AIR QUALITY ANALYSIS IN TAMIL NADU

Phase 4 : Development Part 2

Perform the air quality analysis and create visualizations.

Dataset : "https://tn.data.gov.in/resource/location-wise-daily-ambient-air-quality-tamil-nadu-year-2014**"**

Stn Code	Sampling Date	State	City/Town/Village/Area	Location of Monitoring Station	Agency	Type of Location	SO2	NO2	RSPM/PM10	PM 2.5
38	01-02-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	11	17	55	NA
38	01-07-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	13	17	45	NA
38	21-01-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	12	18	50	NA
38	23-01-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	15	16	46	NA
38	28-01-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	13	14	42	NA
38	30-01-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	18	43	NA
38	02-04-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	12	17	51	NA
38	02-06-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	13	16	46	NA
38	02-11-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	10	19	50	NA
38	13-02-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	15	14	48	NA
38	18-02-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	16	32	NA
38	20-02-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	14	29	NA
38	25-02-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	13	17	17	NA
38	27-02-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	15	16	44	NA
38	03-04-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	12	17	25	NA
38	03-06-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	13	16	29	NA
38	03-11-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	11	18	29	NA
38	13-03-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	15	16	41	NA
38	18-03-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	17	43	NA
38	20-03-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	14	42	NA
38	25-03-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	17	54	NA
38	27-03-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	15	19	62	NA
38	04-01-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	15	66	NA
38	04-03-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	11	16	40	NA
38	04-08-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	14	17	56	NA
38	04-10-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	15	17	50	NA
38	15-04-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	12	14	49	NA
38	17-04-2014	Tamil Nadu	Chennai	Kathivakkam, Municipal Kalyana Mandapam, Chennai	Tamilnadu State Pollution Control Board	Industrial Area	15	16	63	NA

airquality

Perform the Air quality in Data analytics

Performing air quality analysis in data analytics involves collecting, processing, and analyzing data to assess the quality of the air in a specific region or location. This process is crucial for environmental monitoring, public health assessment, and policy-making. Here is an overview of the key steps and considerations in air quality analysis using data analytics:

1. Data Collection:

Gather relevant data sources, including air quality monitoring stations, meteorological data, satellite imagery, and more. These sources may provide data on pollutants such as PM2.5, PM10, ozone (O3), sulfur dioxide (SO2), nitrogen dioxide (NO2), and carbon monoxide (CO).

2. Data Preprocessing:

Clean and preprocess the data to address missing values, outliers, and inconsistencies. This step ensures that the data is reliable and suitable for analysis.

3. Data Integration:

Combine data from various sources to create a comprehensive dataset that includes air quality measurements and relevant contextual information, such as weather conditions and geographic coordinates.

4. Exploratory Data Analysis (EDA):

Conduct EDA to gain insights into the data. Visualizations, statistical summaries, and correlation analyses can help identify trends, patterns, and potential relationships between variables.

5. Feature Engineering:

Create new features or variables that might enhance the analysis, such as daily averages, pollution indices, or spatial aggregation of data.

6. Time-Series Analysis:

Given that air quality data is often collected over time, perform time-series analysis to identify long-term trends, seasonality, and patterns in air quality.

7. Spatial Analysis:

Utilize geographic information systems (GIS) to analyze the spatial distribution of air quality data. This can help identify areas with higher or lower pollution levels.

8. Machine Learning Models:

Develop predictive models using machine learning techniques to forecast air quality conditions based on historical data and relevant features. Models may include regression, classification, or time-series forecasting algorithms.

9. Anomaly Detection:

Implement anomaly detection algorithms to identify unusual spikes or dips in air quality, which could be indicative of pollution events or equipment malfunctions.

10. Data Visualization:

Create interactive dashboards and visualizations to make the results more accessible to non-technical stakeholders. Tools like Tableau, Power BI, or custom web-based dashboards can be useful for this purpose.

11. Interpretation and Insights:

Interpret the results of the analysis and provide actionable insights. This information can be used for policy recommendations, public awareness campaigns, or pollution control strategies.

12. Model Validation:

Evaluate the performance of predictive models through validation techniques like cross-validation, root mean square error (RMSE), or coefficient of determination (R-squared) to ensure their accuracy and reliability.

13. Continuous Monitoring:

Establish a system for continuous monitoring of air quality and update the analysis as new data becomes available. This allows for the detection of emerging trends or changes in air quality over time.

14. **Reporting and Communication:**

Communicate the findings to relevant stakeholders, including government agencies, environmental organizations, and the public, using clear and accessible reports and presentations.

Visualization for Air quality analysis

Creating visualizations in air quality analysis is crucial for interpreting data and communicating findings effectively. Here are some common types of visualizations and the tools you can use to create them:

1. **Time Series Plots:**
   - Display the variation of air quality parameters over time, such as daily, monthly, or yearly trends.
   - Tools: Python libraries like Matplotlib, Seaborn, or R's ggplot2, or data visualization tools like Tableau and Power BI.

2. **Heatmaps:**
   - Visualize the spatial distribution of air quality parameters using color-coded grids.
   - Tools: Python libraries (e.g., Matplotlib, Seaborn), GIS software (e.g., QGIS), or mapping tools like Google Maps API.

3. **Box Plots:**
   - Show the distribution of air quality data, including median, quartiles, and potential outliers.
   - Tools: Matplotlib, Seaborn, R's ggplot2, or data visualization tools.

4. **Bar Charts and Histograms:**
   - Display the frequency distribution of air quality values or comparisons between different locations or time periods.
   - Tools: Matplotlib, Seaborn, ggplot2, or data visualization tools.

5. **Scatter Plots:**
   - Illustrate relationships between air quality parameters and other variables, such as weather conditions.
   - Tools: Matplotlib, Seaborn, ggplot2, or data visualization tools.

