Air Quality

CIVE 202 – Civil Engineering Analysis

Spring 2026

February 2, 2026

Table of Contents

Scope of Work

Summary

Project Goals: The goal of this project is to complete an analysis of air quality data collected from various locations across Nebraska for UNMC to help them understand how air pollution can affect human health. The client has requested four key analyses: (1) identification of the 5 locations in Nebraska with the highest mean and median measurements for components VOC, PM2.5, and PM 10.0, (2) dates when these 5 maximums occurred and their potential causes, (3) analysis of whether humidity and temperature have an effect on air quality, (4) a determination of where and when there have been any Air Quality Index (AQI) health risks, with regard to measurements of PM 2.5 and PM 10.0, and assessment of potential causes, and (5) whether the sensor altitude has an impact on the air quality values.

Task 1

What are the coding tasks?

- Group the data by location (“sensor.name”)
- Calculate the mean and median concentrations of VOC, PM 2.5, and PM 10.0 using the .agg() function
- Sort the data with the top five locations of the highest mean and median concentrations using a pivot table

What research do you have to do that involves no coding?

- What does VOC, PM 2.5, and PM 10.0 represent
- What the values of VOC, PM 2.5, and PM 10.0 represent and say about the air quality
- Why calculating the mean and median are important
- Understand why the top five areas have more concentration than others

How will you convince your client that you have the technical expertise to complete the project?

- Use terminology that aligns with Python functions
- Show familiarity with the air data and results
- Reference key sources
- Communicate results in a clear, concise manner

Task 2

Determining what days the maximum values occur and where the maximum values occur.

Coding tasks: This task takes the mean and median data in the pivot from Task #1 and extracts the dates corresponding to the maximum values in the data. This will provide data for the maximum values of PM 2.5, PM 10.0 and VOC grouped by location. Research involved: analyzing the data in the pivot table to research significance of the dates where the maximum values occurred. For this set of data there was a large correlation between holiday significance rather than weather events or other causes which can lead to poor air quality.

Task 3

Does humidity and temperature have a noticeable effect on air quality?

a. Please use the following categories for humidity:

i. Low humidity occurs at a relative humidity less than 50%, high humidity occurs at a relative humidity between 50 and 80%, very high humidity occurs at a relative humidity above 80%

What are the coding tasks?

- First create a set of if statements that filter temperature values and return a value of "below freezing", "cool", "warm", or "hot"
- This also needs to be done with humidity but with return the values of "low", "high", "very high"
- Based on these if statements, the code will add two additional columns to the dataset: "humidity_level" and "temperature"
- Next, A pivot table will be made with the rows being "humidity_level" and "temperature" and the columns to be "pm2.5_atm" and"pm10.0_atm". The maximum, minimum, mean, and median of each value will also be shown
- Then, we have to call the pivot table

What research do you have to do that involves no coding?

- What does VOC, PM 2.5, and PM 10.0 represent
- What the values of VOC, PM 2.5, and PM 10.0 represent and say about the air quality
- Why calculating the mean and median are important

How will you convince your client that you have the technical expertise to complete the project?

- Understand and be able to explain the code
- Understand statistical analysis
- Use correct terminology

Task 4

In order to determine the locations and dates with the worst AQI values, we need to compare the PM2.5 and PM10.0 values from our dataset to the limits set by the EPA. First, we will filter the data by excluding rows PM 2.5 values lower than 13.4, and then excluding rows with PM10.0 values lower than 154.

Coding Tasks

- Use a filter to set a limit on PM 2.5 values – when they were above AQI limits
- group data by location
- extract dates
- repeat for PM 10.0

Other research tasks

- define AQI
- what values of PM 2.5 and PM 10.0 are unsafe
- investigate locations and dates for potential causes of poor air quality

References

API. PurpleAir Community. (n.d.). https://community.purpleair.com/c/data/api/18

Get Air Quality Data where you live. AirNow.gov. (n.d.). https://www.airnow.gov/?city=false&country=false

U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. (n.d.). Technical assistance document for the reporting of Daily Air Quality. AirNow.gov. https://www.airnow.gov/publications/air-quality-index/technical-assistance-document-for-reporting-the-daily-aqi/

US EPA PM2.5 Air Quality Standards Interactive map by PurpleAir. PurpleAir. (n.d.). https://map.purpleair.com/air-quality-standards-us-epa-aqi?opt=%2F1%2Flp%2Fa10%2Fp604800%2FcC0#5.21/40.002/-97.008