How does surface temperature vary on different materials?

By: Julianna Williams and Savanna Francis

THE GLOBE PROGRAM

Abstract

In this project, we tested how surface temperature affects different surfaces. Our hypothesis was that asphalt would be the warmest and the car surface would be the coldest. We were proven wrong after we took temperatures around our school and averaged them out we found out that wood was the warmest and concrete was the coldest.

Introduction

Surface temperature is the temperature of a surface and can vary depending on the material that the surface is made of, which is what we're researching. This is an important topic to research because scientists can tell based on surface temperatures how they're affecting global warming. Amount of light and color also affect the temperature of a surface. Different colors absorb different amounts of light. White reflects all light and black absorbs all light. A term we learned doing this project is albedo. Albedo is a fraction of light that is reflected off a surface. I found this information off of enceleran.org.nzwww.sci and https://mynasadata.larc.nasa.gov/mini-lessonactivity/what-albedo .

Research Question

Our research question is how surface temperature varies on different materials. Our hypothesis is that asphalt will be the warmest because asphalt is black, and the color black absorbs all light, and turns it into thermal energy (heat). We also believe that car surfaces will be the coldest, because car surface doesn't absorb as much light and turn it into heat, it just reflects light. We are interested in this subject because at our school, some materials are unexpectedly very warm, and some materials are extremely cold.

Absorbs

Reflects

0

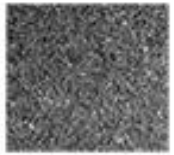
0% Reflected

0.5

50% Reflected

1

100% Reflected



asphalt (0.10)

grass (0.25)

white paint (0.80)

Albedo

Research and Experimental Methods

Procedure

1. Take an IRT, clipboard, paper, and an iPad outside.
2. Record air temp and describe weather conditions.
3. Record 7 temperatures for each different material
4. Find the average temperature of all the materials
5. Graph each different average temperature

