

MY NASA DATA Lesson: See notes at the end of the lesson for data updates with the new Earth System Data Explorer

Hurricanes As Heat Engines

Purpose:

To examine authentic sea surface temperature data to explore how hurricanes extract heat energy from the ocean surface

Grade Level: 6 – 12

Estimated Time for Completing Activity:

50 minutes

Learning Outcomes:

- Students will practice finding data via the Internet.
- Students will practice making line plots and data maps.
- Students will understand how hurricanes gain energy from the ocean surface.

Prerequisite

- Introduction to weather or hurricanes
- Familiarity with accessing the Internet
- Familiarity with finding coordinates on a map

Tools

- Computer with Internet access
- PowerPoint or other presentation software
- Map or Atlas

AP Environmental Science Topics

- Atmosphere-ocean interactions

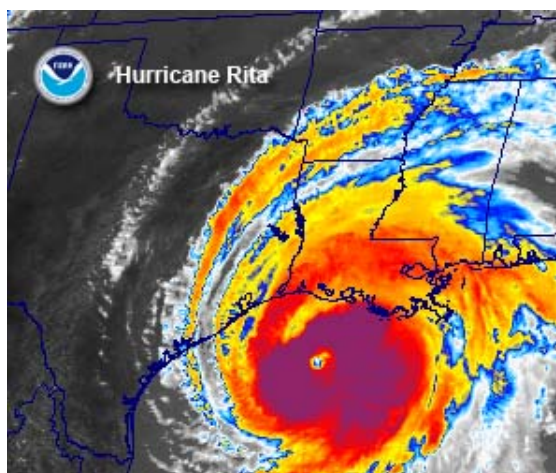


Image courtesy NOAA

- Atmospheric circulation
- Ocean circulation
- Solar intensity
- Weather and climate

Vocabulary:

- [coordinates](#)
- [heat](#)
- [latitude](#)
- [longitude](#)
- [MCSST](#)
- [sea surface temperature](#)
- [upwelling](#)

Lesson Links:

- [Live Access Server \(LAS\)](#)
- [Summary of the 2005 Atlantic Hurricane Season from NCDC](#)
- [The Path of Hurricane Rita from NOAA](#)
- [NASA Hurricane page](#)
- [Line plot at 27N, 90W](#)
- [SST map on September 26, 2005](#)
- [JPL State of the Ocean](#)
- [Other NASA Hurricane Data Tool](#)
- [Path of Hurricane Bertha](#)
- [Paperless version of the lesson](#)

Background:

The passage of a hurricane causes a large transfer of heat between the ocean surface and the atmosphere. It also causes surface waters to diverge, bringing cooler water from below to the surface (upwelling). These effects are so large that they can be seen

by a drop in sea surface temperature (SST) in satellite data observations along the path of the storm. The cooler water conditions may last for a week or longer after the storm.

In this lesson, you will examine a historical Category 5 hurricane, Hurricane Rita, that crossed the Gulf of Mexico during September 18-24, 2005. First, you will use the MY NASA DATA Live Access Server to obtain sea surface temperature data maps of the Gulf of Mexico. Then, you will construct a time series of SST data (line plot) for a location within the path of the hurricane where a drop in SST is observed.

Procedure:

Using the lesson links above, read about the 2005 Atlantic hurricane season and examine the track of Hurricane Rita.

Part I: 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. An example data map is provided above.

1. Click on the lesson link for the Live Access Server (Advanced Edition).
2. If you are not automatically prompted with parameter choices, click on 'Choose Dataset' at the top left of the page to begin.
3. Click on Oceans, then Daily Sea Surface Temperature (GHRST)
4. In the latitude-longitude text boxes below the navigation map to the left of the screen, enter 30 N in the north position, enter 18 N in the south position, enter 98 W in the west position, and enter 78 W in the east position. Make sure to click on 'update plot' at the of the page to see your color plot
5. Select a date during or after the week of Rita. Click 'update plot' at the of the page to see your color plot with the new data for your selected date.
6. Repeat for several consecutive days. Save and print your results, or import your images into PowerPoint.
7. Choose a day of interest and make note of the coordinates along the track of Rita where lowered SST is observed.

Part II: Use the Live Access Server to make a line plot of your selected position in the path of Hurricane Rita. An example line plot is provided above.

1. Return to the Live Access Server data selection interface for MCSST.
2. This time, Select view as Time series. This can be found under the navigation map on the left side of the screen
3. Enter your selected position in the latitude - longitude text boxes to the right of the map.
4. Select a time range for the month of September and October 2005. Click 'update plot' at the of the page to see your color plot with the new data for your selected date.
5. Save and print your results, or import your plot into PowerPoint.

Questions:

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.

Extensions:

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?

Please note: Data is not available for the week after Hurricane Katrina because the hurricane interrupted data processing at the Naval Oceanographic Office at Stennis Space Center, Mississippi.

Lesson plan contributed by the MY NASA DATA Team

[Click here for Teachers Notes](#)

[View lesson without Standards](#)

**Data Notes from Dr. Brad (12/2018):**

Up-to-date daily sea surface temperature (SST) data can be found on the Earth System Data Explorer at Hydrosphere->All Data->Sea Surface Properties->Daily Sea Surface Temperature.

Teacher
Feedback

