



AIR QUALITY AND URBAN DEVELOPMENT

Subject: Python For Arc Gis Eco – 640

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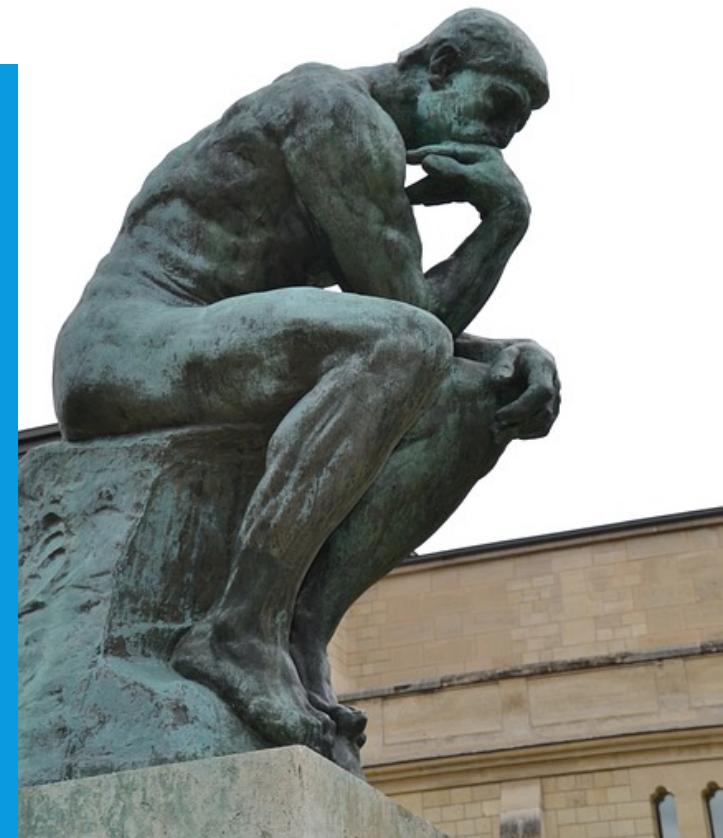
INTRODUCTION

- In the grand tapestry of human civilization, cities stand as epicenters of innovation, culture, and opportunity. Yet, amidst the skyscrapers and bustling streets, a silent threat looms large: air pollution.
- Our project, "Air Quality and Urban Development," emerges from a profound recognition of the critical nexus between urbanization and environmental health.
- Let's see how we narrow things down and, embark on a transformative journey to confront this pressing challenge head-on.



PROJECT PURPOSE

- Protecting Public Health
- Fostering Sustainable Urbanization
- Mitigating Environmental Inequities
- Informing Evidence-Based Policy
- Promoting Global Sustainability



