



Climate

DESCRIPTION

This lesson integrates a series of activities to introduce *changes in water, ice, and soil* as well as understanding how they reflect climate.

OBJECTIVES

Students will

- Explore our changing polar ice caps.
- Explore satellite data and how it relates to climate and how we know what we know.
- Introduce the concept that sometimes there is no one “right” answer to a question or measurement.
- Learn how to measure time.
- Understand the accuracy of a measurement.

NASA SUMMER OF INNOVATION UNIT

Earth and Space Science—Climate and Seasons

GRADE LEVELS

7 – 9

CONNECTION TO CURRICULUM

Science

TEACHER PREPARATION TIME

1 hour

LESSON TIME NEEDED

4 hours *Complexity: Easy to Moderate*



NATIONAL STANDARDS

National Science Education Standards (NSTA)

Earth and Space Science

- Structure of the Earth system
- Earth’s history
- Earth in the solar system

Science and Technology

- Abilities of technological design
- Understanding science and technology

Science in Personal and Social Perspectives

- Populations, resources, and environments
- Natural hazards
- Risks and benefits

MANAGEMENT

The activities in this lesson are best done with pairs or small groups.

CONTENT RESEARCH

Students will use satellite data to understand how the net **flux** of the radiation budget relates to the amount of ice present in the **Northern Hemisphere**.

Students will investigate how surface color affects temperature change. The focus is on making careful observations, recording temperature differences, reaching conclusions, and describing and communicating results.

Key Terms:

- *Flux*—continuous change, passage, or movement
- *Long wave radiation*—infrared energy emitted by the Earth and atmosphere at wavelengths between about 5 and 25 micrometers
- *Net, budget, or balanced radiation*—this is the balance of incoming solar radiation and outgoing terrestrial radiation
- *Short wave radiation*—A term used loosely to distinguish radiation in the visible and near-visible portions of the electromagnetic spectrum

LESSON ACTIVITIES

How Does Earth’s Energy Budget Relate to Polar Ice?

Uses satellite data to understand how the net flux of the radiation budget relates to the amount of ice present in the Northern Hemisphere.

http://mynasadata.larc.nasa.gov/preview_lesson.php?&passid=101

GLOBE Soil Learning Activities: Soil Temperature

Introduces students to the importance of soil, why it needs to be studied, and how it is affected by climate.

<http://classic.globe.gov/tctg/soiltemp.pdf?sectionId=92&lang=EN>

What Is the Right Answer?

Introduces the concept that sometimes there is no one “right” answer to a question or measurement.

http://classic.globe.gov/tctg/gps_la_part1.pdf?sectionId=49&lang=EN

Surface Color and Effect of Temperature Change

Students will investigate how surface color affects temperature change.

[Surface Color and Effect of Temperature Change](#)

ADDITIONAL RESOURCES

This video shows how heat is absorbed by air and water:

<http://www.jpl.nasa.gov/video/index.cfm?id=827>

Climate Kids games: <http://climate.nasa.gov/kids/>

NASA’s Eyes On Earth 10 best climate videos: <http://climate.nasa.gov/ClimateReel/>

MATERIALS

- 2 large containers
 - 2 foam caps
 - 2 non-mercury thermometers
 - 1 sheet of dark construction paper
 - 1 sheet of light construction paper
 - Transparent tape
 - Scissors
 - Heat lamp (or lamp on stand equipped with 100-watt bulb)
 - Safety glasses
 - Dial or digital soil thermometer
 - 12-cm nail or spike
 - 500-mL beaker
 - Hammer
 - Spacers (for limiting soil thermometer insertion depth)
 - Calibration thermometer
 - Wrench for adjusting dial soil thermometer
 - Watch
 - GLOBE Science—At least one clock per student, any type, which shows seconds, will suffice
 - Paper and a writing tool for each student to record times
 - Log(s)
 - Soil Temperature Data Sheet
 - Computer/printer
 - Copies of the GPS Investigation Time Measurements Work Sheet and plot forms for each student
- Optional but desirable:
- Calculator with addition, subtraction, multiplication, and division functions

Landsat images and video: http://www.nasa.gov/vision/earth/lookingatearth/lima_multimedia.html

Real World videos on climate:

<http://www.nasa.gov/audience/foreducators/nasaclips/search.html?terms=&category=0100>

DISCUSSION QUESTIONS

Each NASA activity includes discussion questions in the provided Student Data components.

ASSESSMENT ACTIVITIES

Each activity includes a “Student Data Sheet” that can be used to assess understanding of concepts.

ENRICHMENT

Each activity includes extensions to allow students to continue their learning experiences.