Surface Temperature Compared in the Shade and Sun

6th Shade and Sun Group

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Abstract

The research question states: How does the Surface Temperature Change in the Shade and Sun? The hypothesis states: If the surface is in the shade, then the temperature gets colder, because the SFX building is blocking the sun’s rays from hitting the earth. This makes the temperature of the earth cooler. If the surface is in the sun, the sun's rays directly hit the ground, and this warms the earth, which makes the surface temperature hotter. This is how the sun and shade differ in surface temperature. We collected surface temperature as as class and then worked in small groups to complete the report.The data shows that surface temperature is warmer in the sun, and cooler in the shade, which supports the hypothesis which states: If the surface is in the shade, then the temperature gets colder, because the SFX building is blocking the sun’s rays from hitting the earth. This makes the temperature of the earth cooler. If the surface is in the sun, the sun's rays directly hit the ground, and this warms the earth, which makes the surface temperature hotter. This is how the sun and shade differ in surface temperature.

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Research Question and Hypothesis

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Introduction

Surface temperature is the temperature of the surface of the earth, whether it be on mountains, rocks, grass, or sand. When you measure the temperature of the grass- for example- you are measuring the "surface temperature" of the grass.

The ground heats up because the sun radiates heat to the surface of the earth. On a cool days, the surface of the earth will be very cold, and less sun will radiate to the ground. On hot days the air is warm, so more sun radiates to the ground. This is how the ground heats up.

Materials and Method

- SPER Scientific 800103 Infrared Thermometer
- Etekcity Lasergrip 1080 Infrared Thermometer
- DIY GLOBE thermal glove
- Cloud Viewer (from UCAR)
- Clipboard
- Pen

- Globe Surface Temperature Data Sheets

Method

Procedure taken from GLOBE Surface Temperature Protocols.

Surface Temperature Protocol

1. When necessary, either wrap the IRT in a Thermal Glove before going to the study site or place the IRT outdoors for at least 30 minutes prior to data collection. For more details, refer to the Thermal Glove -or- Place IRT Outdoors For At Least 60 Minutes section of this protocol.
2. Complete the top section of the Surface Temperature Data Sheet (fill out the Supplemental Site Definition Data section if Surface Temperature Measurements are being taken at a particular site for the first time, or if one of the values in that section has changed).
3. Take cloud observations following GLOBE Cloud Protocols.
4. If there is no snow on the ground anywhere in the Site, then check either “Wet” or “Dry” for the Site’s Overall Surface Condition field on the Surface Temperature Data Sheet.
5. Check the box that corresponds to the method used to prevent the IRT from experiencing thermal shock.
6. Pick 9 Observation Spots that are in open areas within the site and are at least 5 meters apart. The Spots should also be away from trees and buildings that create a shadow on the land and in locations that have not been recently disturbed by people or animal traffic.

(Note: It is best that readings are taken at the 9 individual Observation Spots within seconds of each other.)

7. Go to one of the nine Observation Spots and stand so that a shadow is not casted on the Spot.
8. Record the Current Time and its corresponding Universal Time (UT) on the Surface Temperature Data Sheet.
9. Hold the infrared thermometer (IRT) (wrapped in a Thermal Glove when necessary) with an arm extended straight out and point the instrument straight down at the Ground.
10. Hold the IRT (wrapped in a Thermal Glove when necessary) as still as possible. Press and release the recording button. [The recording button MUST be released for the instrument to register and hold the spot's surface temperature.]
11. Read and record the surface temperature from the digital display screen located on the top of the IRT. (Note: Surface Temperature is recorded in Celsius to the nearest tenth degree, ie. 25.8)
12. Measure and record the snow depth in millimeters at the Observation Spot.
13. Repeat steps 7-12 at each of the remaining eight Observation Spots.
14. Record any other information that explains the environmental conditions of the day or site in the Comments field.

Map 1: This map shows the site where the data was collected.

Data Summary

Date	Sun Sidewalk Surf Temp Ave (C)	Shade Sidewalk Surf Temp Ave (C)	Sun Grass Surf Temp Ave (C)	Shade Grass Surf Temp Ave (C)	Sun Asphalt Surf Temp Ave (C)	Shade Asphalt Surface Temp Ave (C)
10/18/2018	9.5	-2.5	10.5	-0.1	11.6	2.9
10/19/2018	8.8	1.3	12.5	4.5	13.5	2.1
10/22/2018	5.3	0.7	9.4	2.3	9.6	0.2
10/23/18	3	10.5	-4.6	1.3	5.5	3
10/24/2018	7.6	8.6	8.4	3.7	9	9.2
10/26/2018	5	2.9	5.4	8	7.3	9.6
10/29/2018	5.5	6.6	9.2	7.8	8.2	8.9
10/30/2018	5.7	1.3	11.3	7.1	10.6	2.9
11/1/2018	18.4	11.7	22.5	13.6	23.7	10.9
Average	7.644444444	4.566666667	9.4	5.355555556	11	5.522222222
Difference		3.1		4.1		5.5

Table 1: This data table shows the surface temperature that collected.