REVIEW DATA SOURCE



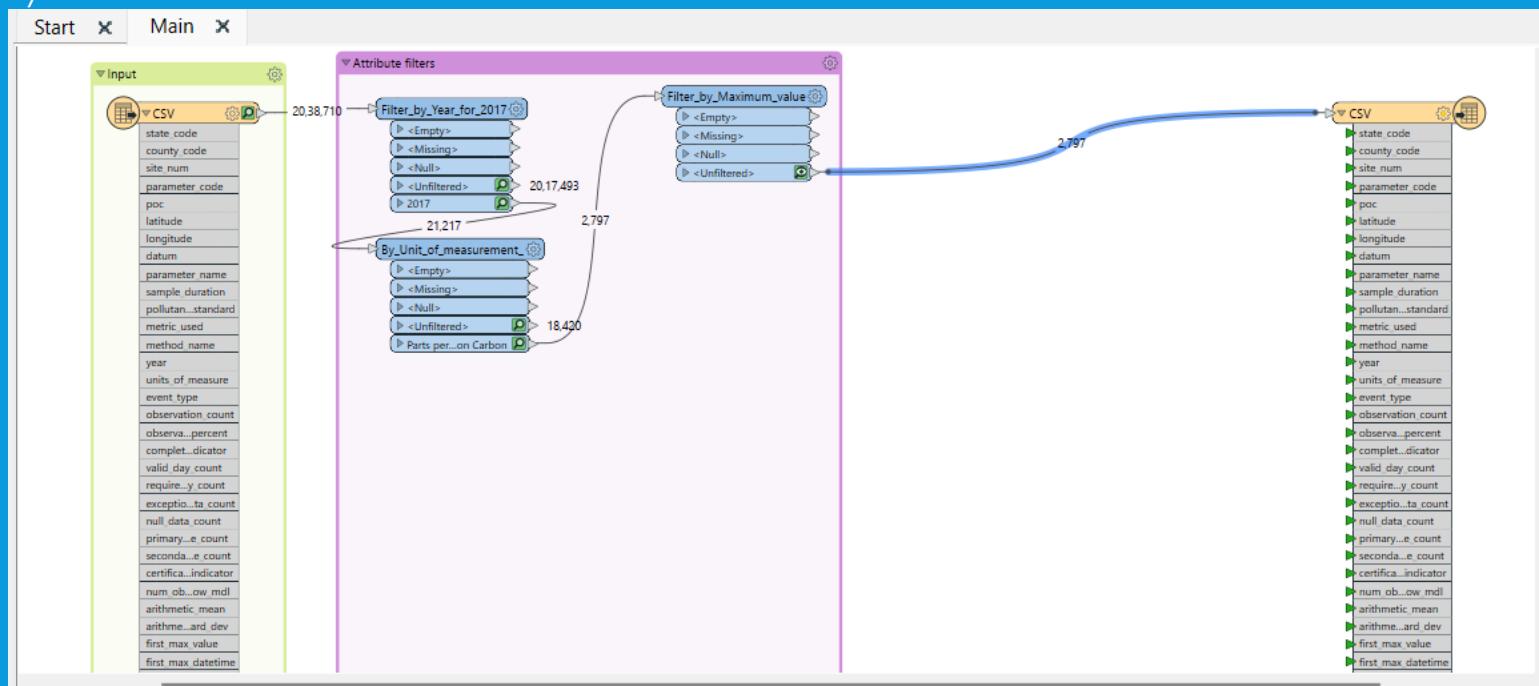
- The Environmental Protection Agency (EPA) creates air quality trends using measurements from monitors located across the country. All of this data comes from EPA's Air Quality System (AQS). Data collection agencies report their data to the EPA via this system and it calculates several types of aggregate (summary) data for EPA internal use.
- Fields Of Interest :
 - Parameter Name:The name or description assigned in AQS to the parameter measured by the monitor. Parameters may be pollutants or non-pollutants.(we mainly focus on PM2.5 and Carbonmonoxide)
 - Units of Measure:The unit of measure for the parameter. QAD always returns data in the standard units for the parameter. Submitters are allowed to report data in any unit and EPA converts to a standard unit so that we may use the data in calculations
