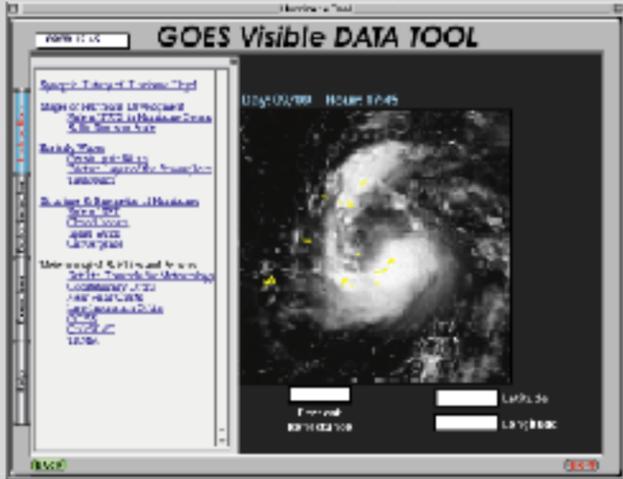


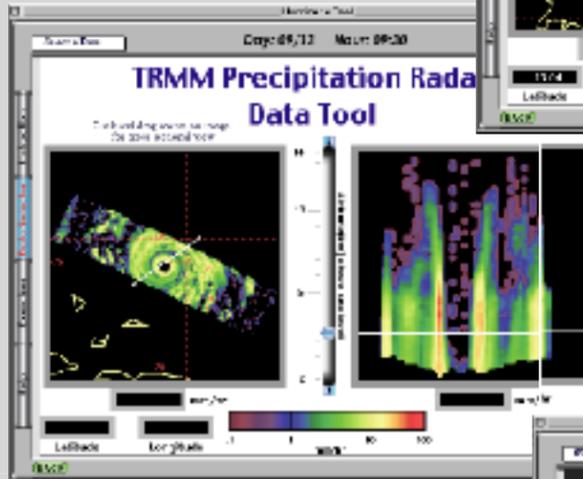
Data Discovery Toolkit and Foundry

Data Discovery: Hurricanes (beta version)

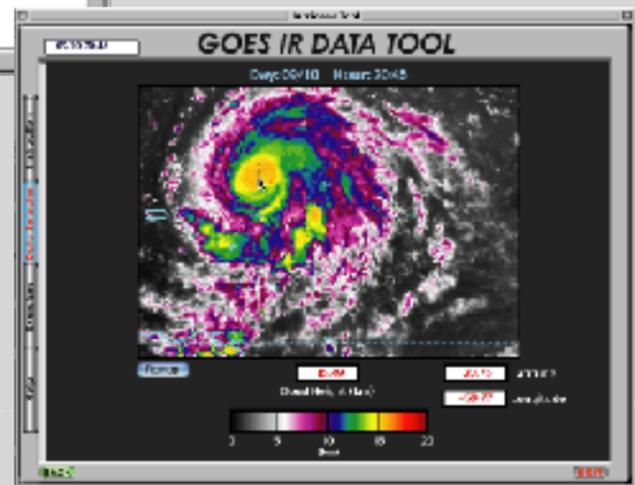
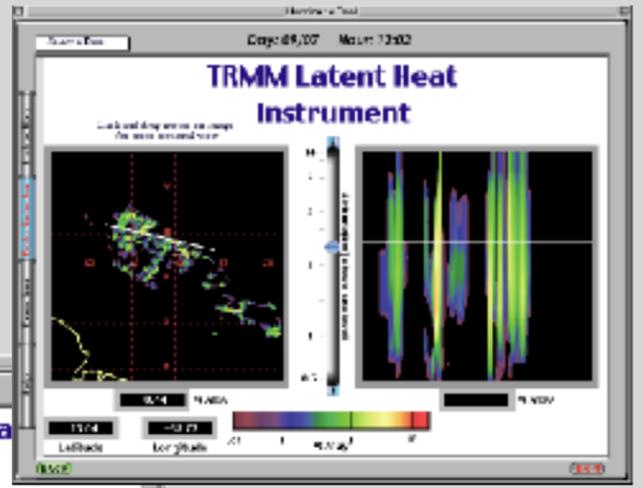
Real data in user-controlled interfaces with interactive user tools and associated science information and laboratory exercises. Works on MacOS (8-9.2) and Windows computers. This tool uses remotely-sensed data for hurricane Floyd from the GOES and TRMM instruments to enable undergraduate students to explore how these data can describe the dynamics of hurricane propagation.



Sliding Window Exposes Curricular Materials and Laboratory Exercises in HTML



Multiple Windows permit data comparisons within and across instruments



NASA GOES IR Derived Winds
Upper Level Winds of Hurricanes: Anticyclonic Outflow

Objectives:

- To define anticyclonic outflow.
- To describe how anticyclonic outflow assists the intensification of a hurricane.
- To use GOES derived winds data to identify the anticyclonic outflow of Hurricane Floyd, evaluate its strength, and judge its relationship to cloud height using GOES colorized IR data.

