

Project 6: Historic Air Quality Analysis with OpenWeatherMap

Project Overview

Air quality often exhibits **seasonal** and **long-term** trends, influenced by factors like local emissions, weather patterns, and broader regional phenomena. In this project, you will use the **OpenWeatherMap Air Pollution API** to retrieve **historical** pollutant data for a chosen city or multiple cities. By examining changes over an extended timeframe, you'll uncover **seasonal patterns**, identify potential **pollutant interactions**, and see how air quality evolves beyond day-to-day fluctuations.

Objective

You will pull **historical air quality** data from the **OpenWeatherMap Air Pollution API** over a chosen period (at least several months) to investigate **seasonal** and **long-term** trends in pollutant levels. By exploring whether certain pollutants spike at specific times of year and how they may correlate with each other, you'll gain insights into the **complex interactions** that shape a city's air quality profile over time.

Major Questions for Your Proposal

1. Historic Timeframe & Location(s)

- Which **city** (or **cities**) will you study, and how far back will you gather data (e.g., 6 months, 1 year, multiple years)? Please note data are only available until 2020.
- What **seasonal** shifts do you anticipate (e.g., winter pollution peaks, summer ozone spikes)?
- Are there local events or emission sources you suspect might show up in the data (e.g., heavy traffic periods, industrial changes, fires)?

2. Data Retrieval & Analysis Approach

- How will you **access the historical endpoints** of the **OpenWeatherMap Air Pollution API**?
- Which **statistical** or **exploratory** methods (e.g., monthly averages, rolling means, correlation analysis) will you use to expose **seasonal** or **long-term** trends?
- How do you plan to handle **incomplete** or **inconsistent** data points?

3. Pollutant Interactions

- Which **pollutants** (CO, NO, NO₂, O₃, SO₂, PM_{2.5}, PM₁₀, NH₃) will you focus on, and why?
- Do you expect any **relationships** among pollutants?
- How will you test or illustrate these interactions?

4. Visualization of Seasonal & Comparative Insights

- What **visuals** (line charts, boxplots, heatmaps) will you create to highlight **seasonal** or **year-to-year** changes in pollutant levels and AQI?
- If you compare **multiple cities**, how will you display differences or similarities?
- Will you incorporate **AQI** to show overall air quality trends alongside specific pollutant fluctuations?

Project Definitions

Historic Air Quality Data

- Encompasses a series of time-stamped pollutant concentrations (e.g., CO, NO₂, O₃, PM_{2.5}) and **AQI** values.

Seasonal & Inter-Pollutant Trends

- **Seasonal Effects:** Temperature, humidity, and sunlight can dramatically alter chemical reaction rates, thus influencing pollution levels.
- **Pollutant Interactions:** For example, NO₂ and O₃ can exhibit inverse correlations under certain sunlight conditions.

Data Sources

OpenWeatherMap Air Pollution API (Historic Endpoints): [API Documentation](#)

- The API provides **historic** data for pollutants, including CO, NO, NO₂, O₃, SO₂, PM_{2.5}, PM₁₀, NH₃, and overall **AQI** starting from 27th November 2020.
- You will need an API key to access historical records.

Project Requirements

1. Data Collection

- Select **one or more** cities and define a **time period** (e.g., 6 months, 1 year, longer if available).
- Retrieve the **historic air quality** data (pollutants + AQI) from OpenWeatherMap for each relevant date/time and location.
- Store the data in a structured format and handle **missing** or **anomalous** entries as needed.

2. Analysis

- Compute **descriptive statistics** (e.g., monthly averages, daily highs, rolling means) to reveal **seasonal** or **year-to-year** variations.
- Investigate **pollutant interactions** and discuss potential reasons for these relationships.
- Compare **AQI** across different times of the year or among multiple cities, if applicable.

3. Visualization

- Present **time-series** plots (line, bar charts, etc.) to display pollutant levels and AQI over the chosen period.
- Include **boxplots** or **heatmaps** to highlight seasonal changes or pollutant correlations.
- If using multiple cities, create **side-by-side** or **layered** visuals demonstrating how different regions differ or align in terms of pollution patterns.

4. Data File

- Save the primary air quality data you used to a **csv** or **json** file.