

COVID-19 AND AIR QUALITY IN NEW YORK STATE

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EES097

INTRODUCTION

- New York reported their first case of COVID-19 on March 1, 2020
 - By the end of the month, NY would be reporting over 80,000 cases, making it the new epicenter of the pandemic and overwhelming hospitals
 - A statewide Stay-at-Home order was enacted March 20, 2020 and lasting until June 8, 2020
- Research Questions
 - How did air composition change in New York as a result of COVID-19 Lockdown?
 - Which factors influence the significance of change?
 - Is there a relationship between long-term pollutant exposure and COVID outcomes?

DATA COLLECTION

Phase One

RETRIEVING DATA MAPS

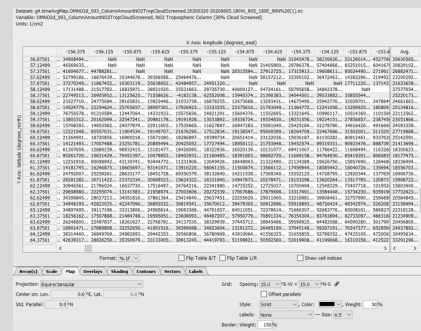
- Giovanni - web app used to create visualizations for different measurements



Phase Two

EXTRACTING DATA

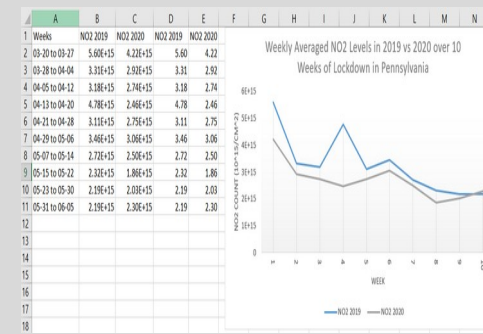
- Panoply - software used to extract column counts from Giovanni downloads



Phase Three

COMPILING AND ANALYZING DATA

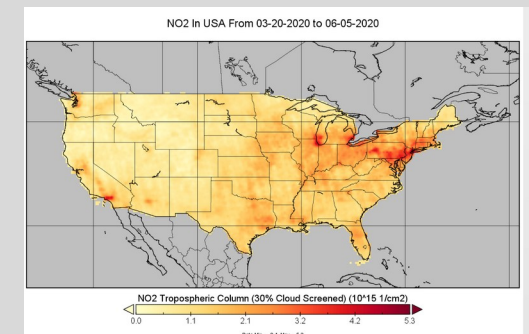
- Excel - creating graphs and charts



Phase Four

REFINING VISUALIZATIONS

- Panoply
- Google Earth Pro

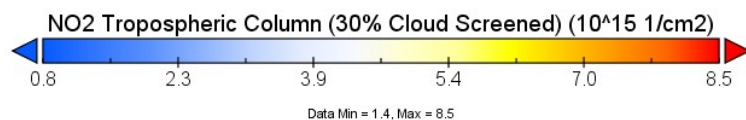
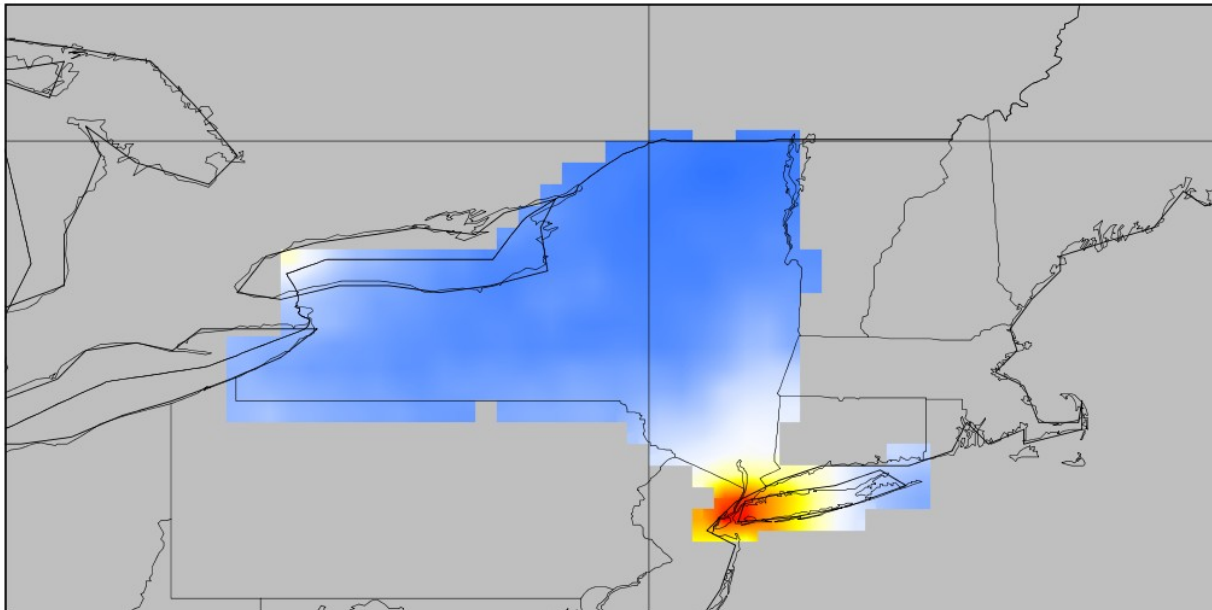


