

Hurricanes As Heat Engines

http://mynasadata.larc.nasa.gov/preview_lesson.php?&passid=50

Focus on Inquiry

Students will examine and use real data to explore how heat energy from the ocean’s surface influence hurricane formations.

Lesson Overview

The students will locate authentic sea surface temperature data on the Internet. They will create line plots and data maps. They will analyze this information to understand how hurricanes gain energy from the ocean surface.

Duration 2 - 50 minutes	Setting classroom	Grouping Individual or small groups	PTI Inquiry Subskills 3.1, 3.7, 3.8, 4.3, 5.2, 5.4, 7.3
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Engage</i>	5 min.		Computer Internet Projector	1	Class discussion of severe weather and hurricanes. Students view video clip from United Streaming entitled, "Hurricanes' Destructive Forces".
<i>Explore</i>	45 min.	3.1, 3.7, 4.3	Computer Internet Presentation Software	3	Students read about the 2005 Atlantic hurricane season and examine the track of Hurricane Rita. They use make daily data maps of SST for the Gulf of Mexico and make a line plot of a selected position in the path of Hurricane Rita.
<i>Explain</i>	25 min.	3.7, 3.8, 4.3, 5.2, 5.4, 7.3	Computer Internet Presentation Software	3	Students compare and discuss observations of daily SST maps of the Gulf of Mexico for the dates during and after Hurricane Rita. They analyze their data to answer questions and then write a paragraph explaining how hurricanes extract heat energy from the ocean surface.
<i>Expand</i>	25 min.	3.1, 3.7, 4.3, 5.2, 5.4	Computer Internet	3	Students examine SST data for other hurricanes and compare the information to their data from Hurricane Rita.
<i>Evaluate</i>	varies	7.3		3	Student daily maps, line plots, discussions, answers to questions, and explanation paragraphs can be used as assessment.

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.



National Science Education Standards – Earth Science

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

Louisiana Grade Level Expectations – Inquiry

Grade 8 GLE#7 Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)

Grade 8 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)



Grade 8 GLE#12 Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
 Grade 8 GLE#13 Identify patterns in data to explain natural events (SI-M-A4)
 Grade 8 GLE#19 Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)

Louisiana Grade Level Expectations Earth Science

Grade 8 GLE#28 Use historical data to plot the movement of hurricanes and explain events or conditions that affected their paths (ESS-M-A12)
 Grade 8 GLE#44 Describe how unequal heating of Earth's surface affects movement of air masses and water in the atmosphere and hydrosphere (ESS-M-C6)

Materials List (per group)

- Computer with Internet access
- Projector to project Internet video to whole class
- PowerPoint or other presentation software
- Map or Atlas

Advanced Preparation

1. Sign up to be a member of United Streaming www.unitedstreaming.com. Locate the video clip “Hurricanes’ Destructive Forces”.
2. Locate and read through the lesson links and background information provided on the activity website http://mynasadata.larc.nasa.gov/preview_lesson.php?&passid=50.
3. Make sure popup windows are disabled in all computer browsers.

Other Information

Learning Objectives

1. Locate and examine authentic sea surface temperature data via the Internet.
2. Create line plots and data maps.
3. Explore how hurricanes form and gain energy from the ocean surface.

Prior Knowledge Needed by the Students

Students should be given an introduction to weather or hurricanes prior to the lesson. They should also be familiar with accessing the Internet and finding coordinates on a map.

Procedure

Engage

1. Engage students in a discussion on severe weather. Let them share any experiences they may have had with severe weather.
2. If there is not mention of hurricanes from the students, inform them that hurricanes are one type of severe weather that can cause much destruction to an area.
3. Show students the video clip “Hurricanes’ Destructive Forces” (02:25) from the United Streaming website.

Explore

1. Students will use the lesson links provided on the activity website to read about the 2005 Atlantic hurricane season and examine the track of Hurricane Rita.
2. Students will use the Live Access Server to make daily data maps of SST for the Gulf of Mexico during and after the passage of Hurricane Rita. Instructions for students to complete this part of the activity are listed on the activity website.
3. Students will use the Live Access Server to make a line plot of a selected position in the path of Hurricane Rita. Instructions for students to complete this procedure are listed on the activity website.



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Explain

The following is a list from the questions section on the activity website. Students complete this section to explain what they have learned from the lesson.

1. As a class, compare the daily SST maps of the Gulf of Mexico for the dates during and after Hurricane Rita. Do you see any evidence of lowered sea surface temperature in the data maps? Do you notice any delay between the hurricane passage and the effect on SST.
2. Examine your line plot of sea surface temperature for your selected location. Can you see the effect on the temperature in your line plot after the hurricane passed? How long did it take for the SST to return to the previous temperature?
3. What conclusions can you make about how hurricanes extract heat energy from the ocean? What other effects on SST may be occurring? Write a paragraph to explain.

Expand

The following is a list from the extension section on the activity website. Students can complete this section to expand their knowledge from the lesson.

1. Using the same procedure, examine the SST data during and after Hurricane Ophelia (September 7 - 18) and Hurricane Wilma (October 17-25). Do you see similar effects on sea surface temperature?
2. Examine other hurricanes in the Gulf, Atlantic or Pacific. Do you see any effects on SST? Why or why not?

Evaluate

The following information can be used as both formal and informal assessment:

1. Students' daily data maps of SST for the Gulf of Mexico
2. Students' line plot of selected position in the path of Hurricane Rita
3. Students' discussions and answers to the question from the questions section of the activity website
4. Students' paragraph explaining their conclusions about how hurricanes extract heat energy from the ocean and other effects on SST that may be occurring

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None

Supplementary Resources