6. **Contour Maps:**
   - Represent air quality data on geographic maps using contour lines to show spatial patterns.
   - Tools: GIS software (e.g., ArcGIS, QGIS), Python libraries like Basemap or Cartopy, or data visualization tools with mapping capabilities.

7. **Pie Charts:**
   - Show the composition of air quality data by pollutant type or source.
   - Tools: Matplotlib, Seaborn, ggplot2, or data visualization tools.

8. **Radar Charts:**
   - Compare air quality parameters across multiple categories or locations.
   - Tools: Libraries like Plotly, Matplotlib, or specialized radar chart tools.

9. **Dashboard Visualizations:**
   - Create interactive dashboards with multiple visualizations to provide a comprehensive view of air quality data.
   - Tools: Data visualization platforms like Tableau, Power BI, Plotly Dash, or custom web development with JavaScript libraries.

10. **Animation:**
    - Animate time-series data to show how air quality parameters change over time.
    - Tools: Python libraries like Matplotlib (for creating animations) or specialized animation tools.

11. **Geospatial Heatmaps:**
    - Visualize geographic patterns using heatmap layers on maps.
    - Tools: Libraries like Folium (for Python), Leaflet, Google Maps API, or GIS software.

12. 3D Plots:

- Represent air quality data in a three-dimensional space to highlight complex relationships or patterns.
- Tools: Libraries like Plotly, Matplotlib (3D toolkit), or specialized 3D visualization software.

Execution:

Diagram 1:

Bar graph using Location of monitoring station by City/Town/Village/Area coloured by SO2

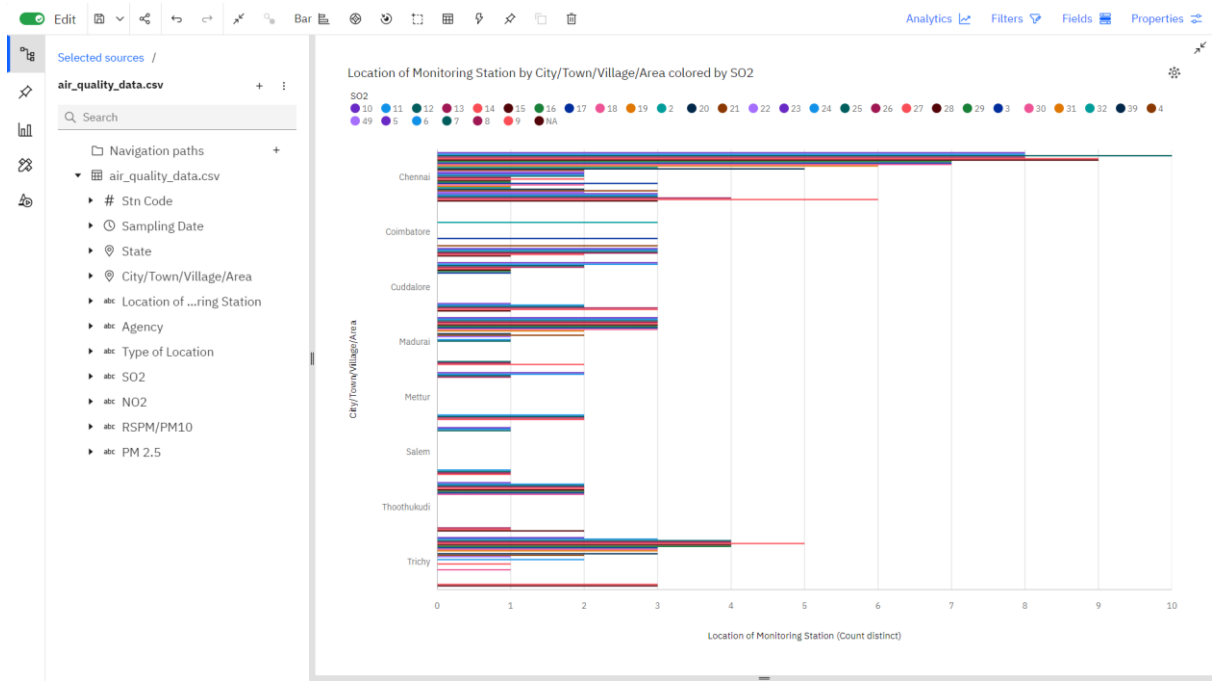


Diagram 2 :

Bar diagram using SO2 by location of Monitoring station coloured by City/Town/Village/Area

