Clouds and Their Effect On Surface Temperature

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THE GLOBE PROGRAM
Global Learning and Observations to Benefit the Environment

Abstract

We predicted that if there are lower level clouds present then the surface temperature will be colder because lower level clouds reflect heat from the sun and prevent its rays from getting to the ground. Based on the data shown later in our presentation, we were correct. We performed our experiment using the GLOBE Atmosphere Investigation Cloud Protocol Data Sheet, a thermometer, and a computer to record the data. We can conclude because of our research that low level clouds work to create a colder surface temperature, while high level clouds do the opposite, making a warmer one.

Research Question

How does the amount of high, middle and low level clouds present in the sky affect the surface temperature measured?

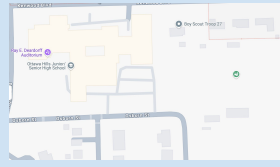
Introduction

Rain, snow, hail, sunny, and cold days. Where does weather influence come from? When we were asked to explore one of the biomes, one specifically stood out to us: the atmosphere. The atmosphere plays a huge role in human life, influencing all biotic factors on earth. When diving deeper, clouds and their influence on surface temperature became our main focus. So the question remains: How does the amount of high, middle and low level clouds present in the sky affect the surface temperature measured? If there are lower level clouds present then the surface temperature will be colder because lower level clouds reflect heat from the sun and prevent its rays from getting to the ground.

Research Methods

Planning Investigation

Our experiment site was Ottawa Hills High School in late fall and early winter seasons
irst, we gather all needed materials (computer, ThermoWorks thermometer, GLOBE Atmosphere Investigation Cloud Protocol Data Sheet)
All materials were provided in the classroom in labeled bins.
We made sure that the thermometer was in Celsius and our GLOBE sheet was secured on a clipboard.
We went during lunch around 11am-12pm because it was the time that worked best for both of us and when we could best access needed materials.



Carrying Out Investigations

***Make sure that you are dressed appropriately for the weather that day as you will be outside for a while.**
Heading outside we start recording information on the type of clouds present in the sky with one of us using the GLOBE Atmosphere Investigation Cloud Protocol Data Sheet and scanning the sky telling the other what to record. We begin with determining clouds as either high, medium and low level. We then look at the number of contrails and if it is clear or foggy. Then we look at the color of the sky and see if it is dark blue, blue, light blue, or near white. Last on our chart, we look at how much of the sky is covered by clouds and what type of clouds are present.
Then, we walk around the parking lot and take 3 temperatures from therewith the ThermoWorks infrared surface temperature thermometer. We would repeat this for our two other sites, the track and astroturf.
***Make sure your arm is facing straight out with the thermometer pointed straight down at the ground and DO NOT point the thermometer at other people, especially towards the eyes.**
After that we record the temperatures we got in our data table on the computer
Finally we head inside.
We did 6 of these trials over about 1 month.

Globe Badges

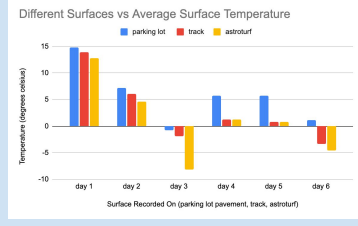
Be a Data Scientist

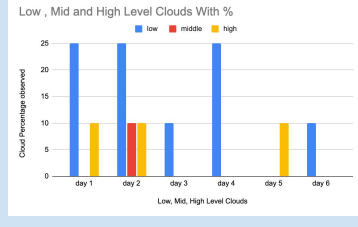
Be a Collaborator

Results

Analyzing Data

Our findings suggest that our initial hypothesis: If there are lower level clouds present then the surface temperature will be colder because lower level clouds reflect heat from the sun and prevent its rays from getting to the ground was consistent with our data. The clouds and temperatures lined up as we thought they would. When higher and mid level clouds were present the temperature tended to be higher, whereas with lower level clouds the temperature was colder. These patterns follow what we predicted to happen very accurately. We believe that we received these results because of how distinct cloud levels have different effects on temperature. Our research says that higher level clouds are thinner and trap the sun's heat as it bounces back off of the earth. This trapped heat warms up the surface temperature. However, low level clouds have the opposite effect as they are thicker and block rays of sun from hitting the surface in the first place. This effectively cools the surface temperature in that covered area. Our experiment was sound but we did have one outlier where higher level clouds were present and it was above 5. But we believe this is due to the difference in season, as when we started it was warmer fall weather but as we continued into winter there was a new "high temperature" for the colder weather. Our results very accurately tested our hypothesis and proved it with lots of evidence of trends/patterns.





Discussion

If we were to do this experiment again we would gather data across more days to get more defined trends. Maybe spanning across a whole year (if we had the time) to see different cloud patterns and their effects on seasonal temperature. Our findings are consistent with other research we have found, matching the idea that low level clouds cool and high level warm the surface temperature. Our research is important because it can be used to help predict weather patterns. This is useful because it aids many people (meteorologists, researchers,etc.) in long term patterns, tracking any occurring changes, and making informed decisions based on these patterns. If we were to do a further study we might look at how these temperatures caused by cloud coverage affect people's health. As we have stated in our introduction, during our research we looked deeper into urban heat islands. If we were to further investigate we might do an experiment with our surrounding areas and see how our community is affected by this.

Conclusions

Based on our data we can conclude that low, mid, and high levels of clouds do influence surface temperature. Other research from National Geographic has proved that high level clouds help to heat the Earth, allowing sunlight to penetrate the sky and prevent heat from escaping. Along with this, low level clouds have been found to reflect heat from the sun back into space, keeping Earth's surface temperatures cool. Our data showed this because on the days that only low-level clouds were present, colder surface temperatures were present. However on days that high and mid level clouds were present along with low level clouds, the temperature was warmer. It is commonly believed that all clouds cause colder temperatures, but based on our data and research this statement is false.

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