

Urban heat islands / Surface temperatures

GLOBE		Related SDGs:	Type of activity
Sphere	Protocols		
Atmosphere	Temperature	4 (Quality education)	Research
Pedosphere	Temperature, Soil Characterization, Surface Temperature	11 (Sustainable Cities and Communities) 13 (Climate Action)	

Overview

The students will record a range of variations in temperature conditions, in different materials in their environment, deducing their varieties and projecting the overall integrated effect at their school level. On this basis, they will deduce associated environmental effects.

Time

One class period to discuss and plan the experiment, another one to set up the experiment, part of one class period at daily intervals (or any other day) to record the results, and two class periods four weeks later to observe and discuss the final results.

Prerequisites

Preliminary handling of concepts associated with energy and its forms.

School level

Upper primary school (From 8 to 12 years old)

Purpose

To understand the concept of Heat Island as a combined expression of heat energy transmission according to the characteristics of the materials and their environmental effects, comparing surface temperatures of different materials and deducing their effects as a whole.

Student outcomes

- To understand the concept of "Heat Island" as the combined effect of heat energy exchange and migration on different material substrates
- To identify environmental implications and effects of the heat energy we measure in temperature
- To determine the effects of heat manifestations on humans

Introduction - Context

The Heat Island has an urban phenomenon connotation of heat accumulation in an asymmetrically spatial form. In urbanization processes, the temperature control in larger areas of land is done by remote sensing or satellite sensors because when weather stations are *inside* the heat islands, they generate erroneous data because they do not record the region climate, but the forced one by the heat island regime. In its study, it is usually important to capture the radiance measurement from the temperature brightness in Kelvin degrees; and, by transforming it to degrees Celsius in order to correlate the Heat Islands with the different variables surrounding the urban environment, consider the instances of heat transfer of the materials present in the study area and identify the phenomenon collateral effects on the environment, specifically on the place biodiversity.

In the present activity we will approach the study of this phenomenon with the intention of studying it in more detail on larger surfaces than those considered on this occasion.

Scientific Concepts

- Forms of heat energy exchange (convection, radiation and conduction)
- Temperature scales and conversions (°K,, °C, °F).
- To differentiate heat and temperature
- Thermal sensation
- Concepts of Albedo, reflection, thermal inversion, ground/atmosphere interface
- Rould's Law

Guiding Research Questions

- What is a Heat Island?
- How does the phenomenon occur?
- What are its main effects?
- What could be the options for mitigating their negative effects on human health?

Materials and Tools

- 30x20x5 cm. box mold (as a mold to make Adobe mudbricks or bricks).
- An infrared digital thermometer

What to Do and How to Do It

Beginning –

- With the help of the frame, make molds out of different materials, such as concrete, Adobe mud, pebbles, free soil, etc., and place them in an area that gets the most sunlight on your school grounds. For three days (ideally sunny), take the temperature of each block with a digital thermometer, three times each for three days at solar noon, two hours before and two hours after. Record the data and, with the above inputs, make comparative graphs, construct explanations together with your students and report the results. As a corollary, collectively construct an idea of a heat island as a result of heat energy transfer in a heterogeneous material set and the corresponding concepts associated with heat transfer.

Development -

Get a scale plan of your school floor plan and reproduce it on a larger scale (something like 50 x 90 cm). Identify areas of different materials and define measurement points according to the predominant material in the area of each measurement. Take the temperature of each block with a digital thermometer, three times each for three days at solar noon, two hours before and two hours after. Record the data.

Closing -

With the above inputs, draw up comparative graphs and assign colors to the different average temperatures, assign a color to each one and color the areas of the plane associated with them. Ask your students to relate the real areas with each average temperature determined and ask them to search for bibliographic material describing the collateral effects on the biodiversity installed in the vicinity of the heat island.

Frequently Asked Questions

How could we deepen and project our study on a larger scale?

Using GLOBE data tools over the city or county where the school is located, design an investigation ideally in the summer season over the entire territory, where using satellite data you can build conclusions at a larger scale and include statistically processed data to deduce effects on local biodiversity, especially birds and human health.

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