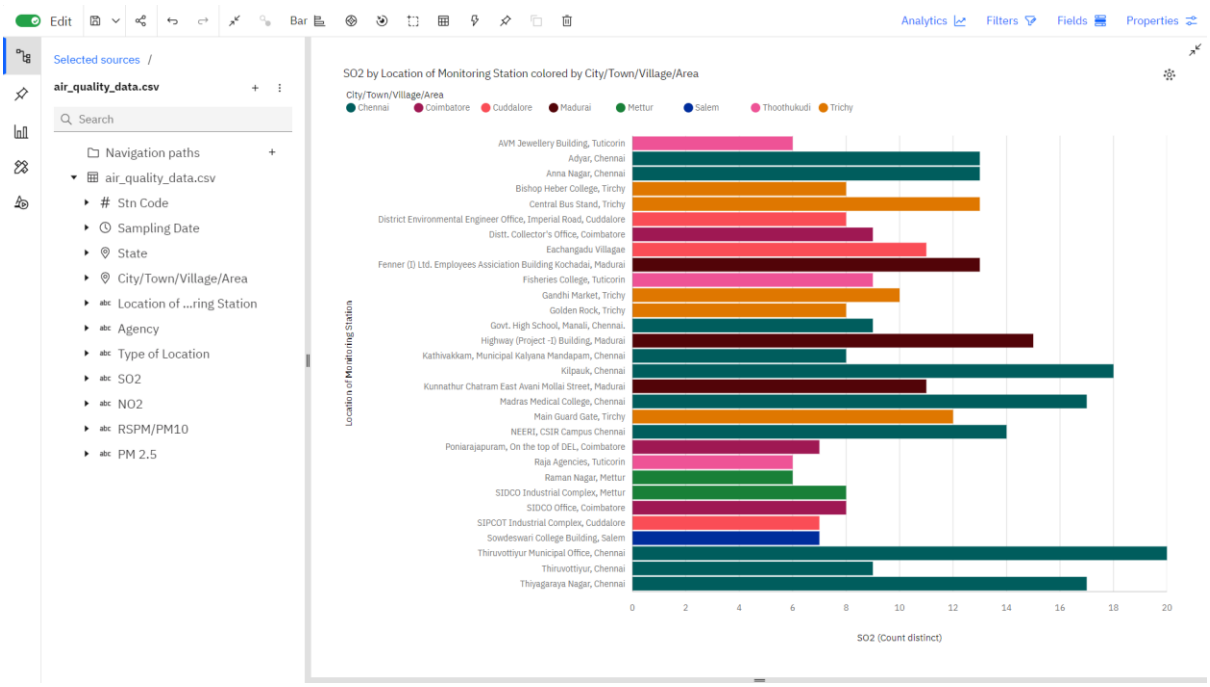


Diagram 3:

Rubble graph using NO2 by type of location coloured by City/Town/Village And sized by Location of Monitoring Station

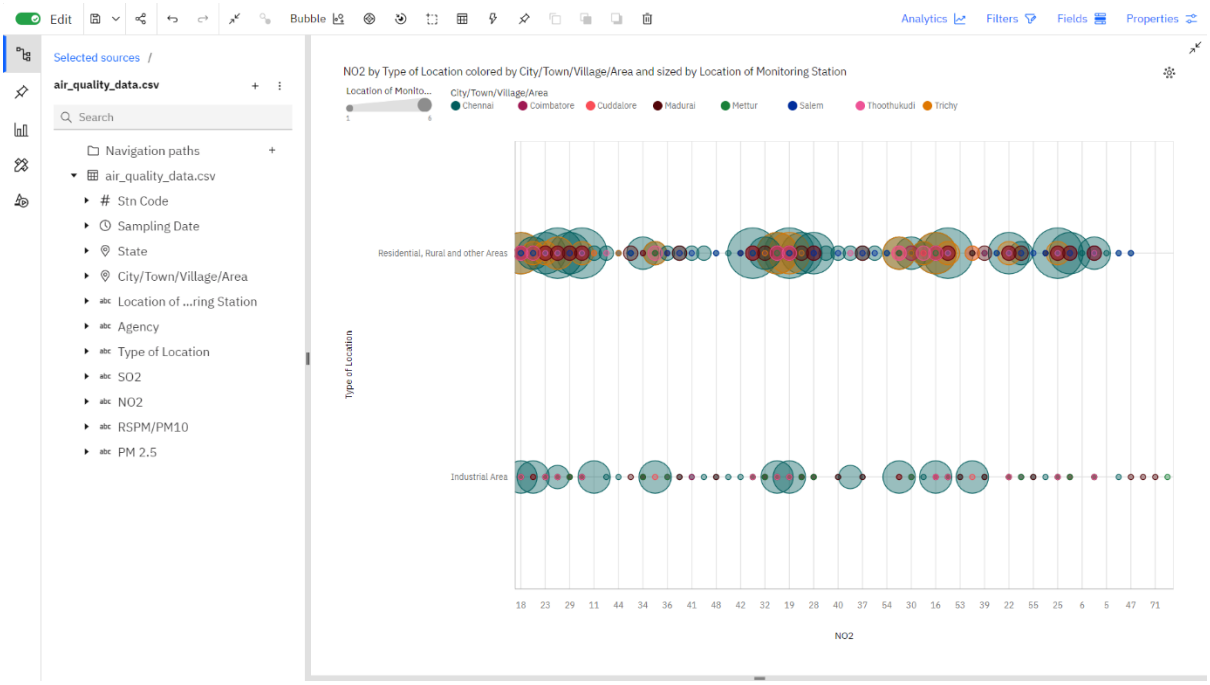


Diagram 4:

Column graph using SO2 by using Location of Monitoring Station by City/Town/Village/Area