 - Arithmetic Mean:The average (arithmetic mean) value for the year.
 - 1st Max Value:The highest value for the year.
 - Latitude and Longitude.

METHODOLOGY

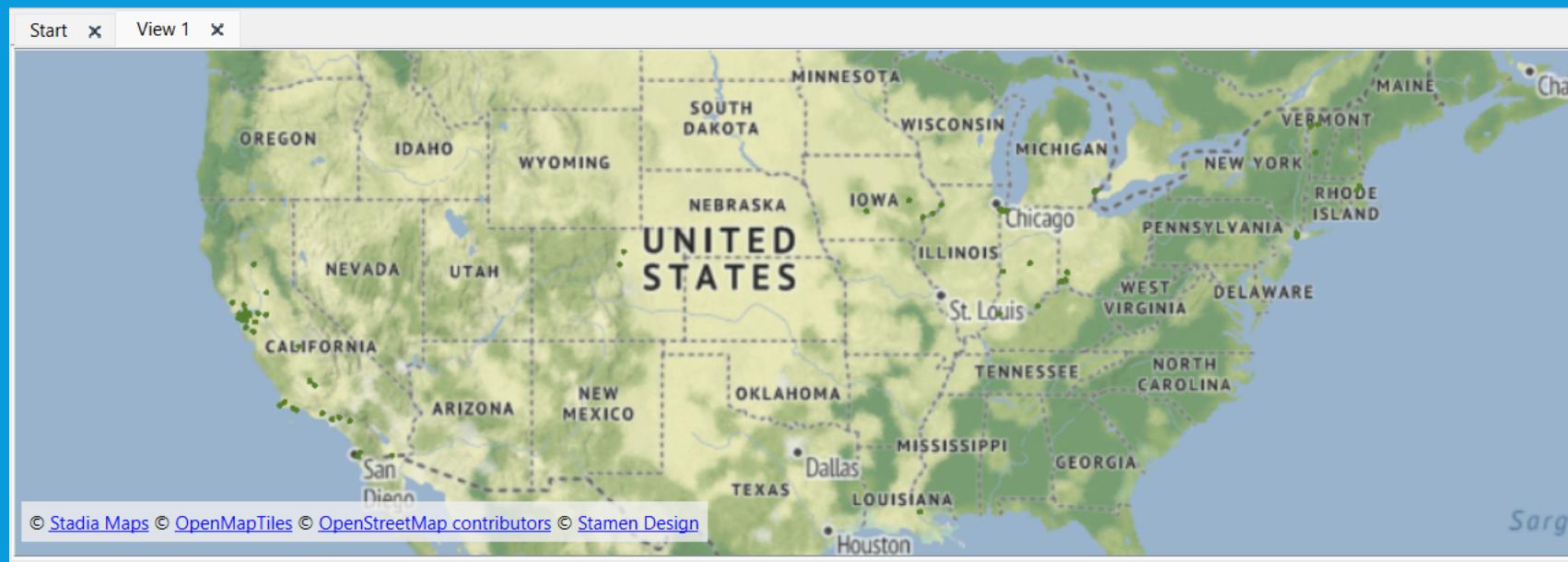
- **Data Collection and Preparation:**
 - Gathered air quality and geographic data from reputable sources.
- **Analysis and Interpolation:**
 - Used FME and ArcGIS Maps for spatial analysis.
 - Developed Python scripts for data manipulation and interpretation.
- **Hot Spot Identification:**
 - Employed point interpolation techniques to estimate air quality.
 - Identified hot spots based on predefined criteria.
- **Validation and Visualization:**
 - Validated results through comparison with ground-truth data.
 - Created maps and visualizations for interpretation.

