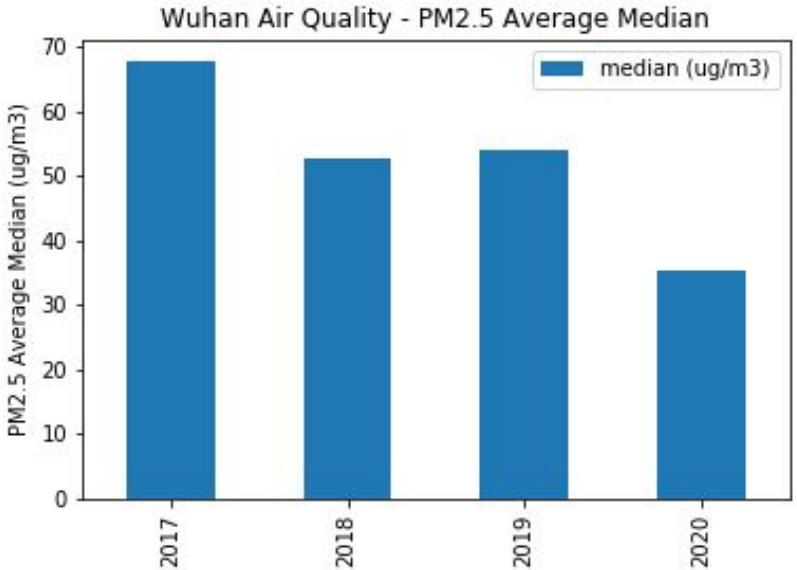
Jacksonville

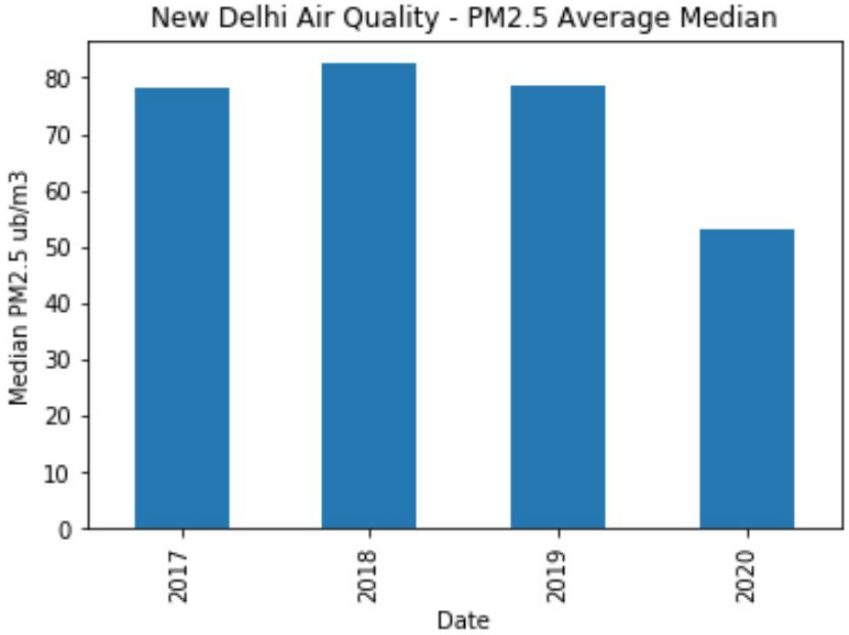


Lockdown dates by City:

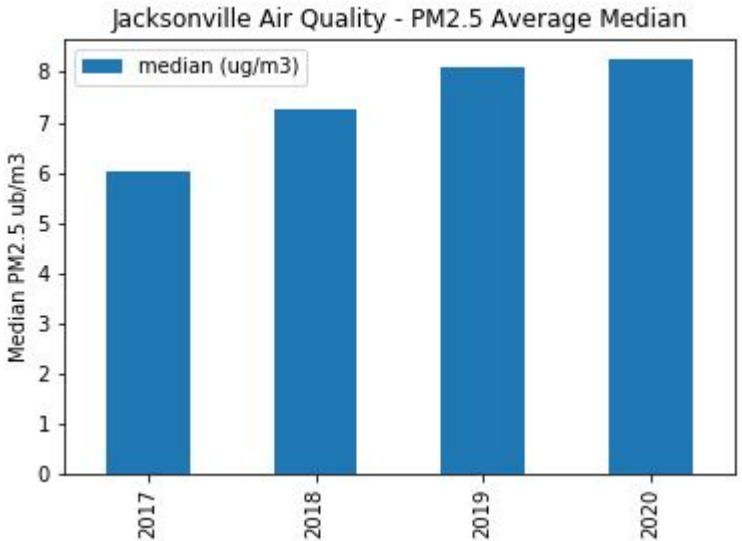
City	Start Date	End Date
New Delhi	March 24	May 3
Houston	March 19	April 16
Los Angeles	March 19	May 8
Jacksonville	April 1	May 18
Manhattan	May 12	June 8
Beiling	Jan 26	April 8
Shanghai	Feb 10	April 8
Wuhan	Jan 23	April 8

