

Differences Between Ground and Air Temperatures

Adapted from: My NASA Data Lesson Plans

http://mynasadata.larc.nasa.gov/preview_lesson_nostds.php?&passid=80

Focus on Inquiry

The students will focus on inquiry by collecting and analyzing temperature and surface type data, then drawing conclusions based on their observations and look for patterns in the data.

Lesson Overview

The students will investigate factors that affect climate and explore real NASA satellite data to compare the near-surface air temperature and surface temperature in different climate regions. Students will draw conclusions about the seasonal patterns and the effect of the underlying surface on the air temperature.

Duration 1-2 50-minute class periods	Setting Classroom/computer lab	Grouping Small groups of 2-3	PTI Inquiry Subskills 3.1, 3.4, 3.5, 3.8, 4.2, 4.3, 5.2, 5.3, 7.2, 7.3
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	10 minutes			2	Students discuss how location affects differences in temperature.
Explore	30 minutes	3.1, 3.4, 3.5, 3.8, 4.2, 4.3	Computer with Internet	3	Students collect and analyze temperature and surface type data on a specific location.
Explain	20 minutes	5.2, 5.3, 7.2, 7.3	Computer with Internet	3	Students answer questions and draw conclusions regarding the patterns and affect of temperature on surface type.
Expand	50 minutes	3.1, 3.4, 3.5, 3.8, 4.2, 4.3, 5.2, 5.3, 7.2, 7.3	Computer with Internet	3	Students repeat experiment using a different location with different climate conditions and explain reasons for differences found.
Evaluate					Answers to questions in the Explain section of the lesson plans can be used for evaluation.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry

Design and conduct a scientific investigation
 Use appropriate tools and techniques to gather, analyze and interpret data
 Develop descriptions, explanations, predictions, and models using evidence
 Think critically and logically to make the relationships between evidence and explanations
 Communicate scientific procedures and explanations



National Science Education Standards – Earth Science

Global patterns of atmospheric movement influence local weather. Oceans have a major effect of climate, because water in the oceans holds a large amount of heat.

Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#6. Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
 Gr. 8, Inquiry GLE#8. Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)
 Gr. 8, Inquiry GLE#11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)



<p>Gr. 8, Inquiry GLE#12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)</p> <p>Gr. 8, Inquiry GLE#13. Identify patterns in data to explain natural events (SI-M-A4)</p> <p>Gr. 8, Inquiry GLE#16. Use evidence to make inferences and predict trends (SI-M-A5)</p> <p>Gr. 8, Inquiry GLE#19. Communicate ideas in a variety of ways (e.g. symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations)</p> <p>Gr. 8, Inquiry GLE#22. Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)</p>
<p>Louisiana Grade Level Expectations Earth Science</p> <p>Gr. 8, GLE#25. Explain and give examples of how climatic conditions on Earth are affected by the proximity of water (ESS-M-A11)</p>

Materials List (per group)

- Computer with Internet access and Printer (optional) access.
- Map or Atlas

Advance Preparation

1. Gather materials necessary to complete lab (have students bring in the necessary supplies)
2. Before implementing the lesson with students, it is strongly recommended that you check to see that the browser being used is compatible with the Live Access Server, and that the pop-up blockers are turned off.
3. If necessary, make sure computers have printer access.

Other Information

Learning Objectives

- Students will locate real NASA satellite data resources on the Internet.
- Students will be able to create and use a graph to read and analyze data.
- Students will be able to conclude information based on the graphs they produce

Prior Knowledge Needed by the Students

- Familiarity with locating positions on a map based on latitude and longitude coordinates
- Familiarity with finding information on the Internet

Procedure

Engage

1. Explain that as the Sun heats the Earth's surface, the atmosphere is warmed from below by the processes of conduction and convection from the surface. However, near-surface air temperature (approximately 10 meters above the surface) is often different than the surface temperature. Explain that the different properties of air, land and water, such as density or heat capacity, as well as seasonal changes of the surface type, can explain these differences.
2. Ask students: What affect does location have on temperature? For example, why is the temperature often different near oceans than in inland cities? Look at a World Map or atlas and point to different locations and have students explain differences in temperature.

Explore

1. Make sure computers are connected to the Access Server (<http://mynasadata.larc.nasa.gov/las/servlets/dataset>) and that pop-up blockers are turned off.
2. Have students form groups of 2-3 and complete Parts 1 & 2 of the student worksheet (Blackline Master #1). Each group will select various a location in which to collect data – Make sure some groups choose a near-water location and some groups choose a more inland location so better comparisons can be made.