Part One: Background science

1. Read the following instructional materials:

- *Synoptic History of Hurricane Floyd*
- *Stages of Development of Hurricanes*
- *Saffir-Simpson Scale*
- *Hurricane Structure and Energetics*
- *GOES*

2. In what direction does anticyclonic wind flow in the Northern Hemisphere?
3. Where does anticyclonic flow occur in relation to a hurricane?
4. What role does anticyclonic outflow play in the development of a hurricane?
5. Indicate the dates on which Hurricane Floyd reached the following stages.

Stage of Hurricane Development	Wind Speed (knots)	Date Hurricane Floyd Achieved Stage
Tropical Depression	22-33	
Tropical Storm	34-63	
Stage 1 Hurricane	64-82	
Stage 2 Hurricane	83-95	
Stage 3 Hurricane	96-113	
Stage 4 Hurricane	114-135	

file:///Natural_Hazards-Hurricanes/Hurricanes/resources/tutorial/pieces/Exercises/ExerciseTwo.html (1 of 2) [4/3/2002 5:36:51 PM]

Latent Heat Release Inside Hurricanes: Hot Towers

5. Examine the relationship between atmospheric height expressed in mb versus km. Refer to Figure 1 in the instructional link *Friction Layer of the Atmosphere* to complete the following table.

Atmospheric Height Expressed as km above sea level	Approximate Height in mb Atmospheric Pressure
2 km	
6 km	
10 km	
12 km	
16 km	

6. Examine the relationship between wind height and direction in a hurricane. Refer to Figure 6 in instructional link *Winds at Different Heights*. In this figure, isotachs with positive labels show the location of wind moving in a cyclonic direction (toward the eye of the hurricane). Isotachs with negative labels show the location and strength of wind moving in an anticyclonic direction. Fig 6 is a vertical slice of the hurricane with conditions up through the eye of the hurricane shown on the y-axis.

- a. What is the speed of the strongest anticyclonic winds shown in the figure?
- b. Through what range of altitude do the strongest anticyclonic winds occur?
- c. Based on the figure, would you expect anticyclonic winds directly above the eye of the hurricane?

Part Two: Using the data tool to examine upper level winds.

1. The upper level derived winds are calculated at three different heights in the atmosphere. What are these heights expressed in ranges of atmospheric pressure (mb)? What colors are assigned to the arrows showing wind speed and direction for each of these heights?
2. Using the data tool, how do you obtain wind speed for a given vector?
3. What color of arrow shows wind data where anticyclonic winds are likely to be strongest above a hurricane?
4. Beginning on what date is anticyclonic outflow clearly evident from Hurricane Floyd? In what stage of development was Hurricane Floyd at that time? Are the wind speeds derived from the satellite data consistent with Figure 6?
5. Does it appear that the anticyclonic outflow became stronger as Hurricane Floyd intensified?
6. Are there strong horizontal winds directly above the eye of the hurricane? Explain.
7. **Bonus:** How can you combine data from two satellites to decide whether or not upper level anticyclonic winds flow through clouds in a hurricane or above the tallest clouds?

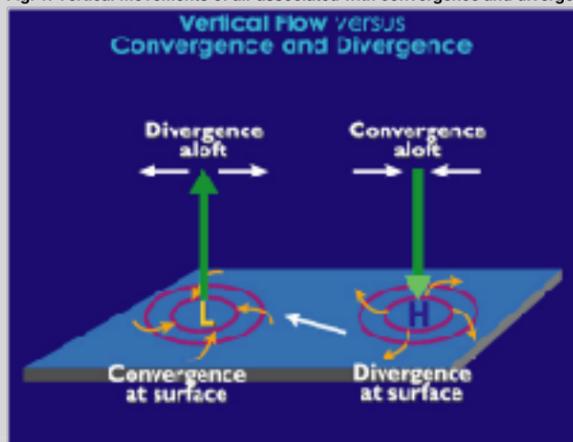
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Convergence

Convergence

Convergence occurs when air moving from different directions collides. When convergence happens near the surface of the earth, such as when air spirals into the center of a low pressure cell, air is forced upward, a process called ascent. When convergence occurs high in the atmosphere, for example near the top of the troposphere, air is forced downward toward the surface, a process called descent, or subsidence.

Fig. 1. Vertical movements of air associated with convergence and divergence.



Winds flowing along a spiral path toward the eye of a hurricane begin to converge some distance from the center of the eye. The ascent of the moisture laden air leads to cumulus convection and thunderstorm formation in the spiral cloud bands of the hurricane. Convergence closer to the center of the storm causes the remaining inflowing air to turn sharply upward 10-100 km from the center of the eye, creating the eye wall of the hurricane.

Fig. 2. Diagram of air circulation in a hurricane, showing ascent of converging air in spiral cloud bands and the eye wall.

file:///Natural_Hazards-Hurricanes/Hurricanes/resou...r_Structure_Energetics/Convergence/Convergence.html (1 of 2) [4/4/2002 2:05:13 PM]



NSDL Project: Data Discovery Toolkit and Foundry is building the shared development space for creating hundreds of "user-near" data tools for classroom use in all grades.

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