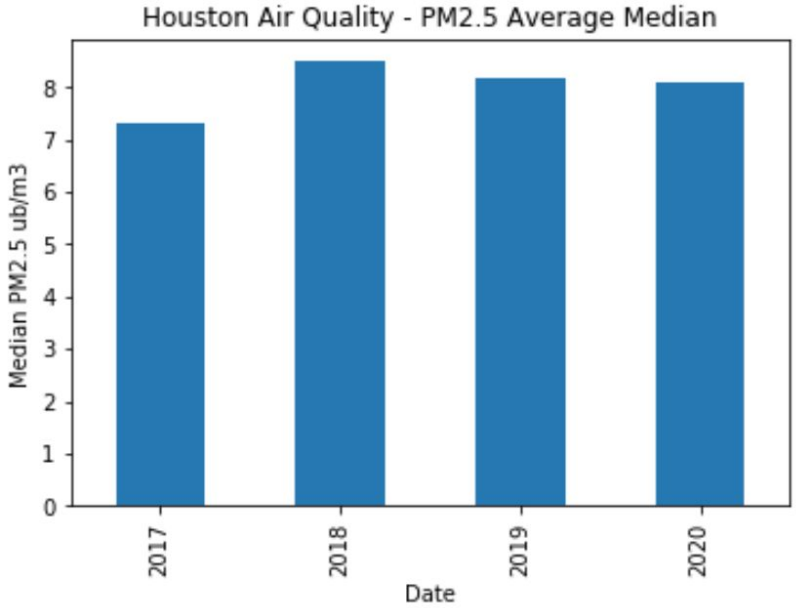
Cities with greatest reduction: Wuhan, New Delhi





Cities with least reduction: Houston, Jacksonville





3. Looking at different types of pollutants (PM2.5 vs. O3) -- are the patterns consistent for each city?

Answer: We were surprised with what we found!

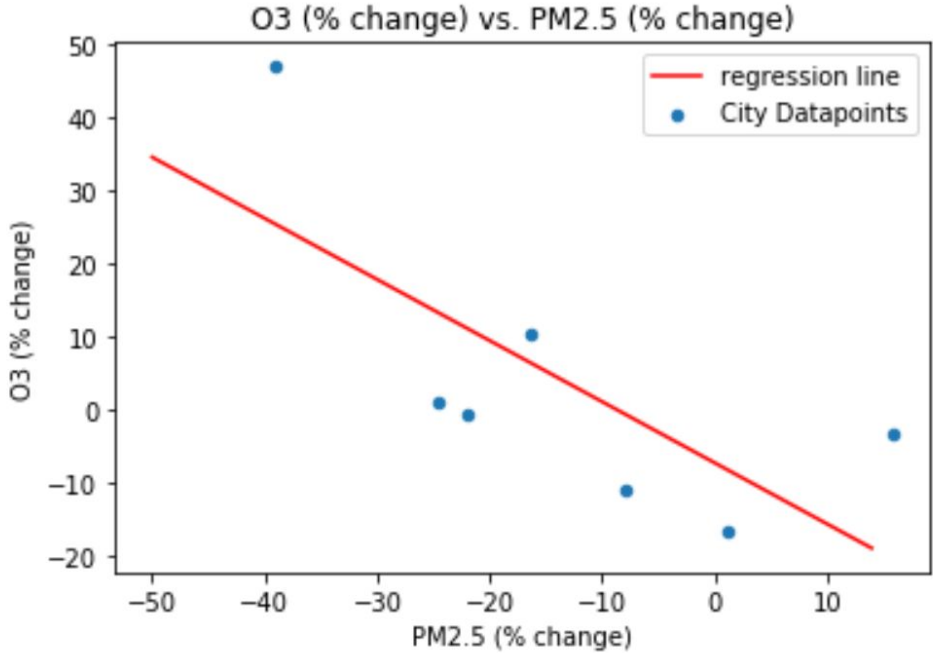
In Wuhan, O3 readings actually **INCREASED** by 47%!

Why?

