Motivation and justification

“Atmospheric contamination is a serious concern and may be invisible to humans as it begins to build and the concentrations of contaminants may be so gradual that it goes unnoticed. Some atmospheric contaminants may continue to build up and become visible, such as smog or the “brown haze” over cities, but the atmosphere is vitally important to the maintenance of life on Earth.” [1] I started with this description of the enormous problem posed by atmospheric contamination because it illustrates why atmospheric science is one of the most critical areas in Earth sciences.

Specifically, the National Autonomous University of Mexico (UNAM) is the largest institution conducting research on air quality and meteorology in the country. In fact, the University has many research lines and a research institute focused on atmospheric sciences. Therefore, having useful information about air pollutants is crucial. “Air pollutants comprise primary and secondary air pollutants. Primary air pollutants are emitted directly from sources. They include, but are not limited to, particulate matter (PM), sulfur dioxide (SO2), nitric oxides (NOx), hydrocarbon (HC), volatile organic compounds (VOCs), carbon monoxide (CO), and ammonia (NH3). Secondary air pollutants are produced by the chemical reactions of two or more primary pollutants or by reactions with normal atmospheric constituents. Examples of secondary air pollutants are ground level ozone, formaldehyde, smog, and acid mist.” [2]

Therefore, UNAM has created a University Network of Atmospheric Observatories (RUOA). The mission of this project is “to promote research and teaching in atmospheric sciences in the country. Through interdisciplinarity and institutional cooperation, the project aims to provide relevant and reliable atmospheric information to study emerging problems and provide solutions to the challenges facing the planet in terms of air pollution, climate change, water resources, food security, among others.” [3]

One of the stations in this network is located on the UNAM campus in Morelia. This station has been monitoring the air quality and meteorology of the city for almost ten years. During those years, different research groups have developed sensors to obtain the most reliable atmospheric data. However, since May 2023, we have witnessed one of the most interesting climate behaviors in the city, country, and planet.

The main objective of this project is to analyze the data from the past year (May 2023 – April 2024) to provide useful and high-quality information about air pollutants. Specifically, the project will consist of three parts: the data cleaning and transformation process, the descriptive analysis of different contaminants and meteorological variables, and finally, some inferential tests to answer the question: which meteorological factors have a greater impact on the concentration of each of the molecules and particles that the observatory has monitored?

Bibliography

[1] Cook, J., Farmer, G. T. (2013). *Climate Change Science: A Modern Synthesis. Volume 1 - The Physical Climate*. Springer.

[2] Tan, Z. (2014). *Air Pollution and Greenhouse Gases. From Basic Concepts to Engineering Applications for Air Emission Control*. Springer.

[3] UNAM. Red Universitaria de Observatorios Atmosféricos. RUOA. Last accessed on April 18th, 2024 from https://www.ruoa.unam.mx/index.php?page=home