Materials

- Air temperature thermometer
- IRT
- Clipboard
- Lined piece of paper
- An iPad

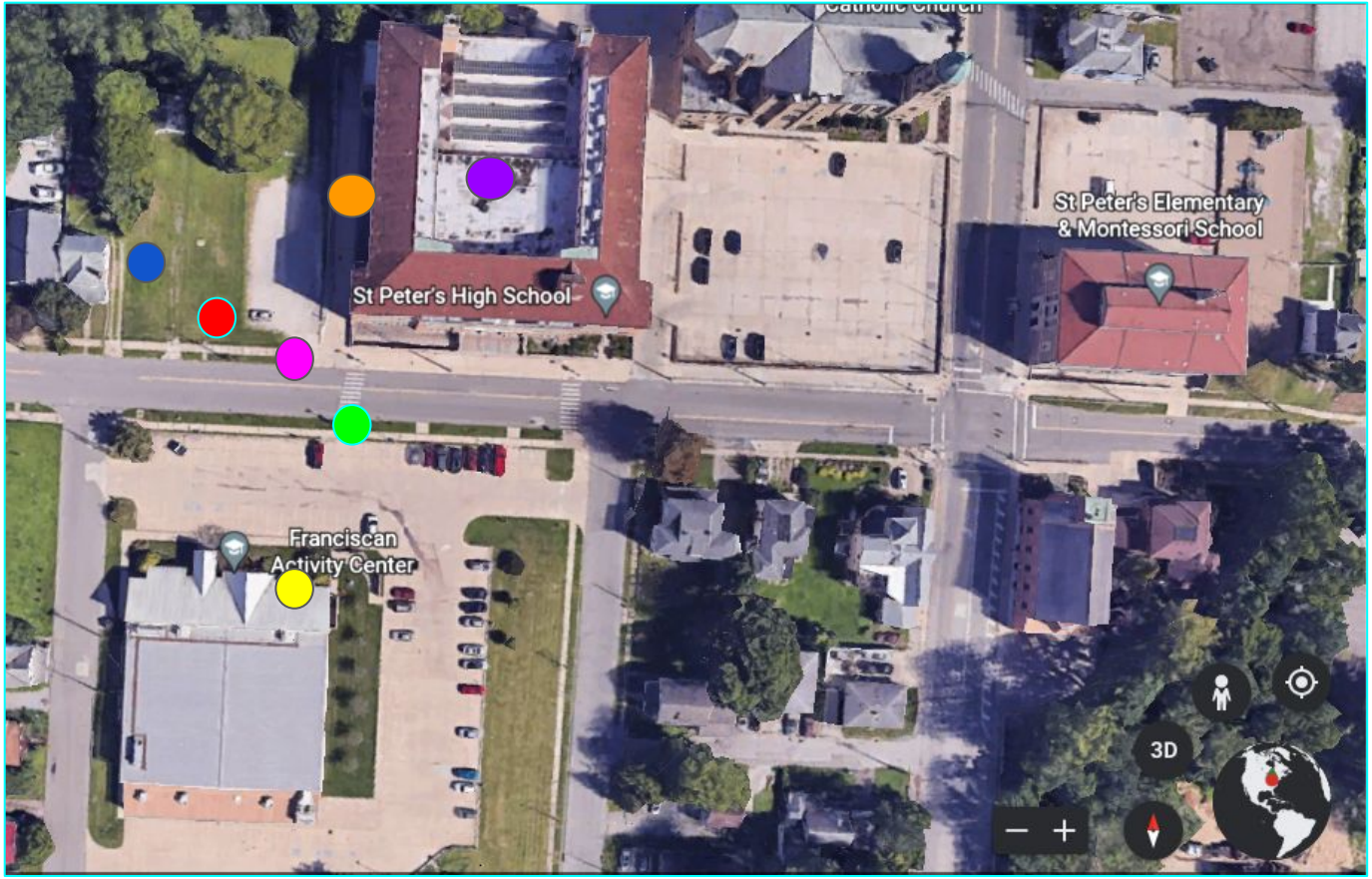
Variables

Independent variable: The different surfaces we tested

Dependent variable: The temperatures of the surfaces

Other variables to consider are that we used different brands of IRTs, the temperature outside, and the cloud coverage because some surfaces were more shady than others.

Map of Site



Blue: Grass
Purple: Tar (roof)
Yellow: Wood
Green: Asphalt
Red: Car surface
Orange: Ceramic tile (roof)
Pink: Concrete

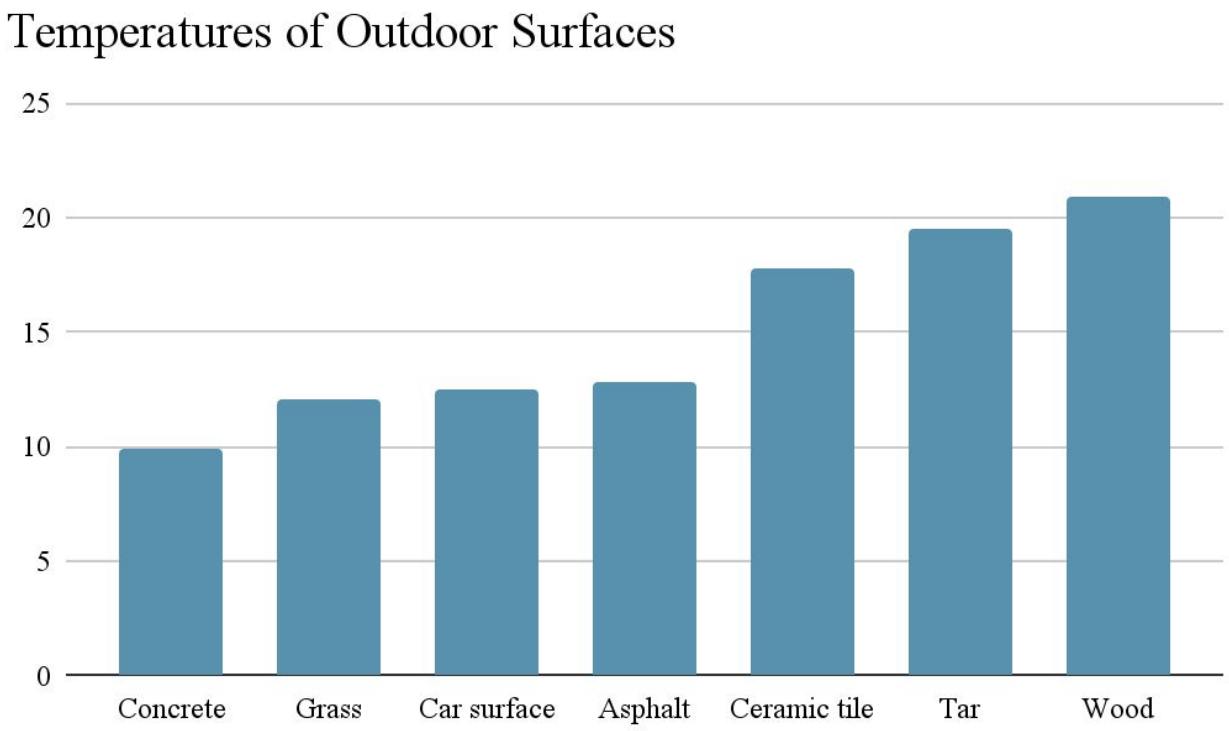
Our Data

(All temperatures in Celsius)

