

---

## My NASA Data - Lesson Plans

### Earth System Satellite Images-Graph Points for a Location Over One Year



#### 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, 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 *graph six points for a location over one year*.

This lesson has been adapted and modified from the [GLOBE Earth System Poster Learning Activities](#).

#### 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

## 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](#)

## Essential Questions

- How can plotting points using a coordinate graph provide you with data pertaining to a specific location on a map?

## Materials Required

- Earth System Satellite Images ([Global](#) or [North America](#))
- Pen, Pencil

*NOTE:* Consider laminating the resources in this list for future use.

## Technology Requirements

- Standalone Lesson (no technology required)
- Internet Required

## 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](#).

---

## Prerequisites Student Knowledge

Students need to be familiar with longitude and latitude, as well as familiarity with qualitative and quantitative observations.

Students need to be familiar with creating a time series graph.

## 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 Temperature
  - Vegetation
2. Select one variable and print all images of the selected variable. Each group will have one full set.
3. Select the location or locations you want the students to graph.

### Part I: Graphing Points for a Location

1. Divide the students into small groups.
2. Give each group all of the images for the selected variable (January, March, May, July, September, and November).
3. Have students arrange the six images in chronological order.
4. Give each group the coordinates of the location they will be graphing.
5. For coordinate graphing:
  1. Have the students identify their location on their images.
  2. Instruct the students to use the legend colors to determine the approximate value at their location for each month.
  3. Have the students plot the values in chronological order.
  4. Allow the students to lead a discussion within their groups (about 5 minutes) about what they observe.
6. Ask students to identify the changes between the six images.
7. Use some or all of the following guiding questions:
  - Which changes are observed over the six images?
  - Do you see a pattern or a relationship?
  - What additional information or data might be useful to consider when analyzing the different images?

### Part II. Close Lesson

As an Exit Ticket:

- 
1. Have the students write questions based on their own observations of the images.
  2. Place those questions in a "bowl" and have one person from each group "fish" a question from the "bowl".
  3. Allow the students a few minutes to respond to the question within their group, then have someone from that group answer the question.
  4. Use sentence frames to support the student-led discussion for this activity:
    - This is similar to\_\_\_\_\_ because...
    - This is different to\_\_\_\_\_ because...
    - This reminds me of\_\_\_\_\_.
    - I disagree with the statement because \_\_\_\_\_.
    - I like how you said \_\_\_\_\_.

## Extensions

- Use the [Earth System Satellite Images Graphic Organizer](#) to explore and analyze the differences between the different variables.
  - Create questions based on the variable(s) you wish the students to analyze. *For example: Observe the locations on the map. What differences are observed within the same months, but different variables?*
- Once the students have had time to complete their graphic organizers, you can moderate a discussion so that students can compare the differences and similarities among the variables.