FME Solution framework – I

■ FME Layout :

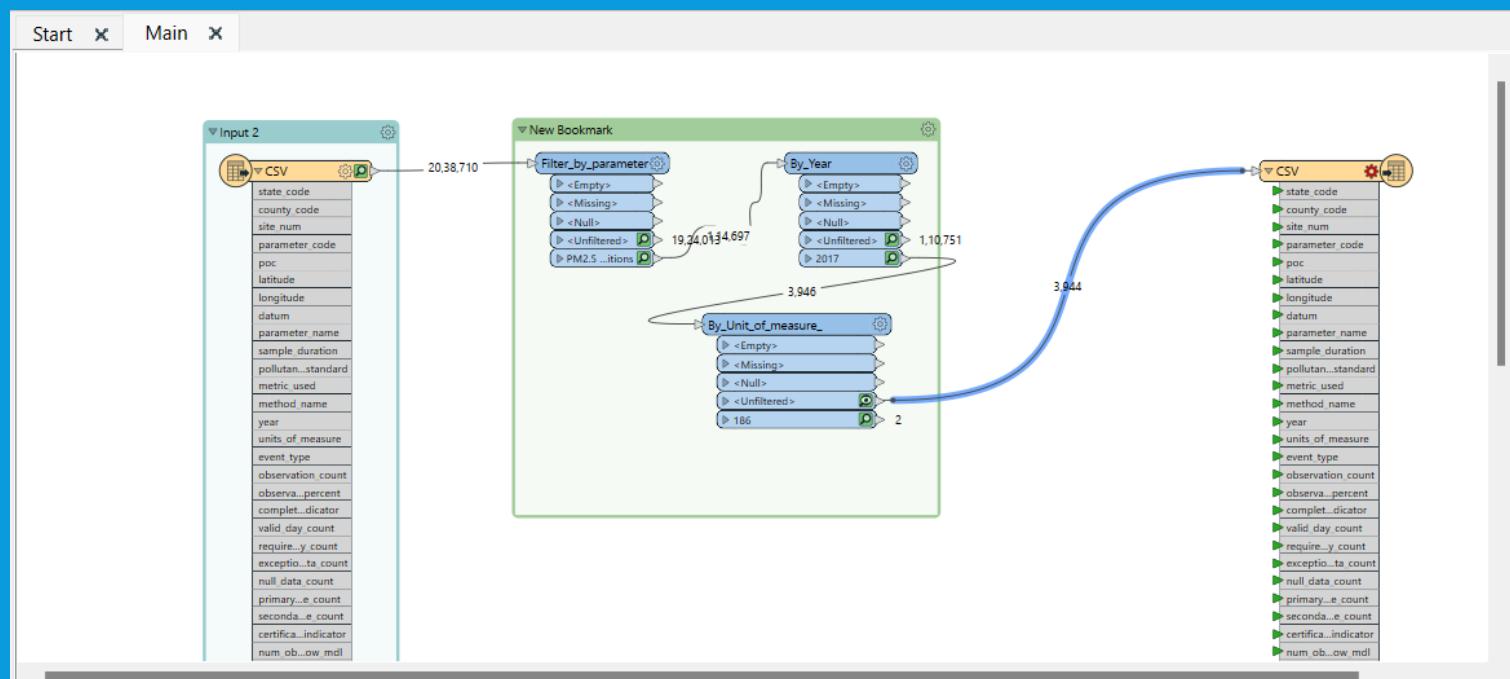


Output – I(CO)

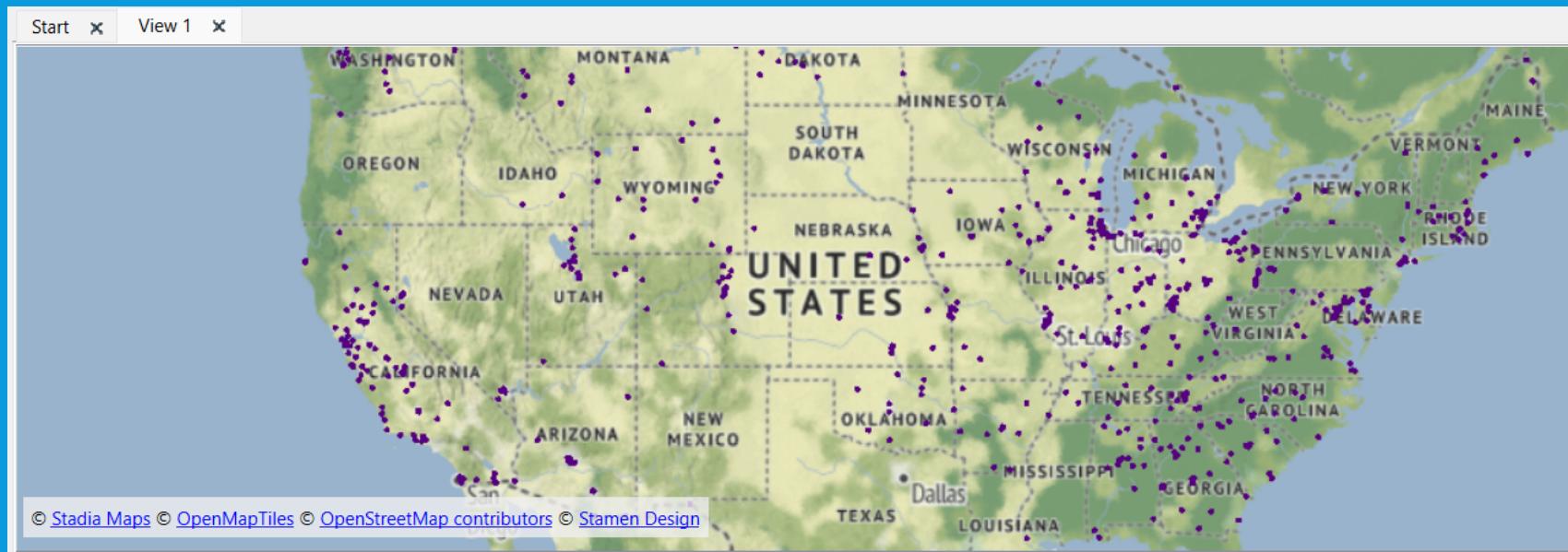


FME SOLUTION FRAMEWORK - 2

■ FME Layout :