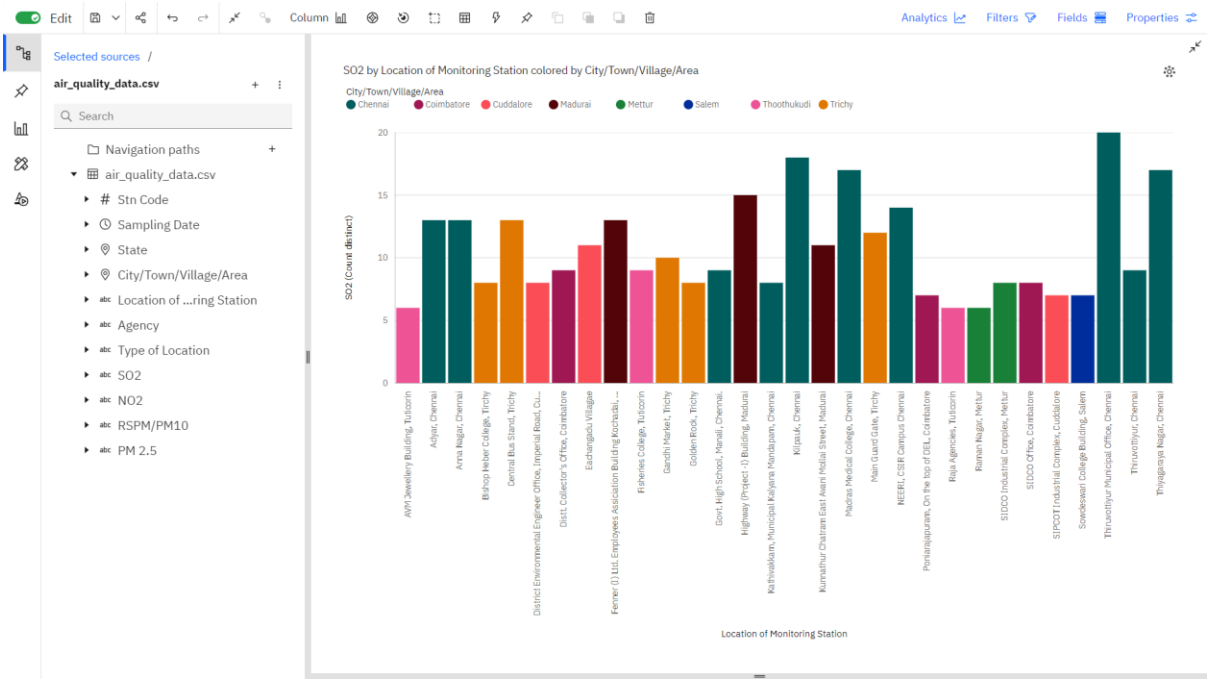


Diagram 5:

Heat map graph using PM 2.5 by Location of Monitoring station and City/Town/Village/Area

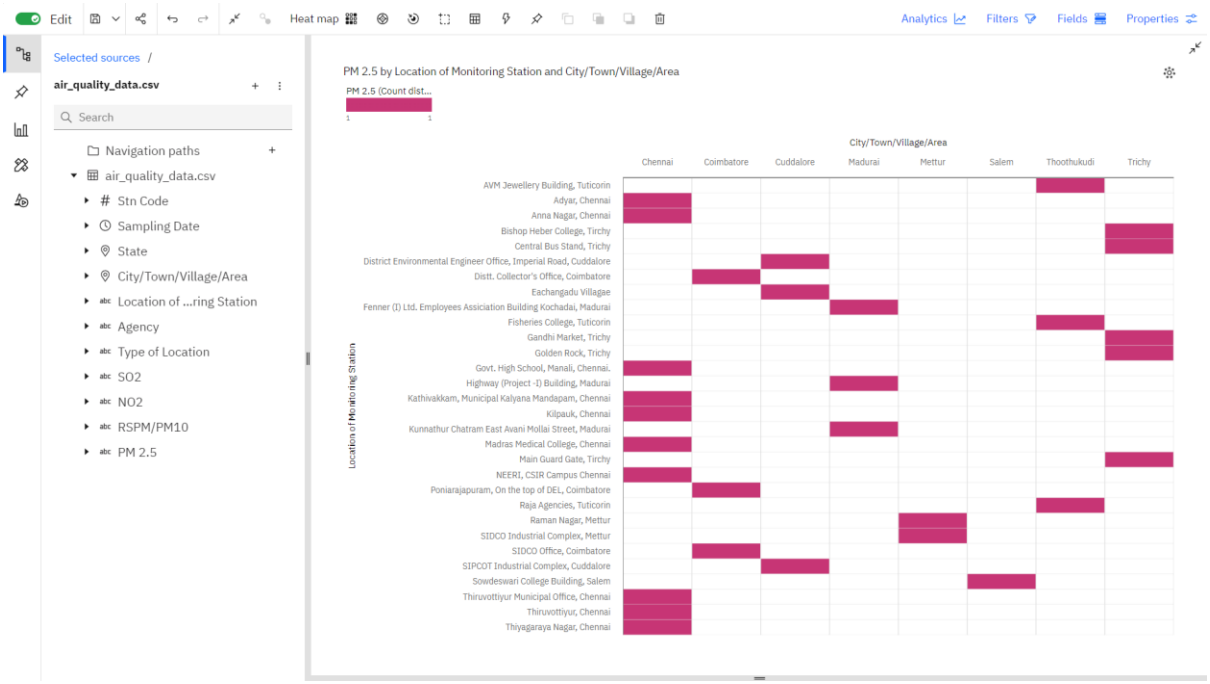


Diagram 6:

Area graph using Location of monitoring station by SO2 colored by City/Town/Village/Area

