My NASA Data - Lesson Plans

Earth System Satellite Images - Analyzing Annual Changes in a Variable

Grade Band

- 3-5
- 6-8
- 9-12

Time

- 50 minutes

Overview

The Earth System Satellite Images available on My NASA Data provide teachers and students opportunities to explore data and identify relationships between/among different components of the Earth system. The Earth System Satellite Images, along with the Data Literacy Cubes, help the learner visualize how different Earth system variables change over time, establish cause and effect relationships for a specific variable, identify patterns, and determine relationships among variables.

In this lesson, students will analyze changes in one variable over the course of *one year*.

This lesson has been adapted and modified from the GLOBE Earth System Poster Learning Activities .

Materials Required

- 2024 Earth System Satellite Images - Global slides or 2024 Earth System Satellite Images - Global PDF
- Data Literacy Cube Template or number cube (1 per group)
- Data Literacy Cube Map Question Sheets (1 per student)
- Task Cards
- Pen, Pencil
  NOTE: Consider laminating the resources in this list for future use.

Procedure

Teacher Preparation before the lesson:

1. There are sets of six satellite image cards, one for every other month in a year, for each Earth system variable as listed below.
    - Aerosols
    - Cloud Cover
    - Insolation (solar shortwave radiation)
    - Precipitation
    - Surface 'Skin' Temperature
    - Vegetation
2. Print **ONE set of variables** *(all images within the variable)* from the Earth System Satellite Images.
3. Print one Data Literacy Cube template for each group.
4. Print one cube map question sheet for each student.
5. There are four different map question sheets.
    - Question Sheets are leveled for both Lexile and English-language proficiencies.
    - The leveled question sheets contain labeled (bottom left) and unlabeled versions for you to use at your discretion to help you differentiate your instruction.
    - *Note*: The Lexile range provided on each question sheet represents the text's difficulty.
    - The students' reading comprehension levels should be taken into account when selecting the appropriate question sheet.
    - Regardless of level, the students in each group will be able to follow along, because the cube has the same six set of question categories: Examine, Search and Find, Analyze, Ask, Connect, and Assess.
    - Some of the question sheets include sentence stems to help struggling readers/writers participate in responding to the questions.

Part I: Using the Cube

1. Divide the students into 6 groups. It is best not to have more than six students per group.
2. Each group will have one month:
    - Group one- January
    - Group two- March
    - Group three- May
    - Group four-July
    - Group five- September
    - Group six- November
3. Distribute:
    - Map question sheet (for each student)
    - Cube for each group
    - Earth System Satellite Images
4. *Optional*: Use the task card to assign their roles (project manager, data manager, chief engineer, and communications manager). Be creative and assign other roles!
5. Assign a person in each group to roll the cube.
6. In their groups, they will answer questions 1–6 on the map question sheet.

Part II: Jigsaw Activity

1. Form new groups so that each group has all of the images of the selected variable (January, March, May, July, September, November).
2. Have students place the images in chronological order and allow time to explore and analyze the annual changes observed.
3. Use some or all of the following guiding questions:
    - What changes do you see through the year?
    - What explanations can you suggest for these patterns?
    - Choose a location or region.
        - During which months do the extreme highs and lows occur?
        - What explanations can you suggest for the timing of those extremes?
    - Which regions experience both the extreme highs and lows?
    - Which regions don't experience the extremes?
    - Why do you think this happens?
    - What differences, if any, do you find between the year's variations over the oceans versus the year's variations over the continents?
    - Are there regions that remain relatively unchanged over the year? Why do you think this happens?

Part III: Close Lesson

1. Select a question that will provide feedback regarding student comprehension. You can generate your own question or use one of the questions in part three of the jigsaw portion of the lesson.
2. Select a location in the room for you to place your "**Parking Lot**" for students to write their responses.
3. The responses should be anonymous to allow them to freely respond. You may choose to use different colors of sticky notes for each group.
4. You may have students respond to the parking lot question before the students exit the classroom, or as bell work for the following morning.

NGSS Three Dimensional Learning

NGSS Disciplinary Core Ideas

- ESS2A: Earth Materials and Systems
- ESS2D: Weather and Climate
- ESS3C: Human Impacts on Earth Systems

NGSS Crosscutting Concepts

- Patterns
- Cause and Effect
- Systems and System Models

NGSS Science and Engineering Practices

- Developing and Using Models
- Analyzing and Interpreting Data
- Obtaining, Evaluating and Communicating Information

Learning Objectives

The learners will be able to:

- Discover, analyze, and interpret patterns in a graphic display of data
- Conduct an analysis of mapped data
- Develop descriptions and explanations using evidence
- Develop an understanding of the interactions within the Earth system
- Establish cause and effect relationships for a specific variable, identify patterns, and determine relationships between variables

Essential Questions

- What information can you determine from the location and colors on maps?
- What information do coordinates on a map show?
- What information does a legend on a map tell you?

Why Does NASA Study This Phenomenon?

Studying how Earth's systems interact is as important as studying the individual systems. NASA and its international partners operate several Earth-observing satellites, collectively called the A-Train, that closely follow one after another along the same orbital track. The near-simultaneous observations of a wide variety of factors help the scientific community advance our knowledge of Earth-system science and apply this knowledge for the benefit of society. Source: NASA 60 Years and Counting

Teacher Background Information

The processes comprising the Earth's environment are interconnected. Understanding how these connections operate on a global scale is to understand the Earth as a system. Understanding the Earth as a system requires a quantitative exploration of the connections among various parts of the system. These processes take place in and between the atmosphere, oceans, fresh water, ice, soil, and living components. These processes also include energy from the Sun, and the gases and particles that enter the atmosphere and oceans from both natural and anthropogenic, or human-caused, sources. The activities in this guide will help students understand variations in environmental parameters by examining connections among different phenomena measured on local, regional and global scales. As students look at the connections between environmental data, they will see that the environment is the result of the interplay among many processes that take place on varying time and spatial scales. They will also understand that environmental processes are not bound by oceans, mountains, or country delineations–they are truly global in scope.

Source: The GLOBE Earth System Poster Learning Activities.

Google Docs Interactive Files

2024 Earth System Satellite Images - Global PDF

Google Slide interactive Files

2024 Earth System Satellite Images- Global