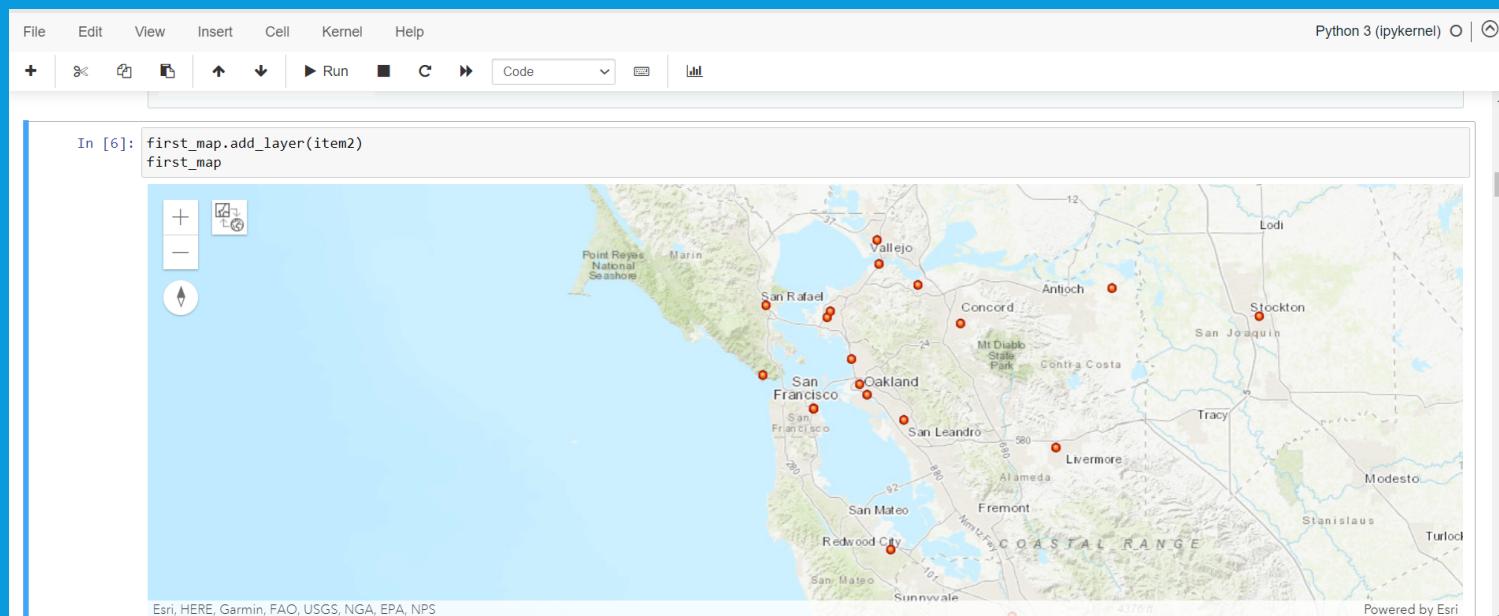
Output – 2(PM 2.5)



RESULT(S)

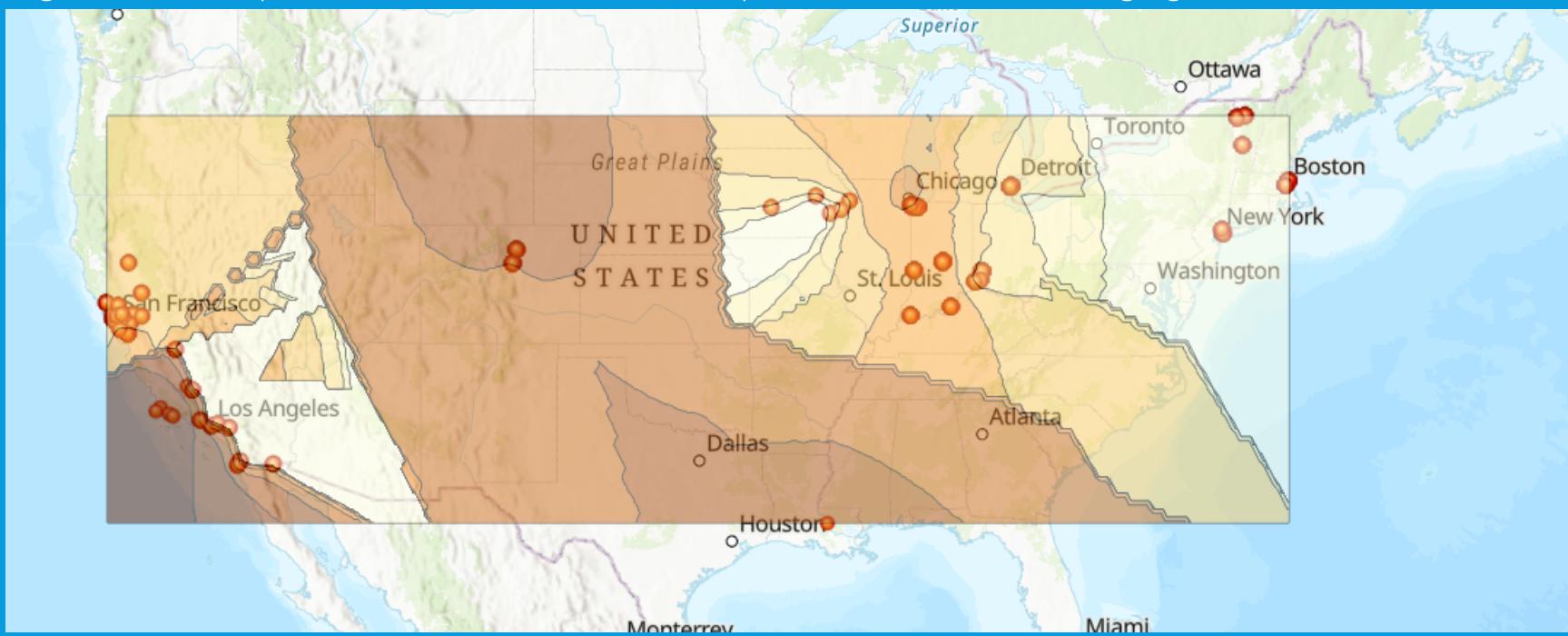
- Filter 1 :