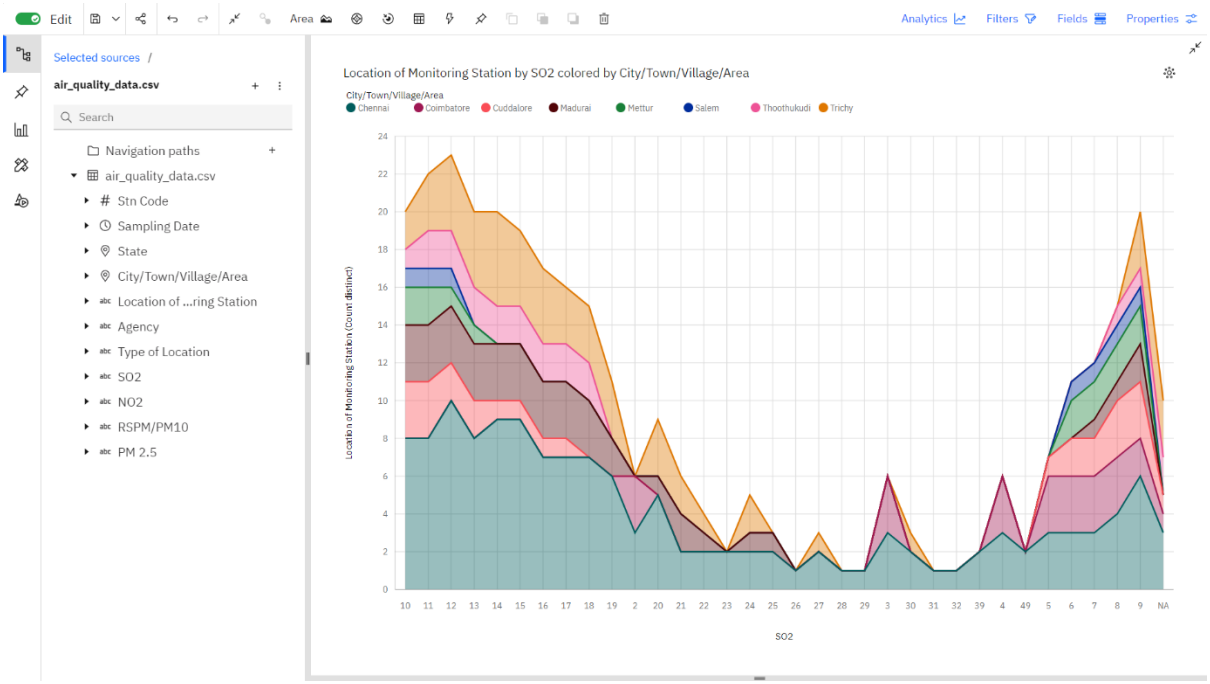


Diagram 7:

Bar graph using Type of location by SO2 colored by City/Town/Village /Area

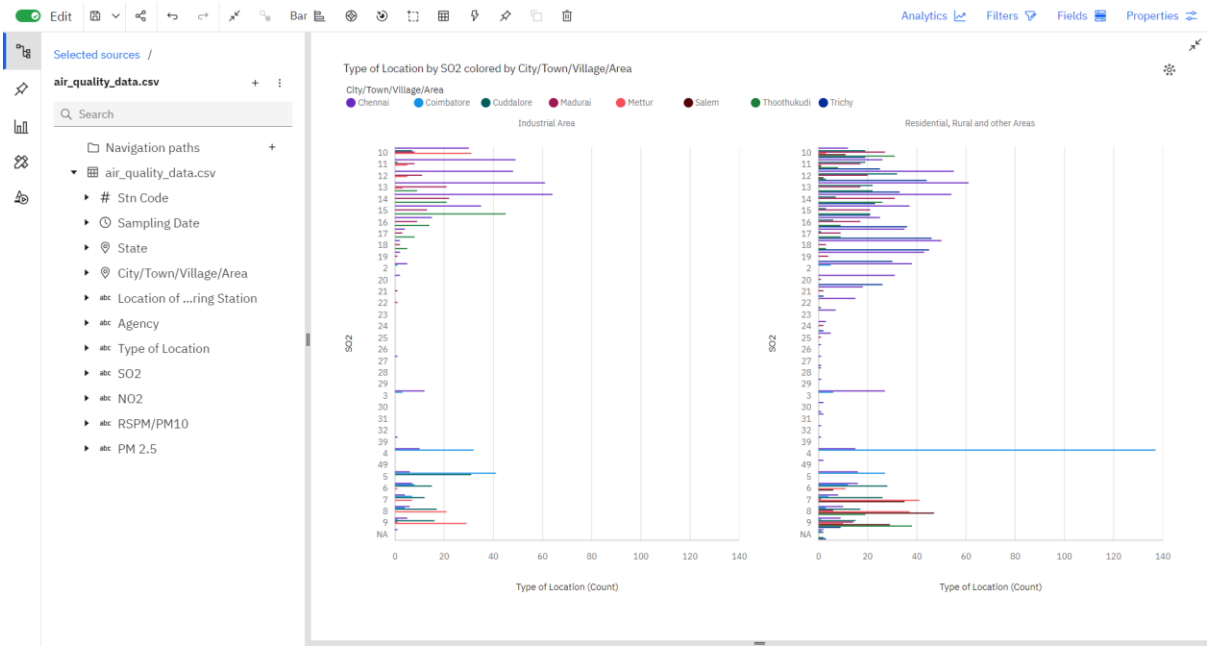


Diagram 8:

Bubble graph using SO2 and NO2 with City/Town/Village/Area and Location station for Type of location