VARIABLES + LIMITATIONS

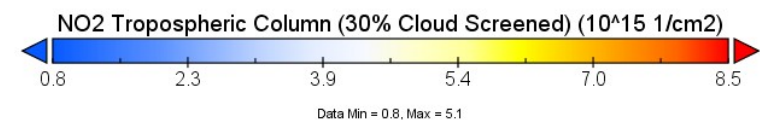
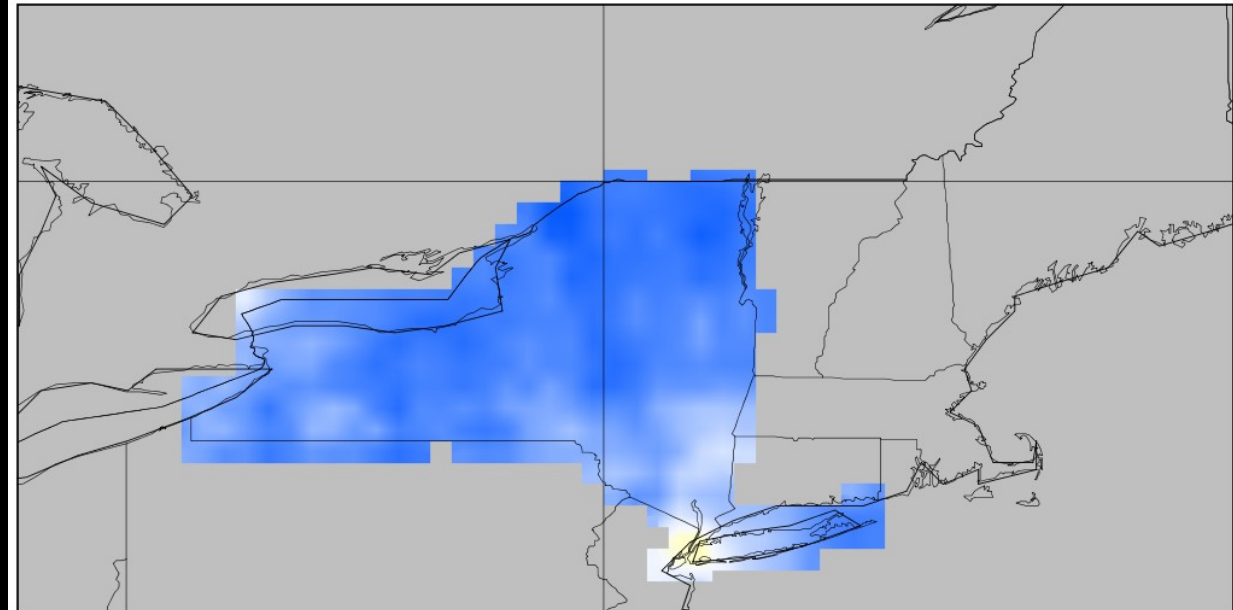
- Nitrogen Dioxide (NO₂) – irritating pollutant mainly released via combustion of fossil fuels
 - OMNO₂d dataset used to obtain tropospheric NO₂ counts
 - Prolonged exposure to high concentrations of NO₂ can increase susceptibility to respiratory infections (EPA)
- Coordinates vary by county
- Satellite data is best for *estimating* tropospheric pollution
 - Ground readings more accurate

