PM2.5 analysis Report

Introduction

The selected study area is Bakersfield, California, USA, with latitude 35.3733° N and longitude 119.0189° W. This area is at a unique location where surrounding mountains are known to trap pollution within the region. Bakersfield, California, also has a broad range of pollution sources such as toxic farming chemicals, dust, transportation fumes, polluted winds from southern California, and Bakerfield's oil-drilling exhausts. Additionally, the risk of wildfire increases due to climate change. The objective of this research is to understand and find the connection between spikes of pollution and its potential cause whether it is because of season, industrial activity, wildfire, sensor errors, or a combination of these events.

Methods

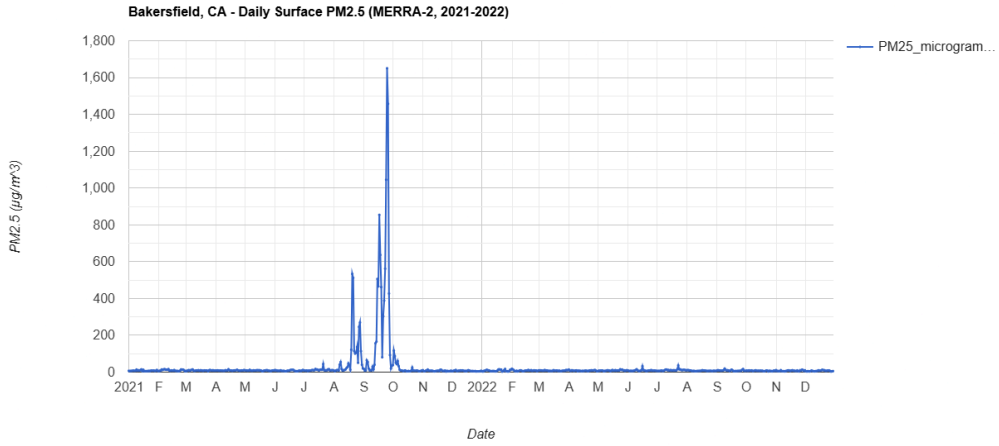
MERRA-2 Aerosol diagnostics has a temporal coverage of 1980-present, hourly, and a spatial resolution of ~50km. Global High Air Pollutants (GHAP) has a temporal coverage of 2017-2022, daily, and a high spatial resolution of 1km. For the first analysis, MERRA-2 Aerosol diagnostics dataset was used and because the dataset doesn't provide calculated PM2.5 data, the PM2.5 reconstruction formula was utilized.

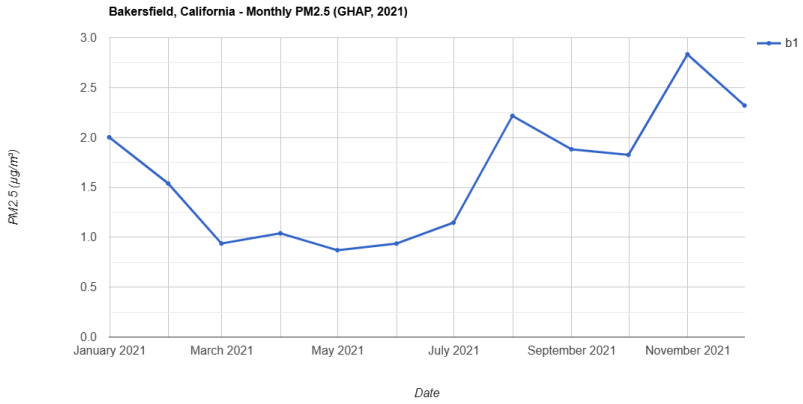
PM2.5 reconstruction formula = *Dust surface + Sea salt + Organic carbon + Black Carbon + Sulfate factor*SO4*

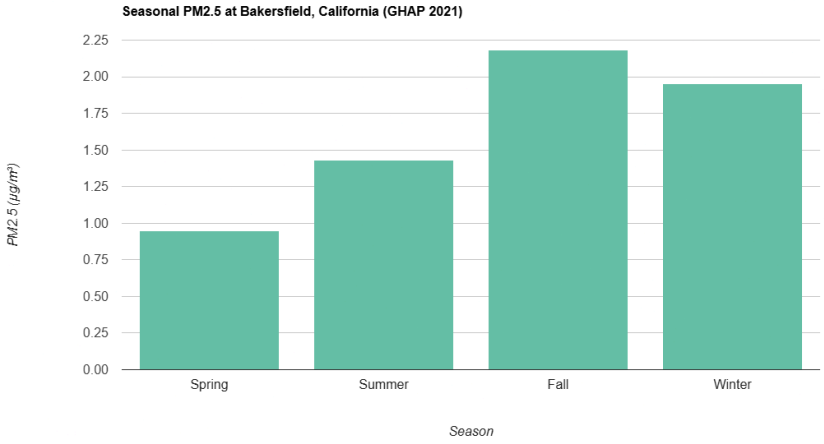
For the second and third analysis, GHAP dataset was used and because the dataset provided PM2.5 data, the primary tasks were to convert the spatial and temporal resolution to desired units and calculate the means for each point on the monthly and seasonal analysis graphs. The first analysis studied 2021-2022 data while the latter two analyses concentrated on 2021 data specifically to ensure temporal consistency during later comparisons and evaluations.

Results

The first analysis suggests that PM2.5 hovered around 7~10 $\mu g/m^3$ following no particular pattern across the 2021-2022 time period. However, there were unusually high PM2.5 spikes on September 25th, 2021 with PM2.5 of 1650.22 $\mu g/m^3$ and September 17th, 2021 with PM2.5 of 854.009 $\mu g/m^3$. The second analysis suggests that in 2021, the month with highest PM2.5 is November, with a PM2.5 of 2.833 $\mu g/m^3$ and the lowest PM2.5 is May, with a PM2.5 of 0.871 $\mu g/m^3$. The third analysis suggests that in 2021, the season with the worst air quality was fall with average PM2.5 of 2.18 $\mu g/m^3$ and best air quality was spring season with average PM2.5 of 0.949 $\mu g/m^3$. The analyses all show a trend of highest air pollution during Fall of 2021.







Discussion and Conclusion

The analyses all indicate high air pollution during Fall of 2021. This could be because historically, wildfires have a high chance of occurring in fall due to the dry and windy conditions. Bakersfield, California has high PM2.5 values, which aligns with the fact that there are multiple sources of air pollution in Bakersfield, California. This indicates that residents are at higher risk of PM2.5 particles entering deep into their lungs or bloodstream, leading to poorer health. Satellite data could be inaccurate, so more data needs to be consolidated to have accurate air quality monitoring.