USING NASA SATELLITE DATA TO LINK AIR POLLUTION AND HEALTH OUTCOMES

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Introduction: Air pollution has been linked to many adverse health outcomes from asthma to cardiometabolic disorders to dementia.[1] The EPA has air pollution data for most metropolitan areas within the US.[2] However, there are many populations in the US that do not have a monitor within range to accurately measure exposure, especially in rural areas. NASA has instruments aboard their satellites that are circumnavigating the globe daily, capturing air pollution data for the entire US.

Methods: We analyzed level 3 gridded NASA instrument data for the US from 2005-2019. CO, PM2.5, and SO2 were measured by MERRA-2 at a resolution of 0.5° by 0.625° (https://disc.gsfc.nasa.gov/datasets/M2T1NXAER_5.12.4/summary?keywords=merra%20pm2.5), and NO2 and O3 were measured by OMI at a resolution of 0.25° by 0.25° (https://disc.gsfc.nasa.gov/datasets/OMI_MINDS_NO2d_1/summary?keywords=omi). All variables were aggregated to the US county-level. We used Python to conduct descriptive statistics (Figure 1) and explore large row anomalies in NO2 and O3 (Figures 2), the pollutants measured by OMI, by year and region.
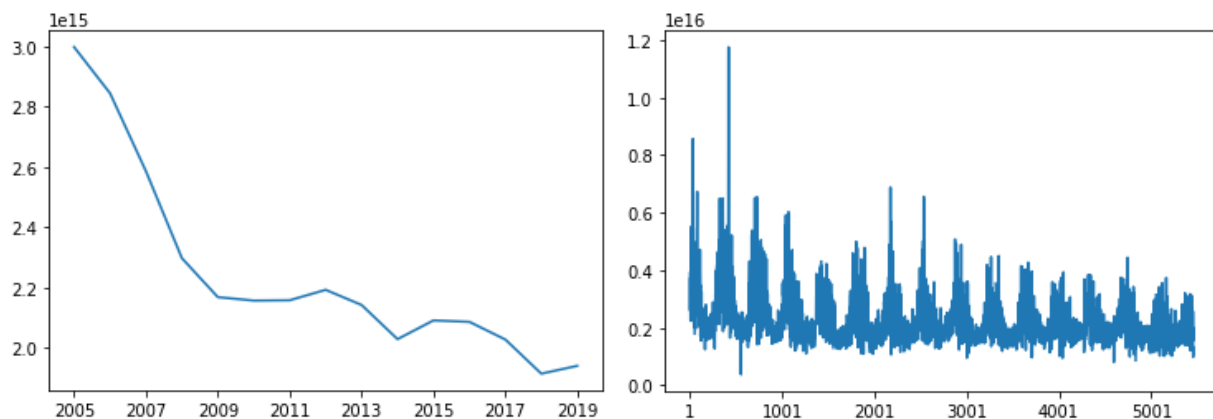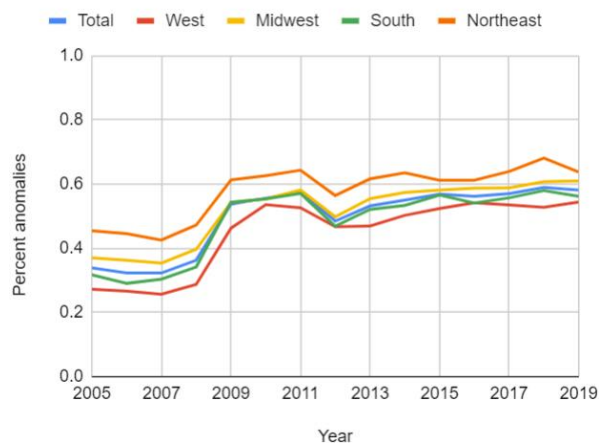
Results:
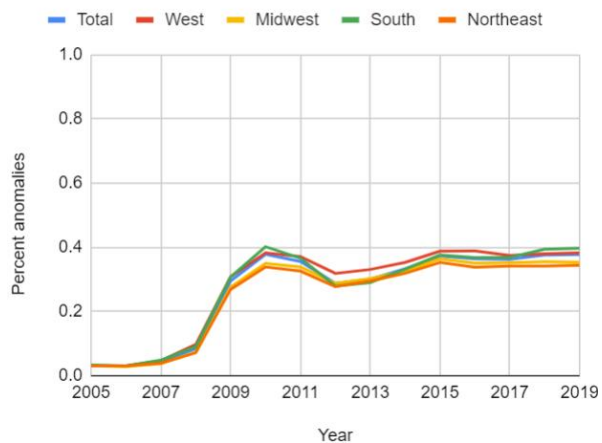

Figure 1: NO2 mean by year and day

Figure 2: NO2 and O3 anomalies by year and region

Discussion: Descriptive statistics indicate how the data changes and what it looks like by revealing temporal and spatial patterns. For example, NO2 levels have steadily decreased 30-40% in the last decade due to environmental regulations,[3] which is reflected by the results (Figure 1). Considering missing values, filler values, outliers, and reasons for them also gives a better understanding of the data obtained by satellite instruments compared to other methods of measurement. By using data from satellite instruments, we can determine whether relative changes in air pollution have the same effect in areas that lack ground-based monitors, helping to bring environmental equality to epidemiological research. With clean data, we can accurately correlate air pollution events with aggregate clinical outcomes. In the future, we can correlate the data and outliers with meteorological factors, EPA monitor data, and other sources like PurpleAir monitors.

References:
1. Bowe et al. The Lancet Planetary Health. 2018, *2*(7).
2. Barrett et al. Tracking Pollution to Help You Breathe: Data and Best Practices for Tracing the Health Impacts of Smoke for the Public Health Community [PowerPoint presentation]. 2020
3. Lamsal et al. Atmospheric Environment 2015, *110*, 130-143.