STATEWIDE NO2 TRENDS IN NEW YORK

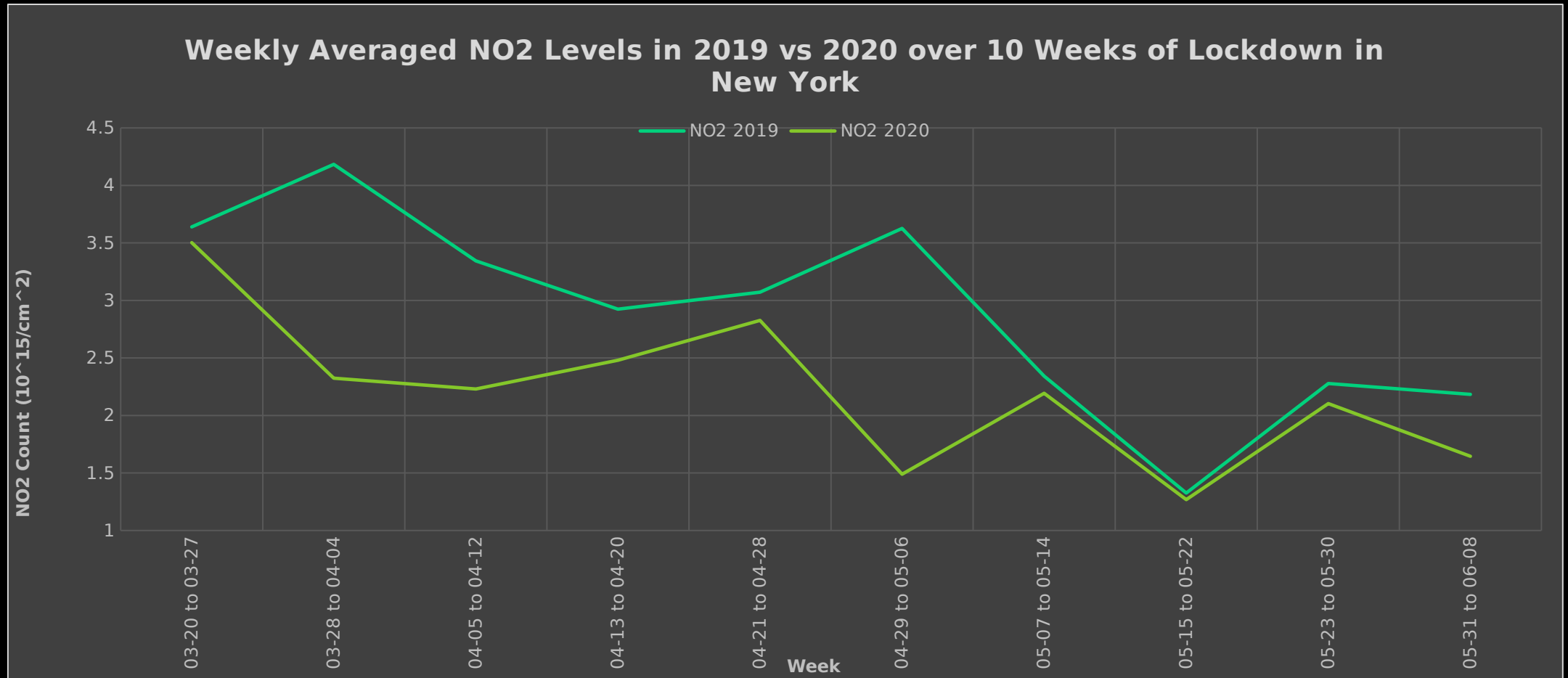
New York Tropospheric NO2 Column Averaged Over 5 Years
01-01-2015 to 01-01-2020



Average Tropospheric NO2 Levels over New York "Stay-at-Home" Order
03-08-2020 to 06-08-2020