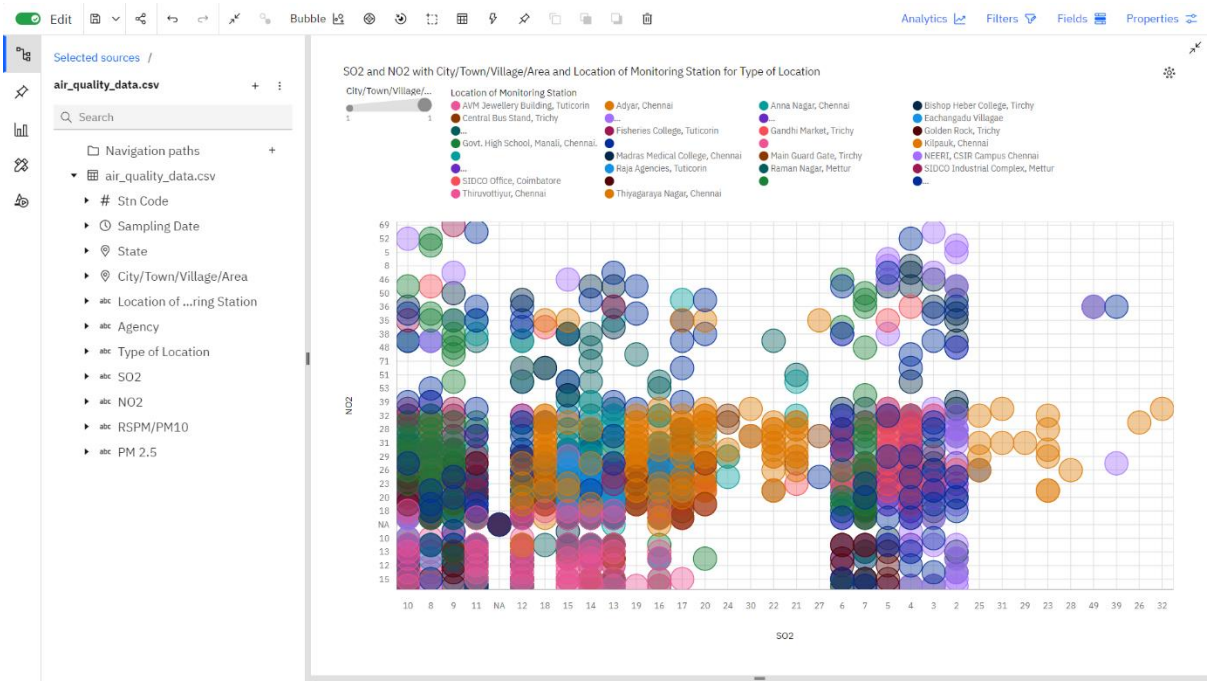


Diagram 9:

Pie graph using City/Town/Village/Area by SO2

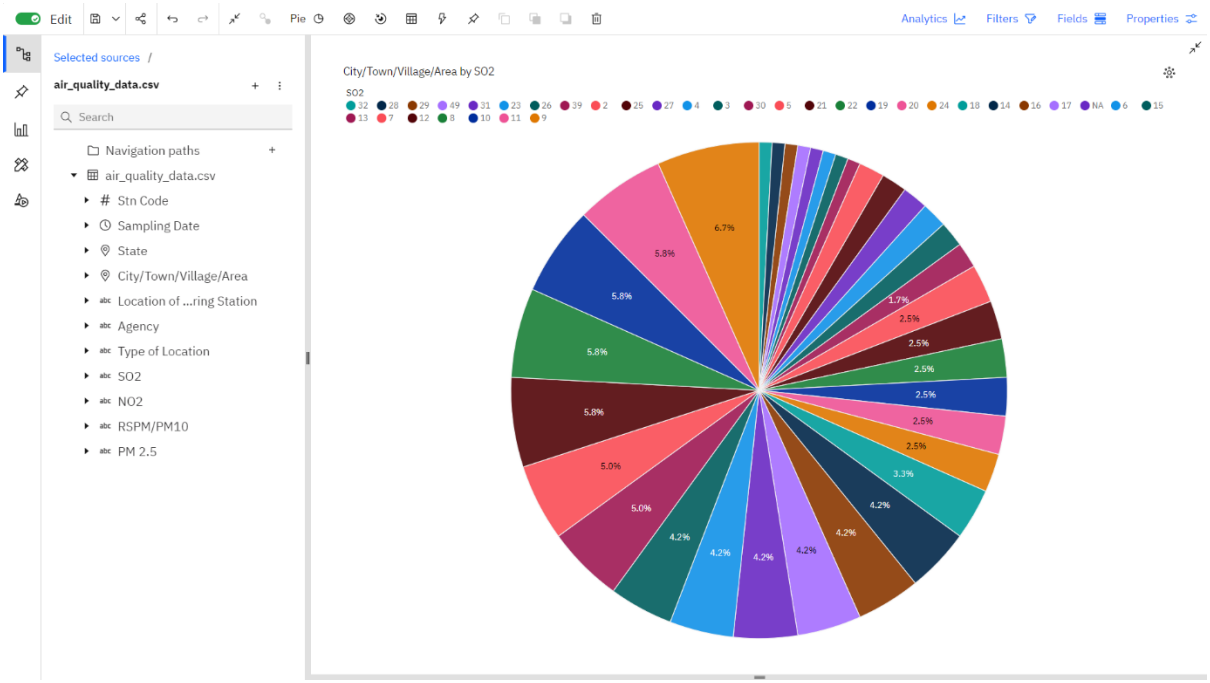


Diagram 10:

