Colombia's Eclipse Prediction Globe Project

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Abstract

This study investigates the relationship between lunar eclipses and atmospheric conditions, focusing on temperature fluctuations and CO_2 levels in Bogotá, Colombia. By analyzing past eclipse data, seasonal variations, and climate records, we observed a consistent drop in temperature (1-3°C) during total lunar eclipses, likely due to reduced atmospheric heating. However, CO_2 levels remained relatively stable, with minor variations attributed to human activity rather than the eclipse itself. Using historical trends, we predicted the atmospheric impact of the upcoming March 14, 2025, lunar eclipse, forecasting a temperature drop to approximately 8°C and CO_2 levels of ~423 ppm. These findings contribute to understanding how celestial events influence local atmospheric conditions.

Research Question

Asking Questions

- What are some similar atmospheric conditions caused by eclipses?
- How do eclipses affect energy production of PV cells?
- How does an eclipse affect the physiological state of people?

Introduction

Why did you choose to investigate this? What was the personal interest?

- I have always been interested in space and astronomy. My older brother had a telescope when we were little. I remember when I was four years old and my brother showed me the moon using his telescope. My father would always watch movies about space. I remember the movie about Apollo 11 with Tom Hanks. The move was intense and demonstrated that space is romantic but also very dangerous and must be respected. Stars have always fascinated me because of their immense distances from Earth and when you look at a star you are looking back in time.

Research Methods

Planning Investigations

1. We compiled a table of past months of lunar eclipses. We focused on dry and rainy seasons. For example, we chose months that had exceptionally high or exceptionally low rainfall.
2. We then researched the change in carbon dioxide levels since 2022.
3. We then researched the change in temperature in Bogota during dry and rainy seasons.
4. We then investigated the change in temperature during lunar eclipses.
5. Based on the analysis of the data mentioned above, we made predictions about future atmospheric conditions during lunar eclipses.

Figure 1. Timeline of past Total lunar eclipses in Colombia

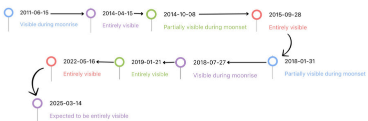
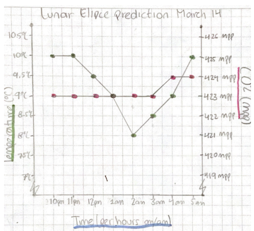


Figure 2. Graph predicion of CO2 and tempeture.



Discussion

Analyzing Data

- Bogotá's Climate: Bogotá is already cold, with average nighttime temperatures ranging from 7°C to 12°C, depending on the time of year. In March, temperatures can dip slightly due to local weather patterns or astronomical phenomenan. For example, total lunar eclipses can lower surface temperatures temporarily, especially during the totality phase, due to the lack of direct moonlight and reduced atmospheric heating. Es changes in CO2 are more gradual over months, with small daily fluctuations due to human activity, vegetation cycles, and weather.
- 2. Estimate for Temperature and CO2 Levels
- Before the Eclipse
- • The nighttime temperature in Bogotá is likely around 10°C (typical March average).
- • CO2 Levels: Based on current global trends (rising ~2.5 ppm per year) and Bogotá's urban profile, CO2 levels could be 423 ppm, extrapolated from recent averages.
- During the Eclipse
- • Temperature Drop: During the eclipse, temperatures could dip by 1-2°C, reaching 8-9°C, especially during totality (1:26 AM - 2:31 AM). This drop occurs because the Earth's shadow blocks sunlight, reducing surface heating further in an already cold environment.
- • CO2 Levels: These will remain stable at 423 ppm, as CO2 isn't directly affected by eclipses but fluctuates minimally due to nighttime cooling and local emissions.
- After the Eclipse
- • After totality ends and the moonlight gradually returns, temperatures might slowly rise again to 10°C by early morning, as natural atmospheric patterns resume.
- • CO2 Levels: Minor local variations could cause a slight increase (from morning traffic or human activity), but it will likely stay close to 423-424 ppm.

Figure 1. Relationship between months with eclipses and average surface CO2.

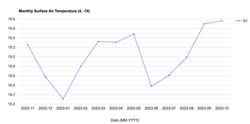
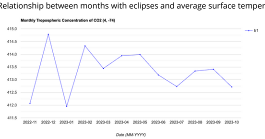


Figure 2. Relationship between months with eclipses and average surface temperature.



Results

Interpreting Data

WHY IS IT COLDER DURING ECLIPSES?

The temperature drop during lunar eclipses is due to a reduction in atmospheric heating and moonlight intensity. However, CO2 does not cause this drop directly—it mainly traps heat, contributing to overall warming. The observed anomaly in some eclipses might involve weather conditions like cloud cover, wind patterns, or additional cooling mechanisms amplified by high-altitude cities like Bogotá. Finally we concluded that during the totally it will reach the 8°C and ~423ppm.

DOES BOGOTA HAVE MORE COLDER MONTHS THAN OTHER?

Colombia, including Bogotá, experiences temperature changes throughout the year, even though it is located near the equator and lacks distinct seasons like summer or winter. These variations are typically subtle and influenced by the rainy and dry seasons rather than drastic seasonal temperature changes.

Bogotá's Temperature Changes Across Months:

1. Dry Seasons (January–February, July–August):

• Slightly warmer temperatures during the day (highs of 19–20°C).

• Nights remain cool (lows of 6–8°C).

2. Rainy Seasons (March–May, October–November):

Conclusions

With the data of previous eclipses we were able to make a little prediction of the temperature and CO2 ('cause based on global atmospheric the CO2 increases about 2.3 to 2.8 ppm annually since 2022, we also needed to take into account that Bogotá's average temperature is around 13°C (58°F) all year, with temperatures ranging from 10°C (50°F) to 18°C (64°F). The temperature can be influenced by the CO2 levels or if it's on dry or rainy season.)

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