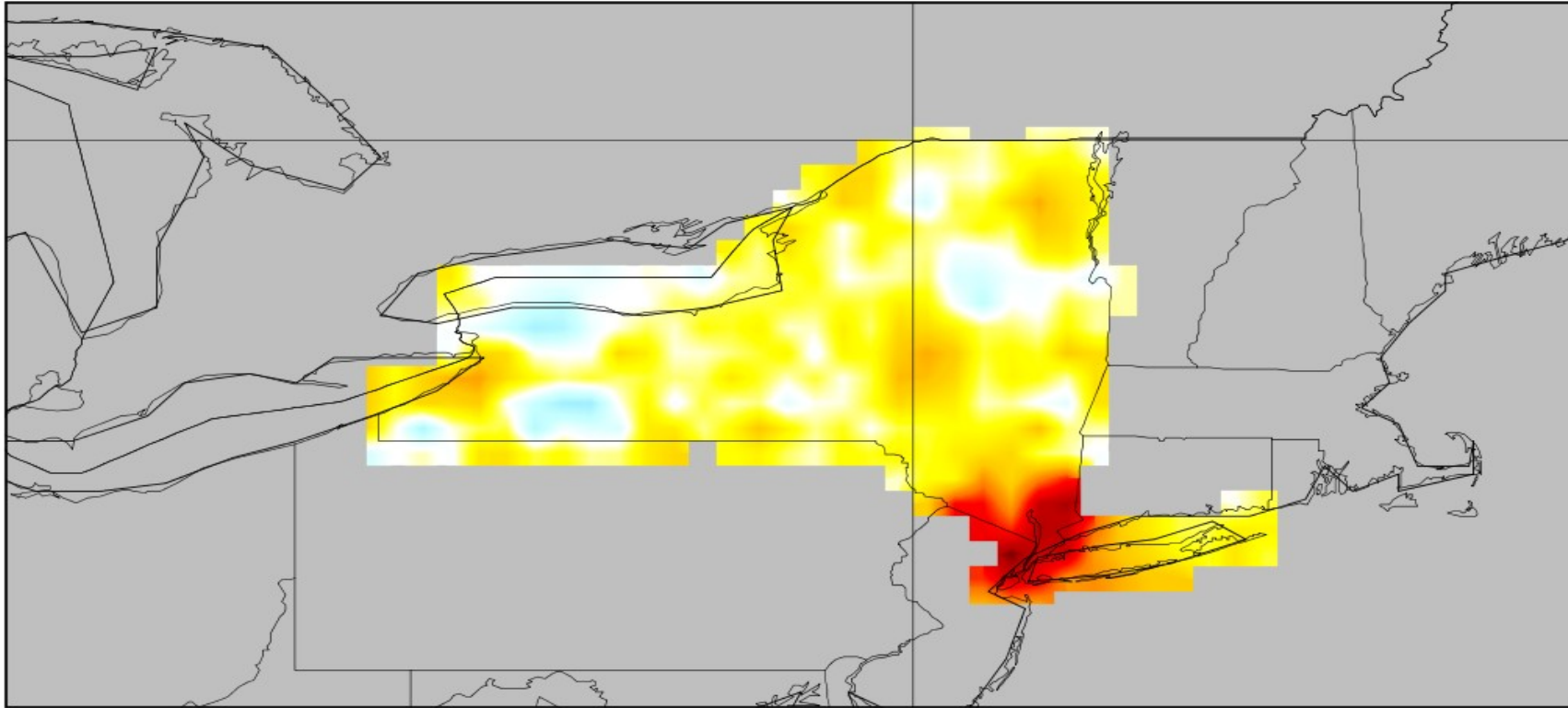
STATEWIDE NO2 TRENDS IN NEW YORK



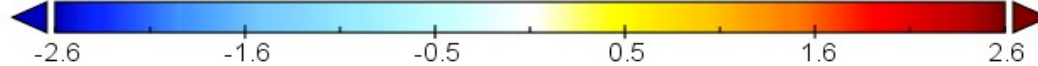
COMPARING NY 2019 AND 2020 NO2 AVERAGE

Difference Between Average Tropospheric NO₂ in 2019 vs 2020 over New York COVID-19 Lockdown

03-20-20xx to 06-08-20xx



NO₂ Tropospheric Column (10^{15} 1/cm²)

