Atmospheric Aerosols

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Abstract

My research is about aerosols. The term aerosol is a generic way to describe many kinds of little bits of particles that end up suspended in the atmosphere. My research question asks if there is a difference in the amount of aerosols in urban or rural locations. I went to the Purple Air website and found the average aerosols for each day. The results were that there were more aerosols in urban areas. My conclusion is that, even though my hypothesis was incorrect, I still learned that aerosols are an important part of our world.

Question/Hypothesis

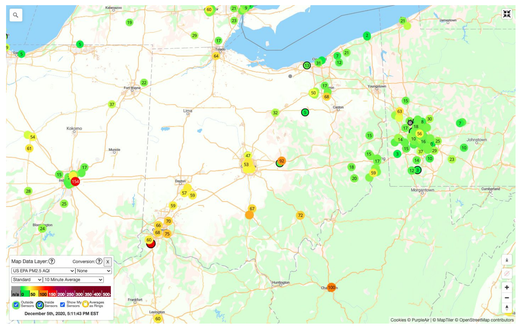
Asking Questions

In class we learned about aerosols, and I wanted to find out more about them. So, my research question asks if there a difference in the amount of aerosols in urban or rural areas. My hypothesis is that there are more aerosols in rural areas. I am interested in researching this topic because it seems very interesting how particles are in the air all around us. I could use data from the GLOBE website's visualization map. This question is important and of scientific interest, because we need to know what we're breathing everyday. This question addresses local and global communities because we all breathe the same particles in the air. Everywhere you go, there are little particles floating in the air. It turns out that aerosols are actually cooling, or reflect the sun's energy back into space. This plays a big part in our environment because that aborted energy is transformed into heat energy, and this heat energy plays a pretty big part in regulating the earth's crust temperature, surface waters, and lower atmosphere. There is only one aerosol that contributes to climate change, which is called soot or more known as black carbon. I have not found much research on this assignment, so I am excited to see the results.

Introduction

Content Knowledge

Aerosols are a big part of everyday society today, but let's start with the basics. An aerosol is a suspension of fine solid particles or liquid droplets in air of or another gas. The scientific understanding of aerosols are important because of the scattering and absorbing of light by atmosphere aerosols, and also by clouds that are modified by aerosols, impacts the earth's radiation balance resulting in cooling (from scattering) or warming (from absorbing) at the earth's surface. Aerosols can also degrade visibly and are harmful to human health. What I know about the topic of aerosols is that they are particles that float in the air around us. A big environmental and society issue caused by aerosols is global warming. Part of the reason for global warming is air pollution which part of that air pollution is aerosols. I know that this experiment contains globe protocols. The definition I got for aerosols was found on NASA.gov, which I found very helpful. I'm excited for the journey ahead and stoked to see the results.



Research Methods

Planning Investigations

Describes the planning process

I am going to be collecting data of the amount of aerosols in the air in the town of Beallsville, Ohio and at Wisemen Hall at Ohio State University in Columbus, Ohio for 5 days, from the "Purple Air" website. Purple Air is a website where you can find aerosol traps with aerosol collection data from all over the world. Purple Air provides a number for the amount of aerosol particles collected by traps, and also presents the information on a color-coded spectrum. I was planning on doing aerosol traps myself, but there was too much precipitation to do so. So, purple Air was my second option. I selected Beallsville because it is a rural Ohio community, and Wisemen Hall because it is an urban area in Columbus. The independent variables are the days data were collected, and the amount of aerosols. The dependent variable is Wisemen Hall and Beallsville. The average temperature of Ohio in December, when this experiment was conducted, is 32-degrees Fahrenheit. There was significant rain and snowfall on the first two days of this experiment. This was important to know because aerosols are affected by climate and affect the climate as well. They influence climate in two primary ways by changing the amount of heat that gets in or out of the atmosphere, or by affecting the way clouds form. Because I did this whole process online the materials I used was a computer, the Purple Air website, paper, and pencil.