Stacked column graph using NO2,SO2,PM 2.5,RSP</PM10, City/Town/Vilage/Area

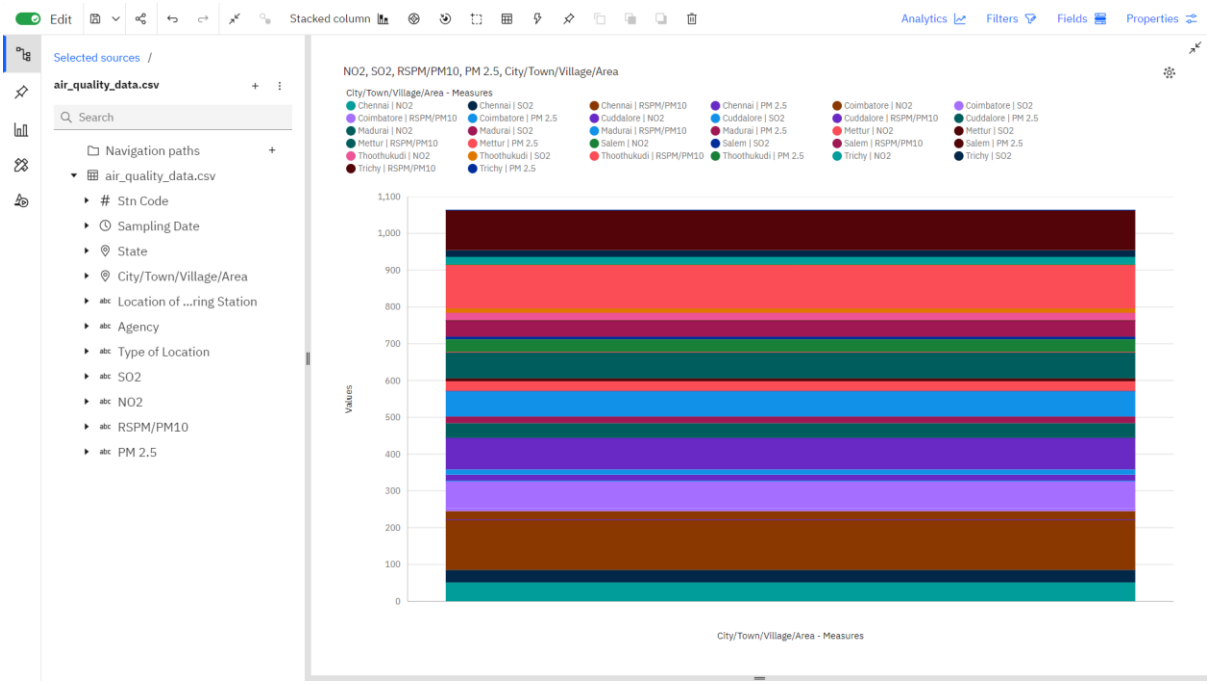


Diagram 11:

Scatter graph using NO2 by SO2 with points for Type of Location

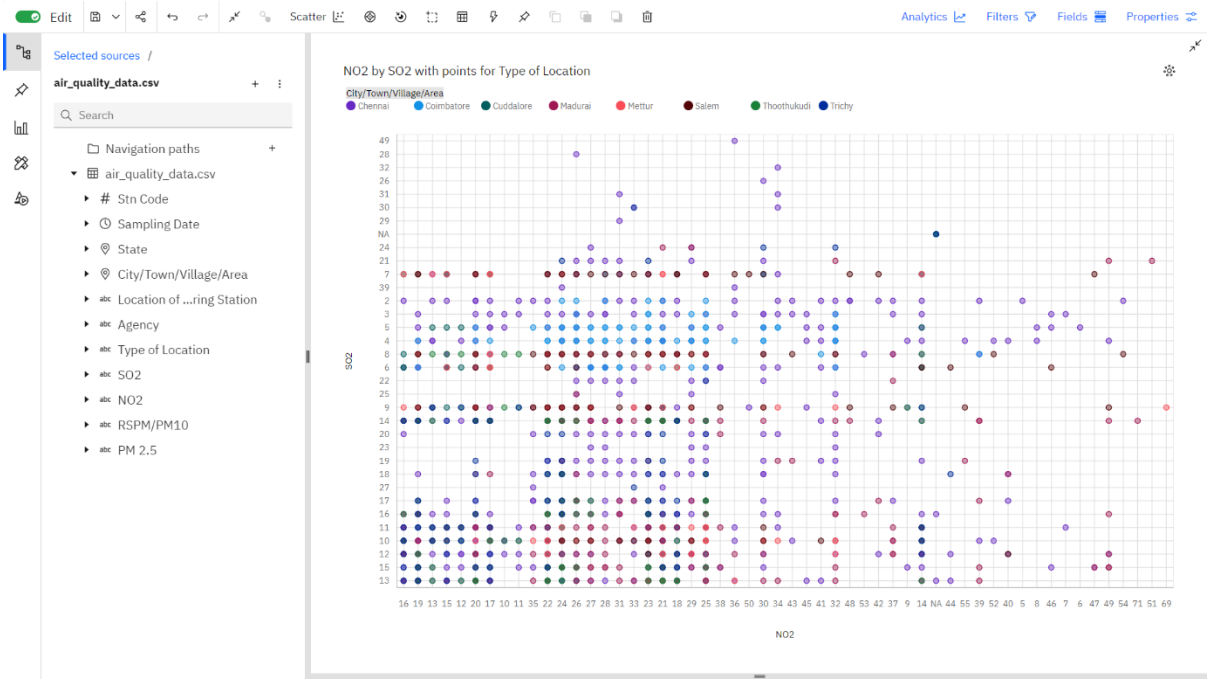
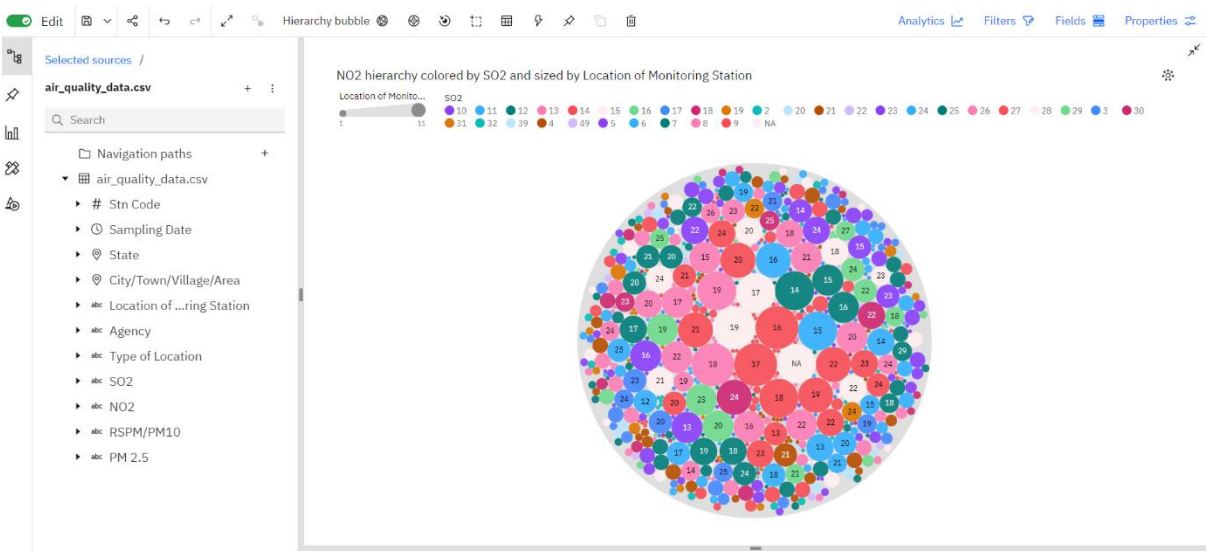


