The Interaction of Day Temperatures and Night Sky Visibility

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THE GLOBE PROGRAM
Global Learning and Observations to Benefit the Environment

Abstract

This project aims to fill a gap in understanding of sky visibility during the night. More specifically, How do temperatures during the day correlate to night sky visibility? I will be using traditional methods like recording temperature and using a data sheet to analyse clouds during the day, but I will also be using more unconventional methods, like going into archives of a website to find the specific visibility data of a specific day after it has passed. the results proved that the peak of visibility was when the temperature was around 50 degrees and the lowest visibility was when the temperature was high around 70. This means that the visibility is related to temperature, but the trend is not perfectly linear.

Research Question

Asking Questions

- Explains why this is an important question and of scientific interest
- Involves an aspect of Earth's environment about a local or global issue
- Considers ideas that previous investigations did not address
- Reflects in-depth knowledge of the content area
- Question is clearly stated
- Are answerable through scientific research appropriate to the scope of the report (i.e., scientifically testable)

How do temperatures during the day correlate to night sky visibility?

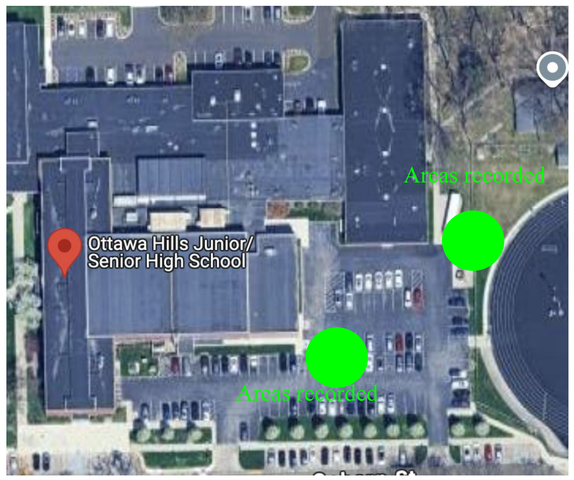
Introduction

This research was prompted by a hole I saw in data for stargazers. I wanted to know the patterns between temperature and night sky visibility so that it could be easily predicted on a day-to-day basis. More specifically, how do temperatures during the day correlate to night sky visibility? Scientific articles have been written about night sky visibility and how to measure it, but none seem to directly analyze temperature and night sky visibility. Having this particular information would be extremely helpful not just for civilian stargazers, but for people like pilots and astronomers so that they can be able to provide the visibility of the nighttime during the day with essential measurements. I believe that if the temperature changes then the night sky visibility will also change because depending on a certain temperature, more or less water particles on the ground evaporate, like fog. If the temperature is higher, then the number of particles will be more, making visibility lower.

Research Methods

Planning Investigations

The land used for the research is the outside of the high school building. I observed the sky while facing the football field so that I would have a clear view of the sky during wintertime. I used the GLOBE protocols Air Temperature and Clouds. Every day that was recorded, I found the temperature outside using our classroom weather reporter. I used the Globe issued cloud observation form. Each collection was around the same time of day once almost every week. The information from night sky visibility was collected later in the experiment from timeanddate.com's archives for planet visibility.



Results

Analyzing Data

To find the relationship between temperature and visibility, multiple sources would have to be found. I used my temperature data collections and weatherunderground.com's temperature data archives to provide an average temperature for each day that I recorded. This provided a much more accurate number. Next, I found the archived night visibility data from timeanddate.com. The data I used came from the planets mercury, venus, mars, jupiter, saturn, uranus, and neptune. I created a scale based on what I observed in the data, with numbers starting from 1 and going to 7 in this order of visibility: extremely hard, difficult, fair, average, good, great, and perfect. Each planet was measured on this scale and the average was found for the day. Both the temperature and visibility were plotted onto a line graph to see the trends. The data suggests that the peak of visibility was when the temperature was around 50 degrees and the lowest visibility was when the temperature was high around 70.

Figure #1
Example of Temperature Data

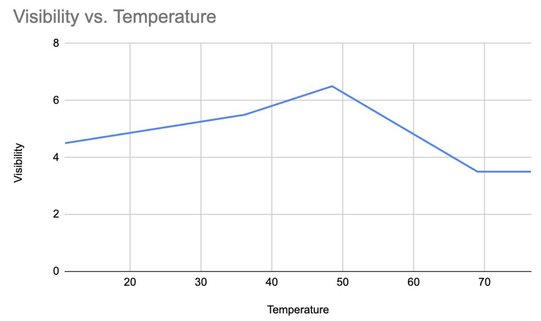
11/26/24 Visibility: 10 mph

6:52 PM	38 °F	24 °F	57 %	WSW	16 mph	0 mph	29.43 in	0.0 in	Fair
7:52 PM	37 °F	23 °F	57 %	SW	13 mph	0 mph	29.43 in	0.0 in	Fair
8:52 PM	36 °F	24 °F	62 %	SW	13 mph	0 mph	29.43 in	0.0 in	Fair
9:52 PM	36 °F	24 °F	62 %	WSW	9 mph	0 mph	29.43 in	0.0 in	Fair
10:52 PM	35 °F	24 °F	64 %	WSW	10 mph	0 mph	29.43 in	0.0 in	Fair
11:52 PM	35 °F	24 °F	64 %	WSW	9 mph	0 mph	29.43 in	0.0 in	Fair

Figure #2
Example of Visibility Data

Planet	Rise	Set	Meridian	Comment
Mercury	Wed 9:05 am	Wed 5:59 pm	Wed 1:32 pm	Difficult to see
Venus	Tue 11:00 am	Tue 7:55 pm	Tue 3:27 pm	Good visibility
Mars	Tue 9:17 pm	Wed 12:04 pm	Wed 4:41 am	Perfect visibility
Jupiter	Wed 5:42 pm	Thu 8:36 am	Thu 1:09 am	Perfect visibility
Saturn	Tue 1:37 pm	Wed 12:39 am	Tue 7:08 pm	Great visibility

Figure #3
Inclusive Line Graph



Discussion

Interpreting Data

These results show the most accurate relationship of temperature and visibility of the general area of the recordings. My hypothesis was that if the temperature changes then the night sky visibility will also change because depending on a certain temperature, more or less water particles on the ground evaporate, like fog. If the temperature is higher, then the number of particles will be more, making visibility lower. This hypothesis was true for the most part, but inconsistencies with the data were shown at the beginning of the graph. I believed that the visibility would be best with lower temperatures, meaning that the graph would start at a higher x axis and eventually travel lower. However, the graph started around the middle for visibility and continued to go up until it reached around 50 degrees. This means that the average visibility goes up from around 0 degrees to 50 degrees, then declines even further than the initial visibility rating. This experiment could have been bettered by having more days to collect data to have better averages, and the experiment is only relevant to the specific location of experimentation. The data also could have been taken more reliably, with my own field work being used instead of finding the visibility ratings online for the area. Overall, having more days to collect the data and doing so with my own data would create a much more accurate and powerful result.

Conclusions

Drawing Conclusions & Next Steps

All in all, the hypothesis was proven correct, but was also added to through the introduction of an unpredicted trend at the beginning. The methods could be improved by gathering more data in general to have more accuracy or holding a longer experiment. If this experiment was to be recreated, these changes would have to be put into place for the best accuracy. Follow-up research can be easily added, considering that the experiment can be recreated easily on any day. Future research may also want to use more data sets and protocols, like the cloud data during the day and temperature during the night to add more variables and improve accuracy.

Bibliography

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Worked with Rafaela Marson to collect data and formulate research question