**Apratim Tripathi 30th October, 2024**

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**DATA 512**

**Part 1 – Common Analysis**

**Visualisations**

**A graph of a number of blue and red lines

Description automatically generated with medium confidence**

**Visualization 1: Distribution of Fires by Distance from City**

This histogram shows the distribution of wildfire incidents by their distance from the assigned city, Jackson, MS, up to 1800 miles. The x-axis represents distance in 50-mile intervals, while the y-axis indicates the number of fires within each interval. The red dashed line at 650 miles signifies the modeling cut-off distance for further analysis, beyond which fires are not included in the smoke impact estimate for the city. The histogram indicates a significant clustering of fires within certain distance bands, with a notable spike in occurrences around 1800 miles. This distribution helps identify how the proximity of fires may influence potential smoke impacts on the city.

A graph with orange lines

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**Visualization 2: Total Acres Burned per Year within 650 Miles of City**

This line plot illustrates the annual trend of total acres burned due to wildfires within a 650-mile radius of Jackson, MS. The x-axis denotes the year, while the y-axis shows the cumulative acreage burned. Each point represents the sum of burned acreage for fires within the specified distance for a particular year. Observing the plot, a distinct increase in fire activity can be seen starting in the early 2000s, with peak years corresponding to notably high levels of acreage burned. This upward trend aligns with broader climate data indicating an increase in fire events, thus contextualizing the potential smoke impact for the city.

A graph of a fire

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**Visualization 3: Annual Fire Smoke Impact and AQI Estimates for the City**

In this visualization, a comparative time series plot highlights the estimated fire smoke impact (green line) and AQI estimates (red line) for Jackson, MS, from 1961 to 2021. The x-axis represents the year, while the y-axis shows the estimated values for both metrics. The green line reflects the estimated smoke impact from nearby fires, which generally increases over time, especially in recent years. In contrast, the AQI estimate varies independently, peaking around the late 1970s and early 1980s, likely influenced by industrial emissions and regulations introduced later. This comparison sheds light on the relationship between fire smoke impact and AQI levels, providing insight into how wildfire smoke contributes to air quality changes in the city.

**Reflection**

This assignment provided a valuable opportunity to explore geospatial analysis and environmental data, enhancing my technical skills in handling complex datasets and my understanding of wildfire impacts on air quality. Working through the research question deepened my appreciation for the intricacies involved in estimating wildfire smoke impacts. I realized that accurately quantifying environmental impacts, particularly those as nuanced as smoke exposure, requires careful consideration of spatial proximity, pollutant weighting, and historical patterns. These learnings will be invaluable for future projects that involve environmental data or any kind of geospatial analysis.

In this project, Trisha and I collaborated on several technical challenges that required specific methods and tools. One key instance was working with geopandas to apply spatial filtering on the wildfire data. Trisha helped in utilizing geopy.distance.geodesic alongside shapely.geometry.Point to calculate accurate distances from each fire to our assigned city. This enabled us to filter fires within the required 650-mile radius, which was foundational for accurately assessing potential smoke impact.

Another critical instance was calculating a weighted AQI estimate. Trisha and I worked together to determine appropriate pollutant weights, with an emphasis on PM2.5 due to its significant impact on air quality and health. She contributed to the development of a formula that normalized these weights based on the availability of each pollutant, ensuring that missing data wouldn’t skew our results. These collaborative efforts enhanced the accuracy and reliability of our final smoke and AQI estimates, combining both spatial and environmental considerations effectively.

Collaboration during this assignment proved beneficial in several ways. The opportunity to discuss different approaches and share insights led to a broader perspective on how to solve complex problems. In the context of this project, I found that working with someone else allowed for more efficient problem-solving, especially in the stages of data handling and estimation method development. This collaboration improved my ability to think critically about methodology, and the exchange of ideas often led to solutions that I may not have considered independently.

Overall, this experience underscored the value of teamwork and the importance of thorough data handling practices when addressing environmental data questions. By effectively combining spatial analysis tools with weighted metrics, the project provided a comprehensive look at how to assess and forecast wildfire impacts. These insights will be particularly useful as I continue to work with complex datasets, where thoughtful analysis and collaborative problem-solving are key to achieving reliable results.