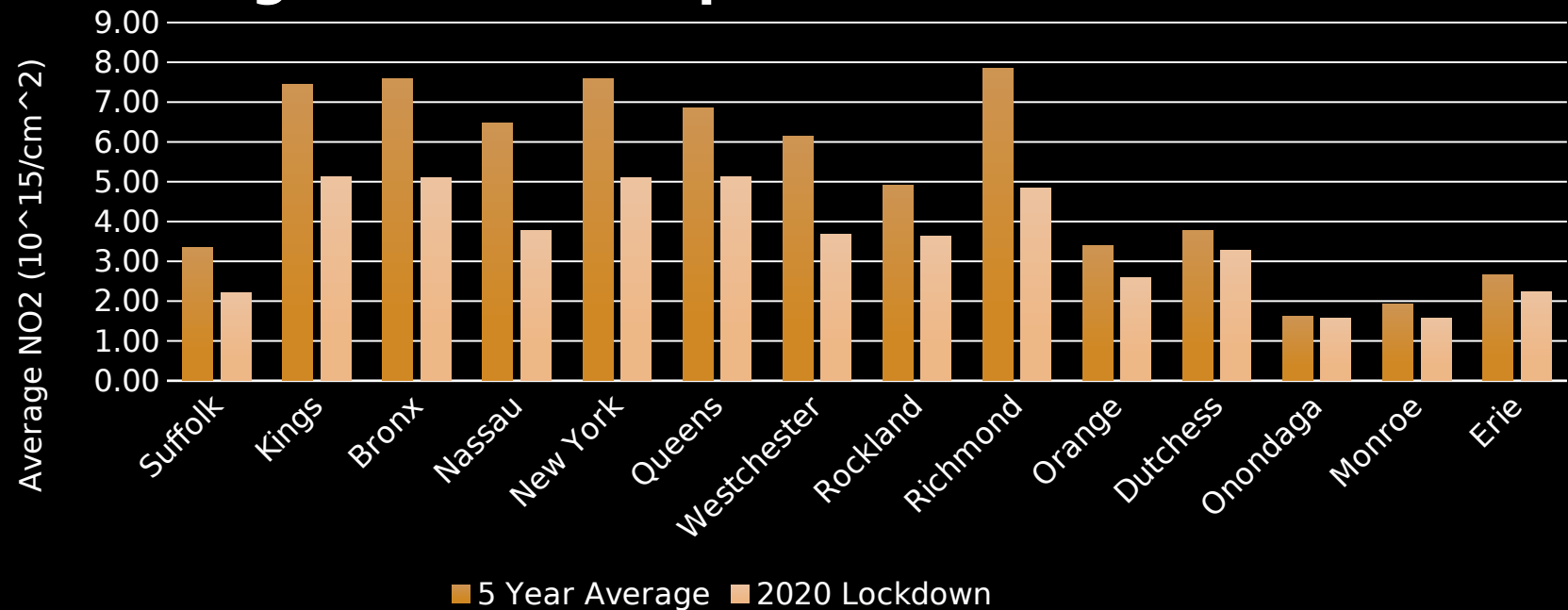


Data Min = -0.9, Max = 2.6

NY COUNTIES MOST IMPACTED BY COVID-19

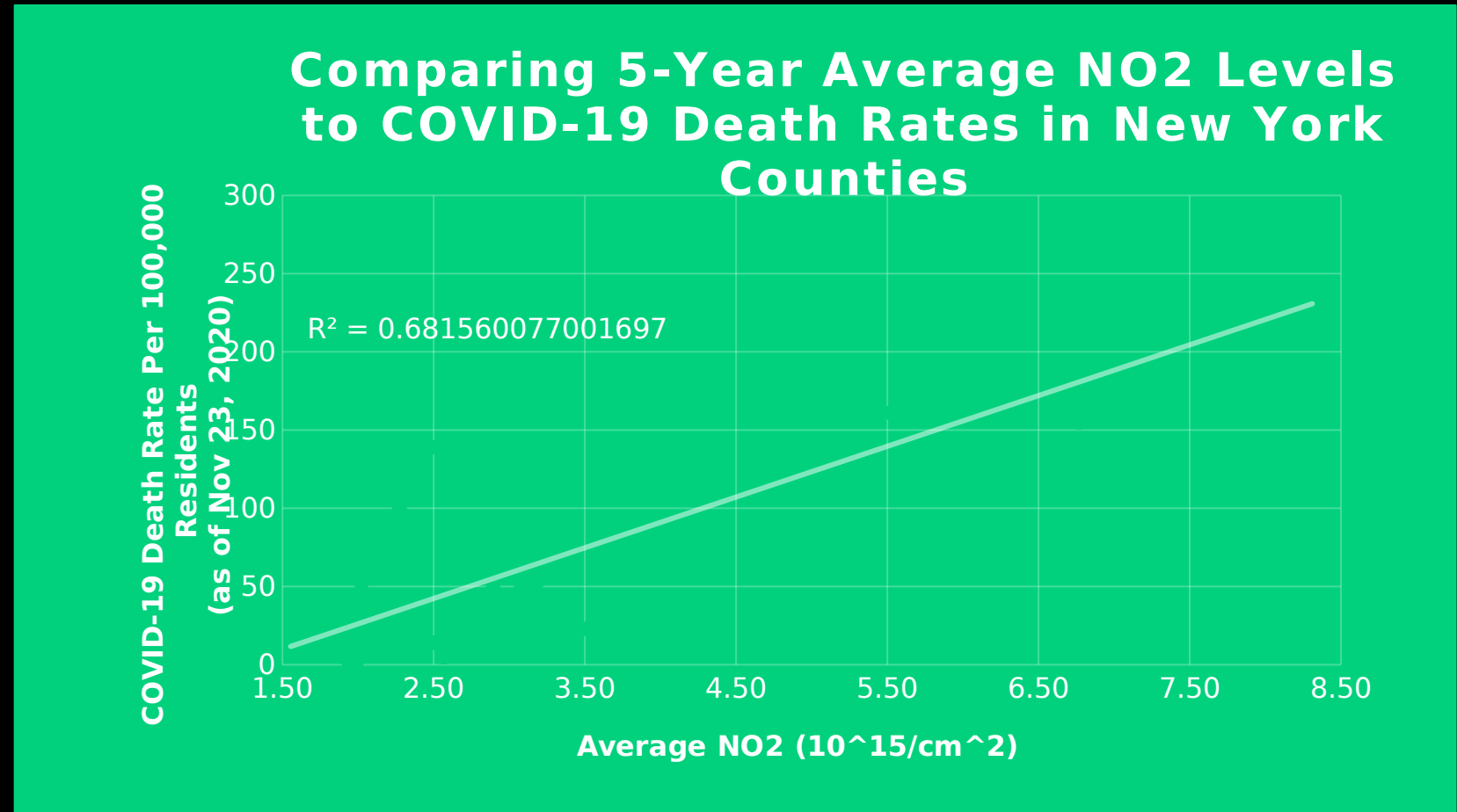
- 15 counties with most positive COVID-19 cases (as of June 8, 2020)
 - All urban
- Significant decrease in NO₂ in hotspot counties
 - 2-tailed paired T-test
 - p=0.000072

NO₂ Levels During 2020 Lockdown VS 5 Year Average NO₂ in Hotspot New York Counties



LONG-TERM EXPOSURE TO NO2

- Includes all counties with reported fatalities
- Positive correlation observed
 - $R^2=0.6816$



DISCUSSION

- What does the data show?
 - Overall statewide decrease in NO₂ in 2020 compared to previous years
 - Statistically significant decrease observed in NO₂ in hotspot counties
 - Correlation between cumulative exposure to NO₂ over 5 years and COVID-19 death rates
- Future Steps
 - Other pollutants
 - Look at yearly data for rural counties, even if they aren't hotspots
 - Which factors make a county more likely to experience significant decreases in pollution?

SOURCES

<https://www.epa.gov/no2-pollution/basic-information-about-no2>

<https://>

www.nytimes.com/interactive/2020/us/new-york-coronavirus-cases.html

Randall V. Martin, Satellite remote sensing of surface air quality, Atmospheric Environment, Volume 42, Issue 34, 2008, Pages 7823-7843, ISSN 1352-2310, <https://doi.org/10.1016/j.atmosenv.2008.07.018> .