- Output :



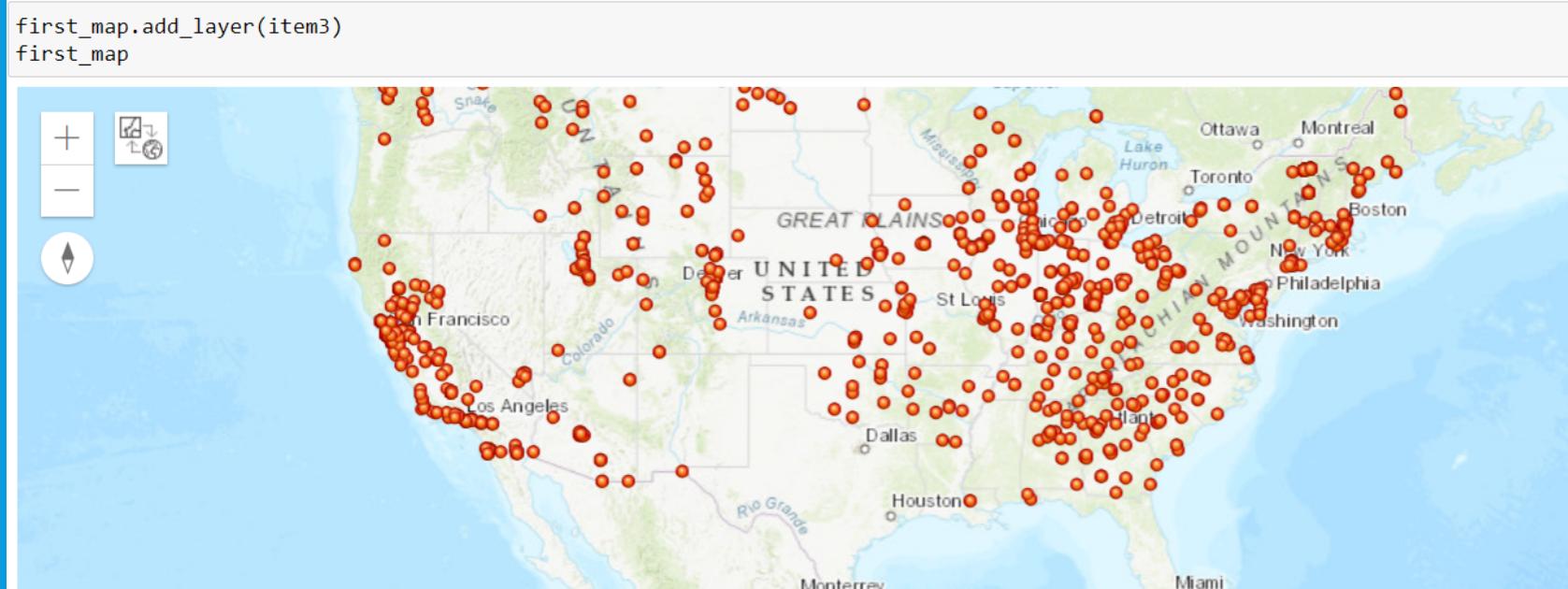
RESULT(S)

- Point interpolation output :
 - This gives us the output where a the whole section of pollution affected area is highlighted
 -



