Summary Document

COVID-19 impacted humanity for most of 2020 and controlling the spread of this disease led to the implementation of lockdowns which resulted in the decline of economic activities for certain months altogether and in partial terms for the rest of the time. The question for my study was:

> ***Did a decline in human activity led to amelioration in air quality?***

Geographic location

To study this question, I chose India's capital city of Delhi as it is a densely populated urban area and faces air quality challenges.

Data

For this analysis, I used the Google Human Mobility Dataset for the year 2020 to understand changes in human activity.

For the Air Quality parameter, I used the European Space Agency's Sentinel 5P NO2 satellite dataset to get the mean NO2 concentration over my study area.

Solution

After checking for missing values and any data gaps, I extracted mobility data pertaining to the Delhi region and aggregated the various mobility variables into a single data column using Pandas and Matplotlib libraries in a Python Jupyter lab notebook. Since the dataset was on a daily scale, I grouped the dataset month-wise to get an overall monthly mobility change metric.

Then I used Google Earth Engine to extract all available Sentinel 5P NO2 imageries for each month in 2020, clipped them to my study area, and calculated mean NO2

concentration statistics from all the images for each month. The resulting mean NO2 concentrations raster was reduced to a single statistic using a Mean reducer function in the Earth Engine Python API.

Then, I appended all the monthly NO2 concentration values to an empty list and created a new data frame that had monthly mobility change and monthly average NO2 concentrations. I used this data result to visualize the relation between the decline in human activity and air quality.

Observations and Result

Before implementation of a complete lockdown in March 2020, NO2 concentration was high compared to the monthly concentrations which followed after the onset of lockdown. As restrictions were eased off starting May 2020, both human mobility and NO2 concentrations increased. There was a slight dip in NO2 concentrations in August-September which might be related to atmospheric changes due to monsoon activity. This, however, is an interpretation not completely explained by the data which I used.

Overall, this analysis shows that air quality shows a net positive improvement as a result of the decline in NO2 concentrations due to a decline in human activity.

Considerations

- Other air quality data such as Sulphur dioxides, Carbon emissions, Tropospheric Ozone, etc. can provide more insights into air quality changes with respect to human activity changes.
- Availability of more anthropogenic activity data such as Industrial activity and transportation data can help in creating more detailed correlations between factors.
- Local-scale socio-economic data and ground station air quality data (interpolated over the region) can help in identifying local communities which face the most economic and environmental hardships.