Air Temperature V. Soil Temperature
Ottawa Hills High School

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Abstract

This report and research was performed to discover the relationship between the temperatures of soil and air and how they affect each other. Throughout our experiments, we noticed very few discrepancies. The air directly affected the soil temperature as its own temperature fell throughout the season. During the founding of our first ideas, we had believed that the air temperature would critically affect the soil temperature. We followed strict and precise procedures to collect our data, surveying similar spots in the ground each time we collected the soil temperature. Our results did indeed confirm said hypothesis. The results stated that the air temperature affected the soil temperature directly. This allowed us to draw conclusions that as the air temperature raised or lowered, the soil temperature would follow similar trends of changing temperatures.

Research Question

- How does air temperature affect soil temperature?
- Our hypothesis was if air temperature decreased or increased, the soil temperature would follow the same trends

Introduction

On some clear sunny days, the ground temperature will be much warmer than the air temperature. On the contrary, clear days during the winter can result in ground temperature being much less than the air temperature (Cliff Mass Weather Blog). The conditions of the weather can greatly affect how the temperatures of soil and air change with each other. We made sure to measure the differences in soil and air temperature. Before our tests, we made sure to question how the two temperatures might affect each other; How does air temperature affect soil temperature over time? After doing some research, we found that many studies came to the same conclusion, that air temperature correlates well with soil temperature (University of Montana).

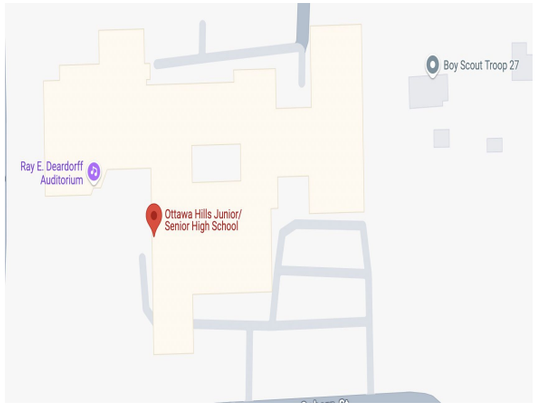
During our temperature tests, we formed the hypothesis that the soil temperature will increase in direct proportion to air temperature, with higher air temperatures leading to higher soil temperatures. We believed this as we saw a quote by a Purdue University Extension corn specialist Bob Nielson "It's all about the sun hitting the soil surface" (Farm Progress). We also read about how heat conduction is the reason air temperature is related to soil temperature. We read that heat conduction, in this case the transfer of heat from the air to the soil and vice versa, is dependent on air–soil temperature gradients (Science Direct). Another interesting fact we found from the New Jersey Agricultural Society is that soil does a much better job of storing heat than air does. The heat is trapped by many different variables like vegetation, snow, and the top of the soil. This insulation also increases as the depth of the measurements increase. This is actually how most creatures tend to survive during the cold winters; The heat trapped by all of the variables keeps the organisms warm (New Jersey Agricultural Society).

Research Methods

You will need a thermometer that will measure soil temperature, a thermometer to measure air temperature, and a recording sheet for the data

Procedure:

1. Check the air temperature on the thermometer or any device that the temperature is displayed on
2. Record the data in the day 1 box
3. Repeat for however many days you are composing this experiment
4. Grab a Lavatools Javelin® PRO Duo Ultra-Fast 1-Second Professional Digital Instant Read Thermometer and locate a general area of soil to measure
5. Stick the thermometer into the chosen area and let it sit for a few seconds
6. Once the thermometer has measured a stable temperature after sitting, record the measurement into the table
7. After the first measurement is recorded, locate a new spot in the general area of the first measurement and repeat steps 5 and 6
8. Repeat the soil temperature measurement steps until the desired amount of measurements have been made and recorded
9. Use this same procedure the next day measurements are taken and recorded, putting the data into the correct day box



Our tests were located near the senior parking lot of Ottawa Hills High School. We measured the temperatures of the grass plots around the parking lot to get our results.

Results

Air Temperature

Label on Thermometer Display	Corresponding Date	Minimum Temperature (oC)	Maximum Temperature (oC)
N1	11/7/24	18	18
N2	11/13/24	11	11
N3	11/26/24	5	5
N4	12/6/24	-2	-2

We used the thermometer in the classroom to check the temperature of the air during our research.

Soil Temperature

Label on Thermometer Display	Corresponding Date	Minimum Temperature (oC)	Maximum Temperature (oC)
N1	11/7/24	15	17
N2	11/13/24	11	15
N3	11/26/24	8	12
N4	12/6/24	1	4

We measured the main temperature of the soil and then minimums and maximums of the soil and compared the to the air temperature later.

Discussion

Some improvements that could be made for this project if repeated in the future could be using a more accurate measuring tool. With the research of this project, it could be impact the area by showing whether or not it would be a great time or place to build a structure or plant something to help nature.

Conclusion

After our research, we came to the conclusion that as air temperature decreases, the soil temperature does the same along with it. We noticed that the air temperature would be significantly cooler than other days and when it was, the soil would show a drop in temperature in our measurements. Even while measurements in different regions of our area, the trend of the two temperatures still continued.

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