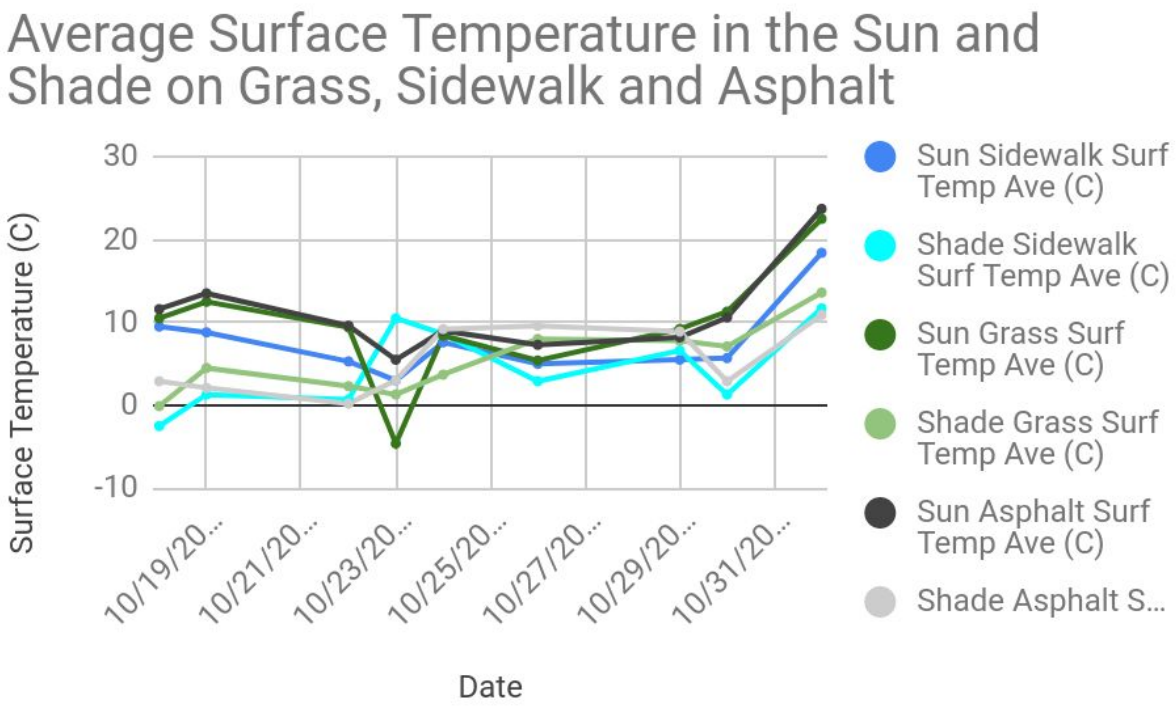

Chart 1: This chart shows the average temperature in the sun

Analysis and Results

Possible sources of error are taking temperatures in F instead of C, taking temperatures of something other than the surface like a shoe or the thermal glove, incorrectly entering the data, or making a mistake in averaging the trials. The group tried to check each other to keep these errors from happening.

Discussion

The data shows that surface temperature is warmer in the sun, and cooler in the shade, which supports the hypothesis which states: If the surface is in the shade, then the temperature gets colder, because the SFX building is blocking the sun's rays from hitting the earth. This makes the temperature of the earth cooler. If the surface is in the sun, the sun's rays directly hit

the ground, and this warms the earth, which makes the surface temperature hotter. This is how the sun and shade differ in surface temperature.

Conclusion

If this experiment could be repeated, more data would be collected and more research would be done. Surface temperature is important because it determines which areas are typically cooler in temperature, and which areas are warmer. This can be especially important to travelers, who need to know what to pack or how to dress, or which events to participate in. Water quality is important because we need to know which water to drink or use for animals. Water quality helped the human race to figure out that only 3% of the earth's water was drinkable. In the future, other protocols like ph of the soil and trees would be studied.

Acknowledgements

We would like to thank Mr. Toth for providing the IR thermometers and weather station. We would also like to thank GLOBE for all the resources. We would also like to thank Amy Woods, our science teacher for leading us through this research and data process.

Badges

Collaborator

Our class collected surface temperature together and shared it with other classes. We then broke into smaller groups with similar interests to complete the report and find more data.

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