Explain

1. Have students answer the questions in Parts 1 & 2 of the student worksheet (Blackline Master #1).
2. As a class, discuss why groups that chose locations near water may have received different results from those that chose inland locations.

Expand



1. Have the students repeat the procedure choosing a different location that you know has a very different climate (i.e. Australia or Africa). Have the students discuss as a class why different results were received.

Evaluate

1. Answers to questions in the Explain section of the lesson plans can be used for evaluation.

Blackline Masters

1. Differences Between Ground and Air Temperatures

Supplementary Resources

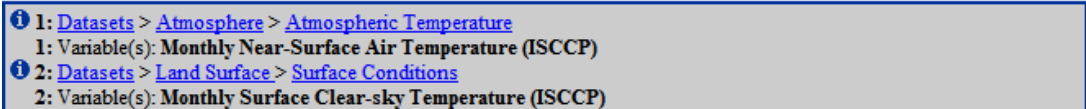
Credits

Lesson plan contributed by Tara Kisiel, Chicopee, Massachusetts

Name: _____ Date: _____

*Difference Between Ground and Air Temperatures***Lesson Links**Live Access Server: <http://mydasdata.larc.nasa.gov/las/servlets/dataset>CERES Biome Types Data: <http://mydasdata.larc.nasa.gov/doc.html>**Procedure:****Part 1: Find the temperature at your selected location.**

1. Your computer should be connected to the NASA Live Access Server. (<http://mydasdata.larc.nasa.gov/las/servlets/dataset>)
2. From the Home page, select Atmosphere, then select Atmospheric Temperature, then check the box next to Monthly Near-Surface Air Temperature (ISCCP). Click the Next link.
3. Click the Compare Two tab on the Left Menu.
4. In the top shaded margin (see screenshot below) for variable 2, select the Datasets link, then select Land Surface, then Surface Conditions, and then check the box next to Monthly Surface Clear-Sky Temperature (ISCCP). Click the Next link.



1: [Datasets](#) > [Atmosphere](#) > [Atmospheric Temperature](#)
 1: Variable(s): **Monthly Near-Surface Air Temperature (ISCCP)**
 2: [Datasets](#) > [Land Surface](#) > [Surface Conditions](#)
 2: Variable(s): **Monthly Surface Clear-sky Temperature (ISCCP)**

5. Verify that you have the correct two variables in the top shaded margin.
6. For Select View, choose Time Series (t) from the dropdown menu.
7. For Select Output, choose Overlay Plot from the dropdown menu.
8. Under Select Region, use the world map and compass rose to enter latitude and longitude coordinates for the location you would like to analyze (For example, you could click somewhere in North America around where you live). You can click on the map to select a location or enter a latitude and longitude manually on the right side of the map.
9. Click Var 2 to the right of the map and then enter the same location (the same latitude and longitude) as you just did for Var 1. Click the Go button underneath these boxes to confirm these values.
10. Underneath the map, for Select Time Range, choose the start and end month and year that you would like to view. For example, January 2004 – December 2004.
11. Click Next to view your output in a new window.
12. Save this data by printing it or clicking File → Save As. Enter “Location Temperature” as your file name and save it to your desktop or another specified location.
13. Answer questions 1-3 on page 2.

Part 2: Find the surface type at your selected location.

1. Return to the home page of the NASA Live Access Server. (<http://mydasdata.larc.nasa.gov/las/servlets/dataset>)
2. In order to make sure you are looking at only a single dataset, click on the single dataset tab on the Left menu. This will ensure you are looking at only one variable in the top shaded margin.
3. Select Land Surface, Surface Cover, then check the box next to Surface Scene Type (CERES SARB). Click the Next link.
4. For select view, choose Longitude-Latitude map (xy).
5. For select output, choose Color plot.
6. Select the region for your location that you chose in Part 1 (i.e. North America). Click Next to create a color plot and view your output in a new window.
7. Using the color bar on the right, determine and record the number that corresponds to your location. Note: If it is difficult to pinpoint the number, you may return to the world map applet and make the region smaller.
8. Using the lesson link for CERES Surface Types (<http://mydasdata.larc.nasa.gov/doc.html>), determine the surface type that corresponds to your number at your location.
9. Answer questions 4-5 on page 2.



Questions:

1. Using your Location Temperature Graph from Part 1, which color line is the ground temperature? Which color line is the air temperature?

2. During which months is the ground temperature greater than the air temperature? During which months is it less?

3. What trends or patterns do you see in your graph?

4. Using the data from Part 2, what climate region or surface type is found at your location?

5. Can you explain your results based on the surface type?