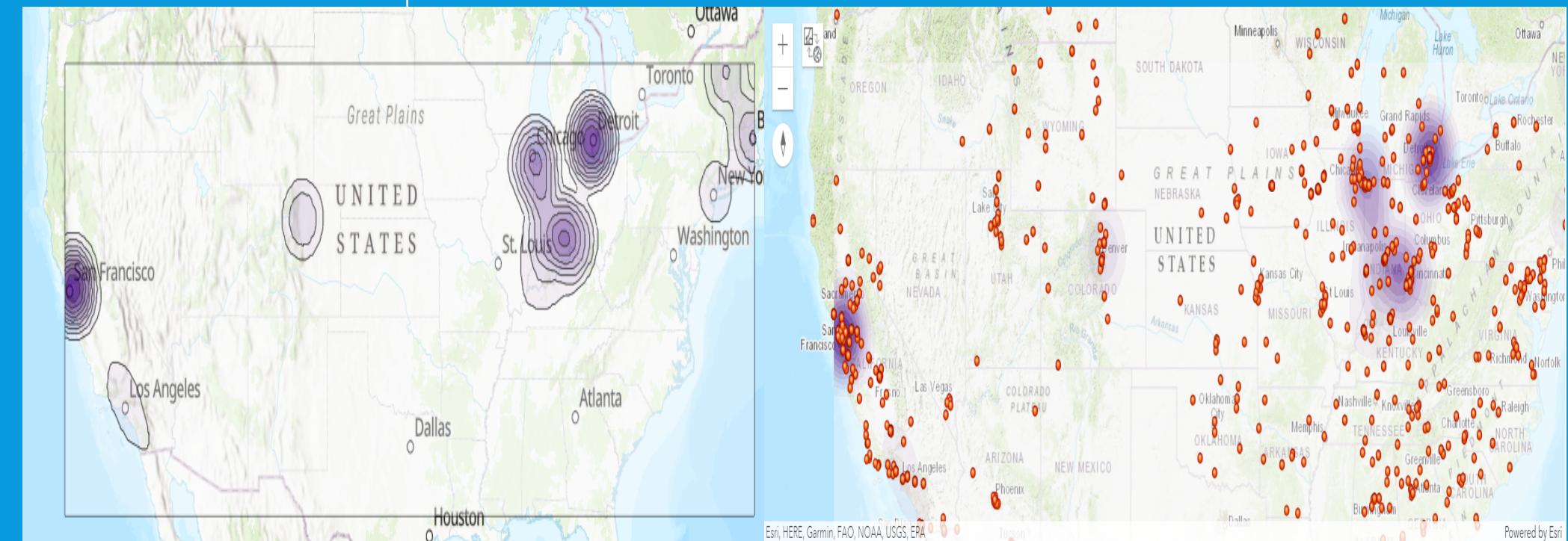
RESULT(S)

- Filter 2 for PM 2.5 :
 - This map shows an added layer of areas affected by high air pollution due to the parameter called PM2.5 , so, here we have 2 parameters CO and PM 2.5



FINAL RESULT

- Our Final Point aggregation has been done by an analysis method called MAX density to find the hotspots in America :



DASHBOARD

- Why cant view all of these outputs in one frame, the solution is ARC gis Dashboard
[https://umass-amherst.maps.arcgis.com/apps/dashboards/
d5ad22362ce149f0a880437cce098a5a](https://umass-amherst.maps.arcgis.com/apps/dashboards/d5ad22362ce149f0a880437cce098a5a)