Date: 1/19/23	Grass	Concrete	Asphalt	Tar	Wood	Car surface	Ceramic Tile
Temp.#1	12.16	10.83	12	18.5	19.67	11	18.5
Temp. #2	13.86	11.83	13.83	22.03	25.13	12.83	20.33
Temp #3	11.83	8.7	11.2	18.83	17	12.56	20.7
Temp. #4	10.67	8.3	13.8	19.67	23.5	10	13
Temp. #5	12.93	11.1	13.16	19.86	13.7	11.3	19.63
Temp. #6	12.67	8	13.8	17.67	23.67	13	13
Temp. #7	10.33	10.33	12	20.16	23.5	16.67	19.5
Averages	12.06	9.87	12.83	19.53	20.88	12.48	17.81

Our Data Graphed

(All temperatures in Celsius)



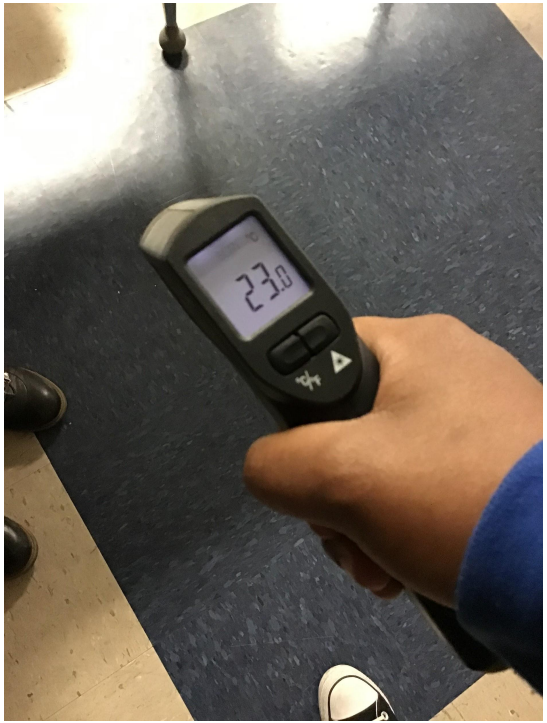
Discussion of Results

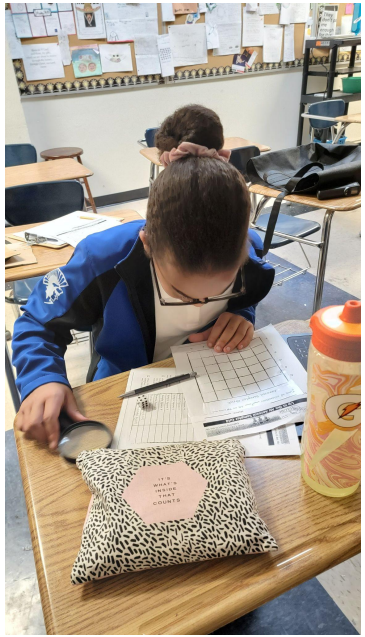
Our results show that the coldest surface was concrete with a 9.87 degree celsius average. The warmest surface was wood with an average of 20.88 degrees celsius. In our hypothesis, we thought that car surfaces would be the coldest and that asphalt would be the warmest. When we went out to collect our data the air temperature was 14°C, it was sunny and windy with minimal clouds, it was also muddy. We had to be careful getting temperature recordings because some surfaces were shady while others were in direct sunlight.

Conclusions

Unfortunately, our hypothesis was proven wrong. We think this may have happened because of certain surfaces being at a certain location, like shady areas because of the clouds or in an especially sunny spot. The next thing we would do is measure the change in temperature over time. If we were to do this experiment again, we would recommend choosing a sunny and much warmer day, and writing down every detail of your experiment. We could also test more materials. This experiment also made us curious about studying the urban heat island effect and considering differences between urban and rural surfaces.

Pictures





GLOBE Activity: Heating Things Up!

This is a picture of our class with Sara, one of our GLOBE mentors, who did a lab with us, inspiring us to do this project. Thanks Sara!

Credits

Thank you to our GLOBE mentors, Sara Mierzwiak and Dr. Kevin Czajkowski. We would also like to thank our maintenance supervisor, Tom Hatfield, and our GLOBE teacher, Mrs. Smith.

Sources

- https://www.freepik.com/vectors/watercolor-earth (template and art)
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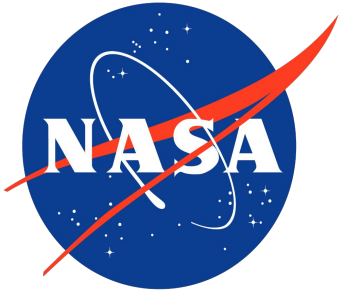

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my NASA data