Carrying Out Investigations

Describes what *actually* happened

The GLOBE protocols related to Atmosphere that I used were aerosols and air temperature. I collected a total of two data points, one in a rural area and one in an urban area, for five days. Every evening for five days, I checked the Purple Air website. I would look up Beallsville, Ohio and check the 24-hour average aerosols and its color category. I would then record the data using paper and pencil. I did this for five consecutive days. Then, I went through the same process for Wisemen Hall . I followed the GLOBE protocols for all of the data collection activities. The average aerosols for Rural was 40.8, and the average aerosols for Urban was 72.8. I found the average by adding the data collected during the five-day period and then dividing by 5. This data can be found in Figure 2 and 3. The data collected for each site will show how the aerosol levels in a rural area compare to those in an urban area.

Figure #1

Beallsville

Wisemen Hall

Results

Analyzing Data

My research question asked whether there would be more aerosols in urban or rural areas. As shown in my data table, the aerosol measurements were higher on day one and two in Beallsville, but they were higher at Wisemen Hall the other four days. On day one and day two, the aerosol levels were similar; however, on days three through five, the aerosol levels were significantly higher at Wisemen Hall. The reason I chose yellow and red on the data tables was to represent the aerosol level color coding system in Purple Air. While the colors changed on certain days, depending on the aerosol measurements, the data tables reflect the color coding of each data set's average. A summary of my results show that there are more aerosols in the urban city than in the rural area.

Figure #2

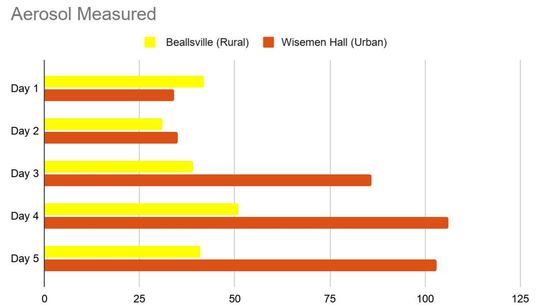
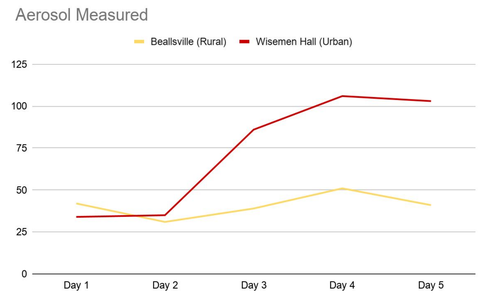


Figure #3



Discussion

Interpreting Data

The most important results are that there were more aerosols in urban Wiseman Hall, Columbus than in rural Beallsville. The results seem to suggest that aerosols are greater in urban locations than in rural areas. My data is limited to two locations and a short period, but other scientific studies have shown the same results. According to NASA, "Aerosols interact both directly and indirectly with the Earth's radiation budget and climate." There are three primary types of atmospheric aerosols; volcanic aerosols, desert dust, and human made aerosols. The major component of human made aerosols come in the form of sulfate aerosols created by the burning of coal and oil. At current industrial production rates or levels, human made aerosols are thought to be much greater than the naturally produced aerosols. The warming effect of greenhouse gases takes place everywhere, but the cooling effect of pollution aerosols is greater in urban and industrial areas. This is basically why the results are what they are. The importance of this study reflects what other studies have shown. Human made aerosols impact climate change. According to National Geographic, "Overall, humans have increased the total amount of particles floating around in the atmosphere, which is about twice as dusty now as it was in the 19th century. The amount of very fine material… has increased by something like 60 percent since before the Industrial Revolution. Other aerosols, like ozone, have also increased- with dramatic health impacts around the world."

Conclusions

Drawing Conclusions & Next Steps

In conclusion, with the data I received, I found that there are higher rates of aerosol levels in urban areas than rural areas. Like I said in the results, aerosols seem to be greater in areas with more industry and pollution, which are found more in urban areas. I reached this conclusion based on data and comparing other studies to mine. I predicted in my research question that there would be more aerosols in rural locations. As you can tell, I was very incorrect. There were a lot of improvements that could have been done like measuring more sites for a longer period of time, varying climates, and being more efficient. In future research, you should do all the improvements previously stated. In conclusion, I may have not been right, but I learned a lot about the relationship between aerosols pollution and climate change.

Bibliography

References

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