

Exploring the Relationship Between Atmospheric Carbon Dioxide and Temperature in Bogota, Colombia

Authors
Hanna Isaza and Maria Camila Gomez

Rochester School

What is this project about?

- Subject: Bogota's temperature changes and the factors affecting it.
- Methodology:
- filter and download CO2 atmospheric levels from 1990 to 2024
 - filter and download temperature levels from 2002 to 2023
 - Transform data to visual graphs
- Tools Used:
- mynasadata.org
- Objective: investigate the relationship between atmospheric conditions and climate change.
- Results:
- Bogota's CO2 levels rose from 375ppm (2002) to 415ppm (2023), increasing the temperature variations.
 - Traffic congestion and inefficient urban planning worsen CO2 creation, and increase the heat produced by the presence of buildings, roads, and other infrastructures that retain heat.

Motivation:

We decided to conduct this investigation because Bogota is experiencing severe droughts. This has led to the rationing of water in the city. For example, every eight days the city cuts off the water for 24 hours. This has a major influence on our daily habits and routines. During the cutoff, we are unable to bathe, cook, brush our teeth or flush toilets. Restaurants are seriously affected. As you can imagine, biosecurity protocols are also jeopardized because of decreased hygienic practices due to lack of water. Because of these reasons, we wanted to investigate the relationship between atmospheric conditions and climate change. Based on the current events described above, we proposed the following questions.

Discussion:

It is known that Earth's temperature is constantly changing, however, this occurs due to many factors, such as solar radiation, greenhouse gases, and human activities. The real question is, how does this affect Earth's temperature? It keeps getting warmer.

The fact that most of Colombia's GDP comes from agriculture and other types of land use these factors contribute to the rise of CO2 levels, and since products such as meat or products that come from agriculture have such a high demand the production should be equally balanced to comply with the necessities of production, another cause for the increase CO2 production is the fossil fuels produced and the burning of harsh materials that generate greenhouse gases such as coal, oil, and natural gas for power generation are extremely important factors that contribute to the development and growth of CO2 levels, moreover one of the biggest contributing causes is the deforestation, this is because when trees are cut down the production of oxygen is affected, because the function of trees in the environment is to absorb CO2 and provide "clean" air, so when deforestation takes place the damage caused by these different factors is even harder to "reverse" or manage.

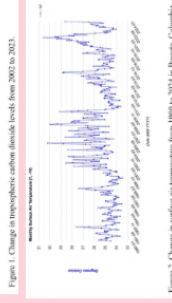
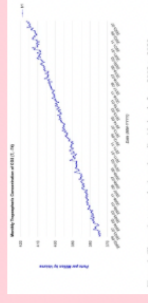
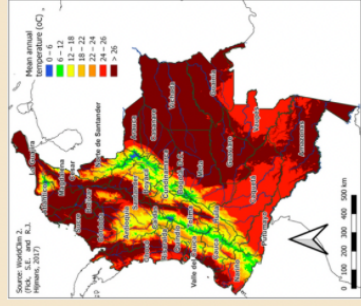


Figure 1. Change in atmospheric carbon dioxide levels from 2002 to 2023.

Figure 2. Change in surface air temperature from 1990 to 2024 in Bogota, Colombia

Results:

Figure 1 shows the change in carbon dioxide (CO2) levels from 2002 to 2023. The CO2 level in 2002 was 375 ppm. The CO2 concentration gradually increased to 415 ppm in 2023. The CO2 levels changed by 40 ppm during those 21 years. Figure 2 shows changes in surface air temperature (SAT) in Bogota, Colombia from 1990 to 2024. From 1990 to 1992 the SAT mildly fluctuated between 24.5°C and 25.5°C. The SAT spiked in 1992 to 27.5°C. From 1992 to 1998 the SAT fluctuated between 23.5°C and 25.5°C. Again the SAT spiked in 1998 to 27.5°C. From 1999 to 2010, the SAT fluctuated greatly between 25.5°C and 30.5°C. The SAT dropped to 23.5°C in 2011 and gradually increased yearly to 28.5°C in 2016. Once again the SAT spiked in 2016 to 30.5°C. The SAT gradually increased yearly to the greatest recorded SAT of 30.5°C in 2021. The SAT dropped to 24.6°C the following year and then dramatically increased to 28.5°C in 2024.



Conclusion

- From the year 1990 to 2024 there has been a significant increase in the average CO2 and temperature, this is demonstrated by various sources and the data that we collected from MyNasaData evidenced the fact that CO2 levels have been increasing, this is something that makes sense if we consider the actual amount of people and the evident increase in population. Colombia's population has grown from 32,440,069 in 1990 to an estimated 52,695,952 in 2024 (UN), demonstrating that evidently the population in Colombia is growing significantly, this causes more pollution and CO2 production because the most common way of transportation is using cars or motorcycles, these vehicles produce greenhouse gases and oxidized residues that pollute the atmosphere.
- The urbanization in Bogota has multiple issues that do not contribute to diminish the overall CO2 that is produced in the city, this is because multiple laws urge citizens to own more than one car causing traffic and therefore more pollution in the climate and as stated before the rising CO2 levels to generate higher temperatures and causing the water levels to decrease and consequently causing more issues for the daily lives of the people who live in Bogota since the multiple cutoffs affect the restaurants, the shops and even people's homes. By implementing sustainable mobility we would significantly reduce the amount of CO2 being produced. This is because if the people that usually use cars switched to these methods and the city was already implementing ecological transportation infrastructure, then the CO2 levels would diminish and the overall repercussions would be less severe.
- In Colombia, air quality may vary depending on the place. For instance, rural air quality is not the same as urban air quality. Air pollution in Colombia is a major public health concern, causing respiratory diseases such as asthma, bronchitis, and chronic obstructive pulmonary disease (COPD), as well as increasing the risk of strokes and heart attacks. The air quality varies depending on the location, it is not the same air quality in an urban area than in a rural area. This is seen to be affected by various factors, in urban places, it is common gas emissions from vehicles, industrial activity (e.g., factories), and construction sites. Rural areas are affected mainly by household air pollution (use of solid fuels such as charcoal and wood), as well as trapped gases in houses due to lack of access to clean energy sources, which leads to various respiratory system diseases (including lung infections, chronic respiratory diseases, and cancer).

Background information:

Bogota is facing severe climate changes, including rising temperatures and worsening air quality due to increasing CO2 emissions. Rapid urbanization, reliance on fossil-fuel-powered transportation, and inefficient city planning contributes to pollution to escalating pollution levels. These environmental changes impact not only the city's infrastructure but also public health, leading to deadlier cases of respiratory diseases. This study explores the correlation between atmospheric CO2 and temperature variations, emphasizing on their effects on urban development and human well-being.

Methodology:

Data Collection: CO2 levels (1990-2024) and temperature (2002-2023) in Bogota obtained from mynasadata.org. Data Processing: the data collected was filtered, transformed into a graph and analyzed through graphs to understand the trends. Comparative Analysis: CO2 trends were correlated with temperature changes, taking into account external studies.