Inverse correlation:

r = -0.72

slope = -0.84

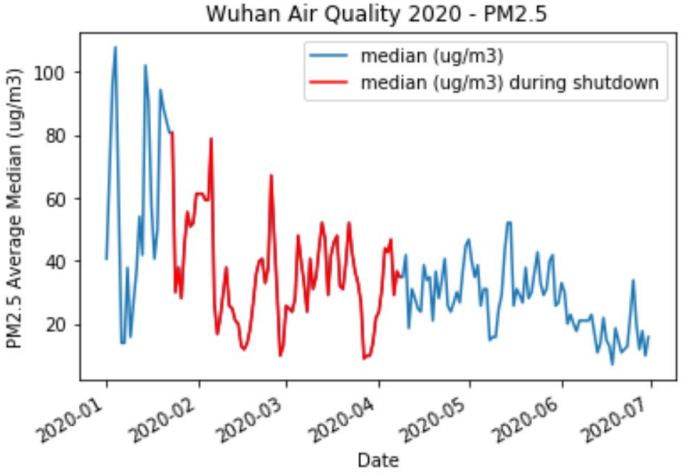


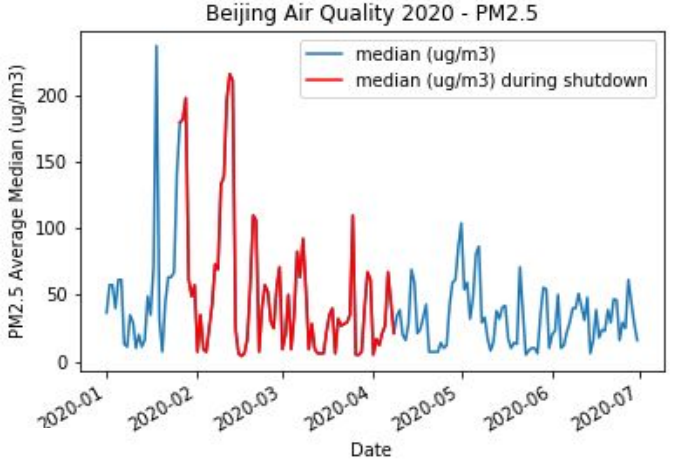
O3 is a ***secondary pollutant*** caused by sunlight reacting with primary pollutants
Therefore, it is inversely related to decrease in PM2.5

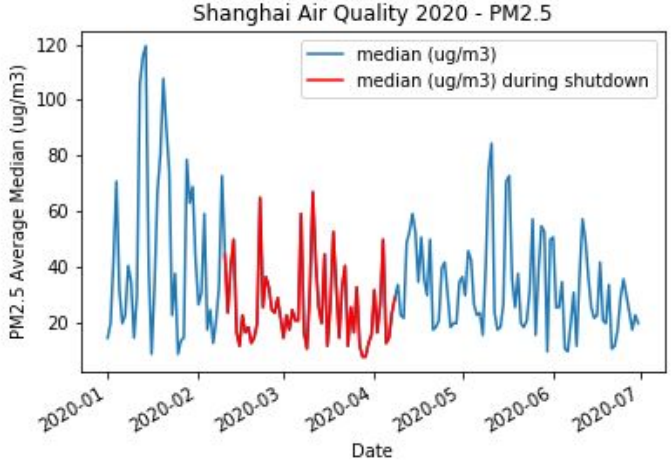
4. Were there any other major events or factors that influenced AQI during the time period studied?

- Reopening dates
- Black Swan events
- People ignoring shutdown or not
- weather (rain, wind)
- Seasonal (winter and summer, especially)