Diagram 12:

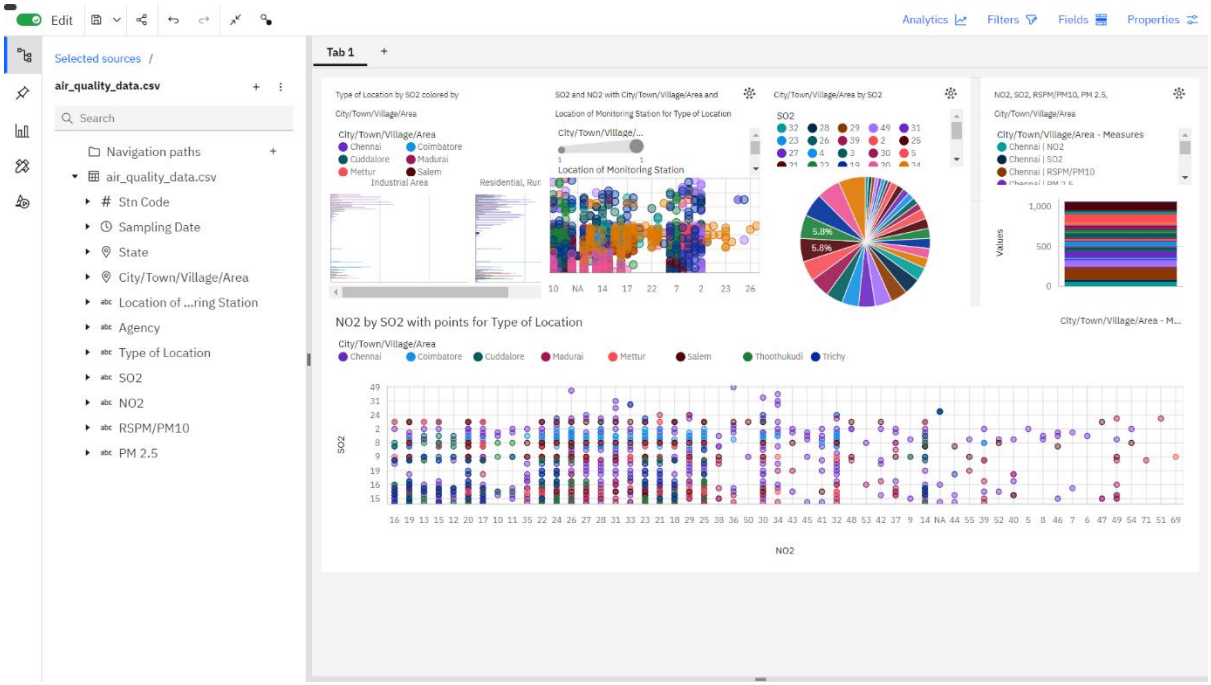
Hierarchy bubble graph using NO2 hierarchy colored by SO2 and sized by Location of Monitoring station



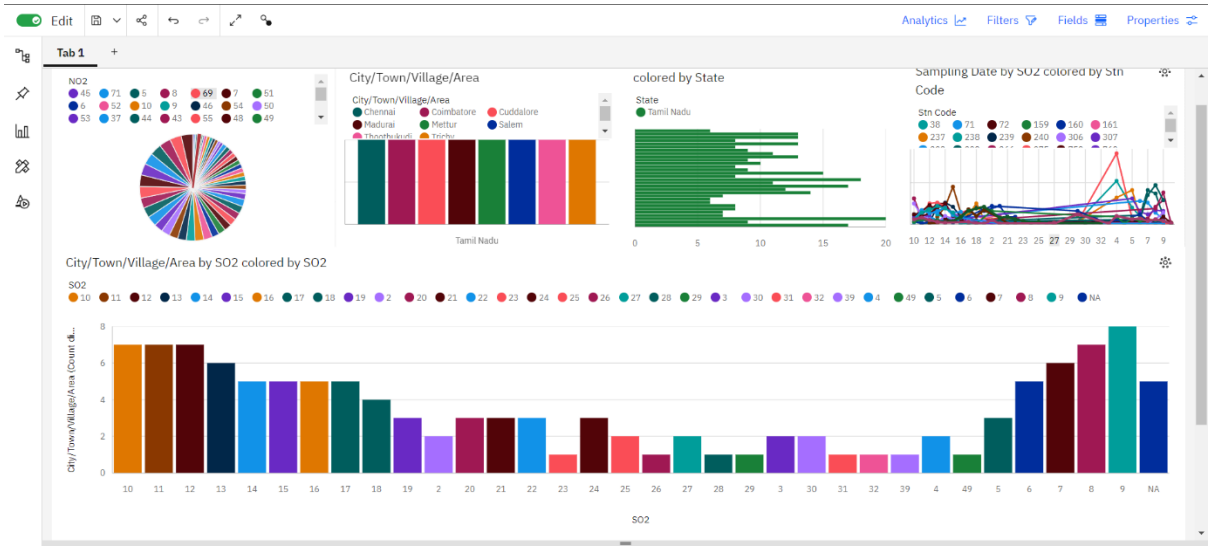
Overview :

Graph 1:

Graph 2:



Graph 3:



Conclusion:

Performing air quality analysis and creating visualizations is an integral part of addressing air pollution, protecting public health, and mitigating environmental and climate-related challenges