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Introduction

Temperature to Night Sky Visibility

We all have questions that sometimes we think that can't be answered. For example, how did the world begin? Is space really infinite or is there an end? How is there not an end? Although science cannot prove some things, there are others that it explains. The Solar System, rotation of the planets, gravity, stars, light, energy, everything is science. Much research has already been done and much more will be done, and perhaps a question that was unanswered today can be answered in the future. In that regard, we also wanted an answer to our own question, so we did some research. This research was prompted by a hole we saw in data for stargazers. We 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. Here, a scientist analyses the correlation between cloud cover and night sky glow due to pollution. “As the cloudiness increases in light-polluted areas, the brightness of the night sky glows also increases. In areas free of this type of pollution, the cloudy sky is darker than the cloudless one,” (Ścieżor, 2020). 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. We 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.

Because of a gap in specific research, we decided to find our own methods for temperature and visibility measurements. Although we could not utilize a physical Sky Quality Meter Lens, there were multiple alternative methods. We chose to look into the “Planets Visible” archive from *timeanddate.com* “The header on the Night Sky page shows the current Moon phase, along with information about the night time at your location.”. This website provides a clear and accurate reading of specific data such as date, time, location, and graphs. Looking into the registers gives us opportunities to compare our temperature readings with the visibility in the sky from that night without having to record extra data.

Methods and Materials

To make the analysis of the clouds, we collected our data with the Sky Color and Sky Visibility, Cloud and Contrail Type, Cloud and Contrail Cover, Cloud and Contrail Visual Opacity Field Guides and Cloud Protocol Data Sheet from [globe.gov](https://www.globe.gov) one day of a week for a month; We used a cloud identification tool to help us measure the different types of cloud and color of the sky to fill out our data with the guided sheets. We also had to measure the temperature of the day with the [weather underground](https://www.weatherunderground.com), the visibility by looking at the trees and seeing how much and if there was fog and what the soil was like at the days of the to collect data. For each data collection process, we marked the time and date of the procedure carried out in a

separate document. Once this data is made, then we can compare it with the website wunderground.com which helps us with the information of the visibility and temperature of the day night.

Data and Results

Since the purpose of our research is to find out how the temperature of the day affects the visibility of the night sky, we collected our data on daylight and with the website wunderground.com we compared the temperature and visibility of the sky at night on the days we collected the data respectively.

Days we collected our data: fall

11/13/24

Temperature at daylight: 40°F

Visibility at daylight: 10 mph

Night Measurements:

Time	Temperature	Dew Point	Humidity	Wind Speed	Pressure	Condition
6:52 PM	49°F	31°F	50%	10 mph	29.46 in	fair
7:52PM	49°F	30°F	48%	6	29.45 in	fair
8:52PM	49°F	29°F	46%	6	29.42 in	fair
9:52PM	49°F	29°F	46%	3	29.39 in	Mostly cloudy
10:52PM	48°F	31°F	52%	7	29.35 in	Partly cloudy

11:52PM	47 °F	32°F	56%	8	29.32 in	Cloudy
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Visibility of Planets:

Planet	Rise	Comments
Mars	9:57pm	Perfect visibility
Saturn	2:28am	Great visibility
Neptune	2:57am	Difficult to see

Clouds:

Solar Measured At:2024-11-13T11:34:00

Cloud Cover:none

Sky Visibility:unusually clear

Sky Color:light blue

Dry Ground:true

Data Source:GLOBE Observer App

The day we collected our first data (11/13/24) at daylight the sky is pretty visible, with a few clouds, light blue color. The temperature at the day was around 40F and humidity of 50% making the thermal sensation the same as the actual temperature. On the other hand, at night, after the sunset, with the temperature about 49F, there are on average a lot of clouds in the sky, but the visibility of the planets are pretty clear.

11/26/24

Temperature at daylight: 46°F

Visibility at daylight: 10 mph

Night Measurements:

Time	Temperature	Dew Point	Humidity	Wind Speed	Pressure	Condition
6:52 PM	38°F	24°F	57%	16 mph	29.43 in	fair
7:52PM	37°F	23°F	57%	13	29.43 in	fair
8:52PM	36°F	24°F	62%	13	29.43 in	fair
9:52PM	36°F	24°F	62%	9	29.43 in	Fair
10:52PM	35°F	24°F	64%	10	29.43 in	fair
11:52PM	35°F	24°F	64%	9	29.43 in	fair

Planet	Rise	Comments
Venus	7:55pm	Good visibility
Mars	9:17pm	Perfect visibility
Saturn	1:37pm	Great visibility
Uranus	4:25pm	Average Visibility
Neptune	2:06pm	Difficult to see

Clouds

Solar Measured At:2024-11-26T11:26:00

Cloud Cover:broken

Cumulus:true

Stratocumulus:true

Cloud Cover Low:broken

Opacity Low:translucent

Dry Ground:true

Data Source:GLOBE Observer App

The day we collected our second data (11/26/24) at daylight the sky was about the same as the first one with few clouds. However the temperature of this day was lower- around 46F with humidity of 60%. At night, there were a fair amount of clouds in the sky and the temperature fell to 38F. The visibility of the planets are still good and perfect taking of Neptune which was hard to see.

12/05/24

Temperature at daylight: 25°F

Visibility at daylight: 10 mph

Night Measurements:

Time	Temperature	Dew Point	Humidity	Wind Speed	Pressure	Condition
6:52 PM	25°F	23°F	92%	14 mph	29.59 in	Light snow
7:52PM	25°F	23°F	92%	14	29.59 in	cloudy
8:52PM	21°F	19°F	92%	8	29.65 in	cloudy
9:52PM	21°F	19°F	92%	8	29.65 in	Fair
10:52PM	21°F	19°F	92%	8	29.65 in	fair
11:52PM	19°F	18°F	96%	7	29.65 in	fair

Planet	Rise	Comments
Venus	11:02am	Good visibility
Mars	8:44pm	Perfect visibility
Saturn	1:02pm	Great visibility
Uranus	3:48pm	Average Visibility
Neptune	1:30pm	Difficult to see

Clouds:

Solar Measured At:2024-12-05T11:24:00

Cloud Cover:overcast

Altostratus:true

Nimbostratus:true

Stratocumulus:true

Cloud Cover High:overcast

Cloud Cover Mid:overcast

Cloud Cover Low:overcast

Opacity Mid:opaque

Snow / Ice:true

Raining / Snowing:true

Data Source:GLOBE Observer App

The day we collected our third data (12/05/24) at daylight the sky was overcast and opaque and was snowing. The temperature was about 25F. At night the temperature was the same as the day with light snow and cloudy with a humidity of 90-95% making the thermal sensation much colder than it would be. The planets were very visible, but the same as the second day, Neptune was difficult to see.

Discussion

What is the visibility of the sky at night: To study the night sky visibility of the planets, stars and moon it is necessary to have an understanding of two factors to have a clear or not sky, the temperature of the daylight and the clouds. The clouds are vapor water condensed. Depending on the temperature of the day, it will be more cloudy or not the sky. On hot days that the temperature is higher, more water will condense making more clouds in the sky. That means that on winter days, the visibility of the sky at night has to be cleaner than on hot days.

Conclusion

Our hypothesis is correct. The temperature of the day lights affects directly with the visibility of the sky at night. The visibility of the sky at night is the amount of clouds present, making it difficult or easier to see the stars, planets and the moon. If the sky has a larger amount of clouds at night, it means that the temperature of the daylight was higher. That is caused because the water of rivers, oceans and water reserves evaporates with the temperature-condensation making it expand in the air causing more clouds to be in the sky.