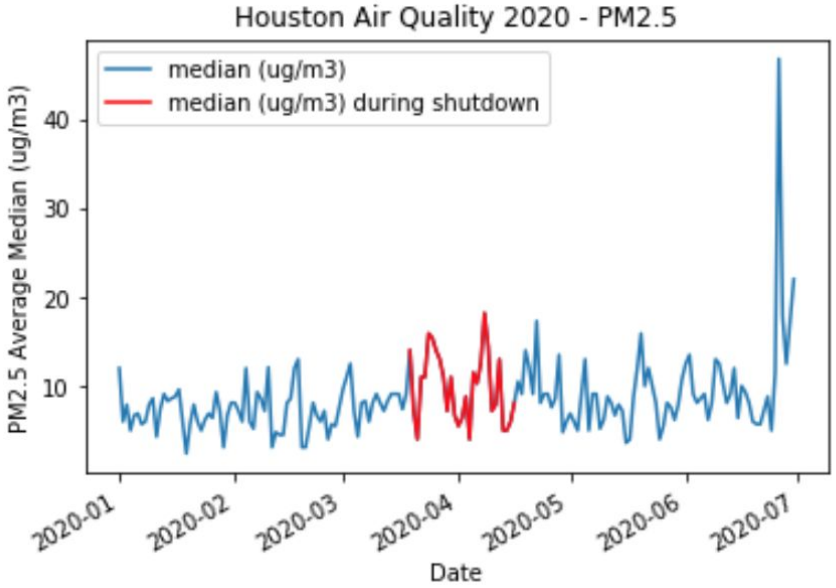
Chinese Cities Show Seasonal Pollution

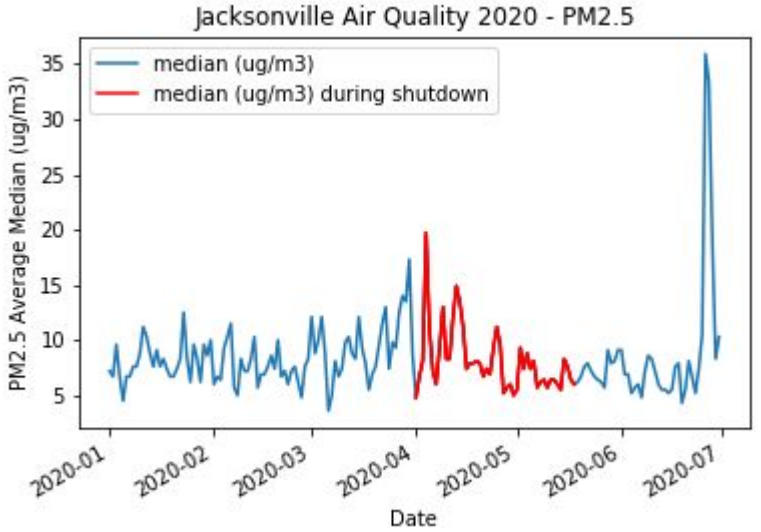




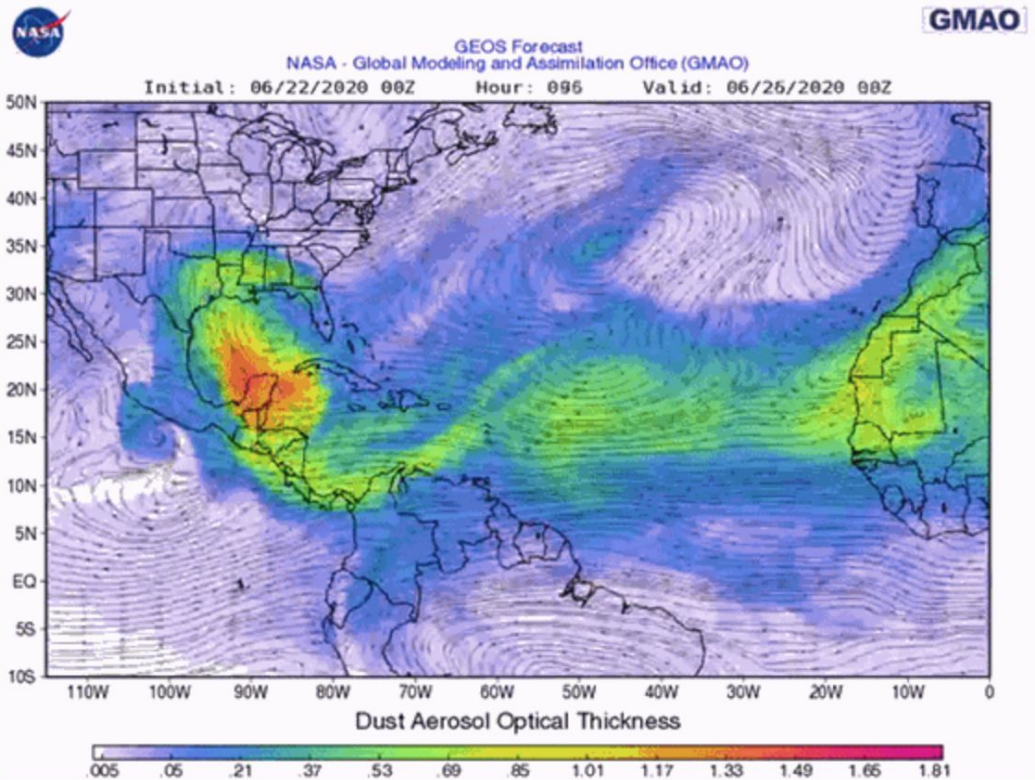


Houston, Jacksonville PM2.5 - Jan.-June 2020





Sahara Dust Cloud - June 26, 2020



Insights and Observations

1. AQI is not a linearly related to measurements
2. Data suggests that cities major lock down had more reduction of PM2.5, and cities with less strict lockdown had no change or even increases
3. The correlation of PM2.5 vs O3 is inverse -- more sun actually increases O3 production because it is a secondary pollutant
4. Other important factors included the Saharan Dust Storm which reached both Houston and Jacksonville, spiking their PM2.5 levels

Next steps: We noticed a definite correlation between weather and pollution, which could represent a next step in the analysis