INTERPOLATION TECHNIQUES

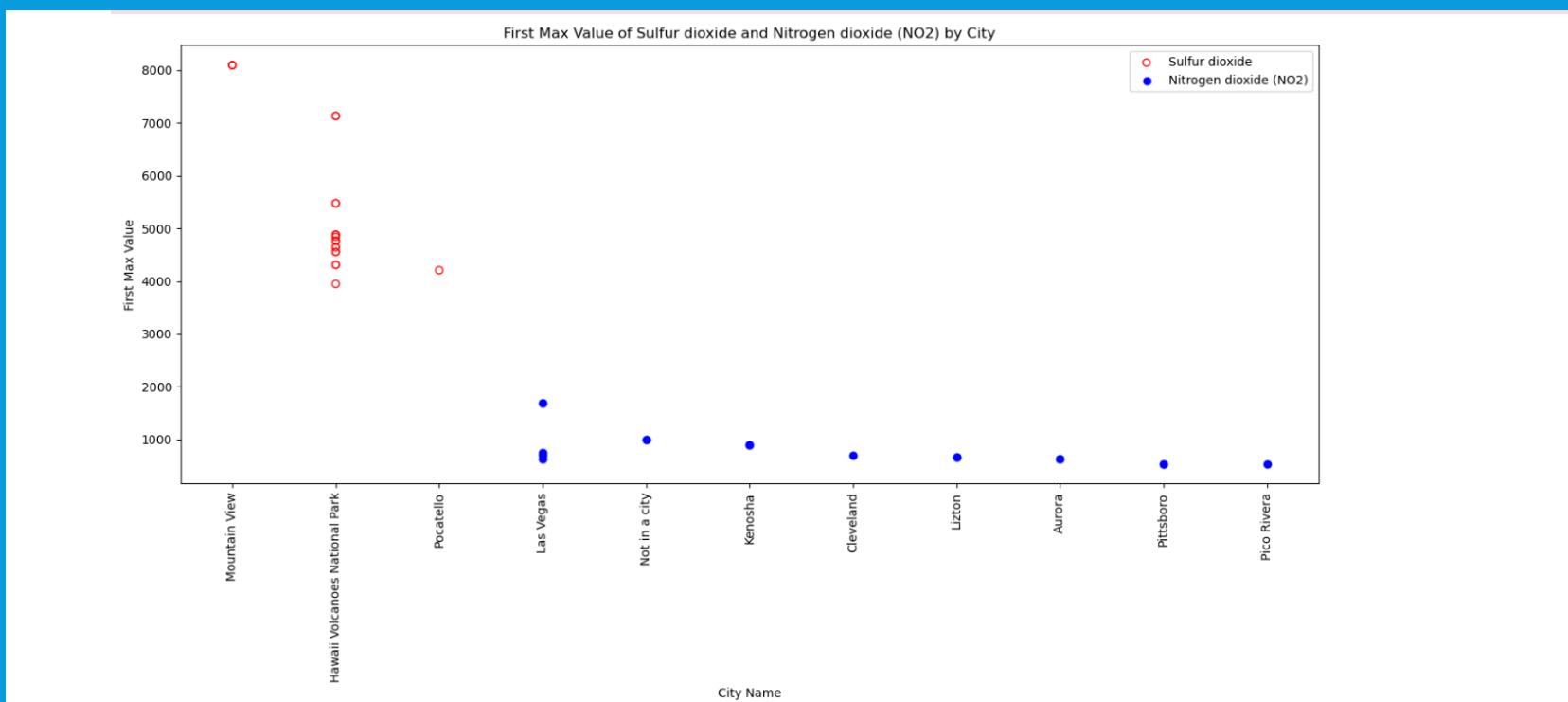
- **Inverse Distance Weighted (IDW):**

- Assigns values to unknown points based on the values of nearby known points, with closer points having more influence.

- **Natural Neighbor:**

- Determines values for unknown points by interpolating from the nearest known points, weighted by their proximity and using a triangulation method.

MORE OUTPUTS FOR OTHER PARAMETERS IN MAT PLOT



CHALLENGES FACED

- Data Cleansing – used some interpolation and data cleaning in Excel to overcome this.
- The data set was originally not for the whole of the USA – had to find other data sources to match my initial parameters.
- Some Layers wouldn't add on to the existing map.

FUTURE WORK

- SCALING
- EFFICIENT DATA CLEANSING
- EXPLORING MORE INTERPOLATIONS
- EXPANDING THE DOMAIN ON PARAMETERS

ARC GIS Notebooks

- The Forth Mentioned outputs can be saved as GeoPackages and imported into ARC gis Notebook for further analysis.
- The layers used in the ARC Gis Notebook are below :
 - Filter 1 : <https://umass-amherst.maps.arcgis.com/home/item.html?id=1flee25259ca4d6291bcd3c0b40c89cb>
 - Filter 2: <https://umass-amherst.maps.arcgis.com/home/item.html?id=fc6ab13d6b284daf86b7ce35f4c16b54>
 - Interpolation Filter : <https://umass-amherst.maps.arcgis.com/home/item.html?id=92c1e1cf04474dd981d48705e8bbbedab>
 - Max Density Filter : <https://umass-amherst.maps.arcgis.com/home/item.html?id=22d98cbe7ed54403b21ed8ea19acd290>
 - Final Notebook : <https://umass-amherst.maps.arcgis.com/home/notebook/notebook.html?id=c1d80286d3d348209b6c9a836bcd8e23>
 - Recording Link : [640 Final Presentation - Shravan Sundar Ravi.mp4](#)