

MY NASA DATA Lesson:

Storm Clouds– Fly over a Late Winter Storm onboard a NASA Earth Observing Satellite

Purpose:

To use CERES cloud data and a weather map to explore cloud coverage during a winter storm

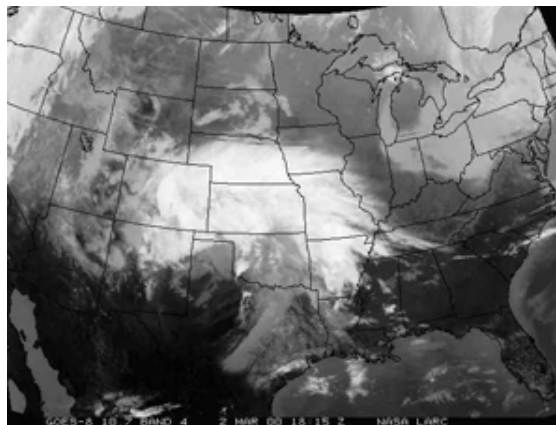
**Grade Level:** 6 – 12

Image courtesy The GOES satellite

Estimated Time for Completing Activity:

One 50-minute class period

Learning Outcomes:

- Locating map locations using latitude and longitude coordinates
- Using a microset of satellite data to investigate cloud characteristics
- Applying percentage to determine cloud cover

Prerequisite

- Familiarity with accessing websites on the Internet
- Familiarity with locating given geographical locations using latitude and longitude and a map
- Ability to recognize the symbol for and meaning of the term percentage

Tools

- Computer with Internet access
- Atlas or map showing latitude and longitude lines and the continental USA
- Journal, notebook, or other paper for recording data

Vocabulary:

- [latitude](#)
- [longitude](#)
- [percentage](#)

Lesson Links:

- [Data Map](#)
- [Microset of cloud cover](#)
- [NCDC Storm Events](#)
- [Satellite image](#)
- [Viewing data using IDL Virtual Machine](#)
- [Opening MY NASA DATA Microsets in Excel](#)

Background:

When atmospheric scientists, including meteorologists, study weather patterns, they may use several different sources of information. For example, in studying storm patterns, they may use a combination of Earth Observing Satellite data, such as from CERES, weather satellite imagery, such as from NOAA, and geographical tools to determine locations and paths of storms. As one part of the training to analyze this data and imagery, scientists look at 'case studies' such as the late winter storm shown in the weather satellite imagery included here. This is an infrared satellite image, meaning that it is looking at the temperature. Cold things (like high clouds) are very bright. Warm things (like Mexico and Florida) are dark. This imagery can be compared to data collected by other satellites, so that improved models of storm patterns can be developed.

Procedure:

1. Open the microset (see the Links section) for cloud cover over central USA during the March 2, 2000 winter storm. The microset is made available in text format, but may also be imported into a spreadsheet for easier viewing.
2. Open the satellite image (see the Links section) corresponding to the time of the microset.
3. On an atlas or world map, locate the USA state of New Mexico.
4. Using the atlas as a guide, locate New Mexico on the print-out of the satellite image.
5. From the microset, select a data point with coordinates that are located within the

boundaries of New Mexico. (For example, 33.41,-105.42)

6. In your journal or on paper, record the percentage cloud cover for High, UpMid, LowMid, Low, and Total cloud coverage.

(For the example above, the cloud coverage amounts would be High 0.2 percent, UpMid 0.3 percent, LowMid 28.4 percent, Low 17.8 percent , and total 46.7 percent)

7. Using the atlas as a guide, locate the selected data point on the satellite image.

8. Around this selected point, draw a square with sides of 1 degree in length, so that the point is in the center of the square. Use the atlas to estimate how long to draw each side to represent 1 degree on the map.

9. Estimate and record the percentage of total cloud cover within this 1-degree square. (For the example, an estimate would be about 50 percent)

10. Repeat steps 6-10 for at least another 9 different points selected from the microset. Be sure to record the location and mark the point on the satellite image.

Questions:

1. Look at the ten (or more) data points recorded, along with the percentages of cloud coverage. Write a paragraph which compares the total percentage cloud coverage as reported by the satellite in the microset with the total percentage cloud coverage as estimated from the satellite image. Do the data agree? Use your recorded data in your explanation.

2. Look at the first data point selected (the example). Do the data agree? Explain. (For the example point, the satellite microset reported total cloud coverage to be 46.7 percent and the satellite image estimate was 50 percent. The estimate was about 3 percent greater. This is good agreement considering the value from the satellite image is a visual estimate.)

3. Look at the percentages for the different layers of clouds. Do the data agree with what you visually observe on the weather map? Remember that the weather map shows high cold clouds as bright white and warmer layers as less bright.

Extensions:

1.a. Open the data-map (see the Links section) which shows the swath of data points (listed in the microset) across the southern United States. The grid lines on the data-map represent latitude and longitude. Note: the map can also be plotted by students using the free IDL Virtual Machine tool (see the Links section). How many orbits are shown by the swath data?

1.b. On the microset, notice how the values for the longitude seem to be listed in cycles. The longitudes increase in value, then start over and increase again. How might this relate to the orbits of the satellite? How many orbits were made? Does this agree with your answer to Part 1.a above?

2.Examine the National Climatic Data Center (NCDC) storm events (see the Links section) noting where areas of snow, thunderstorms, hail and tornadoes occurred. (At the NCDC web site, click Continue, enter the date 03 02 2000 for begin or end date, and click List Storms). Record the listed time of the events. Remember that your microset is data from around noon. Do you think that cloud cover throughout the layers of the atmosphere affects the locations of severe weather events?

Lesson plan contributed by Carrie Phelps and Susan Moore

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