Barometric Pressure

MIDDLE GRADES SCIENCE NSPIRED

TEACHER NOTES

Science Objectives

- Students will examine and describe parts of a hurricane.
- Students will discover how barometric pressure changes in relation to a hurricane.

Vocabulary

- barometric pressure
- millibars
- eye of a hurricane
- eyewall

About the Lesson

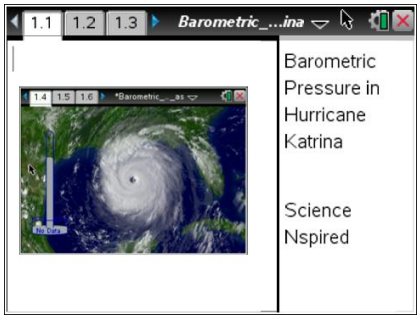
- This lesson is a simulation of barometric pressure measured across different points in relation to Hurricane Katrina. This provides an opportunity for students to gather data and explore parts of a hurricane and how barometric pressure changes in relation to the hurricane.
- As a result, students will:
  - Measure the distance of the eye of Hurricane Katrina from the coast and measure the diameter of the hurricane.
  - Collect data on barometric pressure across different points of an aerial view of Hurricane Katrina.
  - Use collected data to classify Hurricane Katrina on the Saffir/Simpson Hurricane Scale.

TI-Nspire™ Navigator™

- Send out the *Barometric_Pressure_in_Hurricane_Katrina.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: TI-Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software



Tech Tips:

- This activity includes class captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Materials:

Student Activity

- Barometric_Pressure_in_Hurricane_Katrina_Student.doc
- Barometric_Pressure_in_Hurricane_Katrina_Student.pdf

TI-Nspire document

- Barometric_Pressure_in_Hurricane_Katrina.tns

Discussion Points and Possible Answers

Move to pages 1.2.

Have students read the background information for the activity on their student activity sheets and/or on their devices.

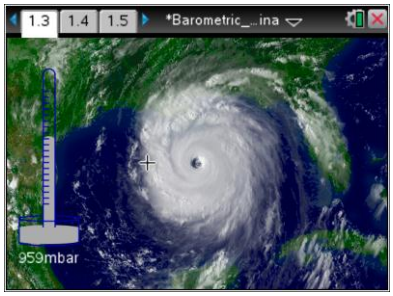
Part 1: Exploring Barometric Pressure and Parts of a Hurricane

In this part of the lesson students explore barometric pressure and parts of a hurricane.

Move to page 1.3.

Have students read the directions for the simulation. Make sure students note where the barometer is located on the screen.

1. Students will be moving the cursor across the screen using the left ◀ and ▶ right arrows. Make sure students can see that the cursor changes from an arrow to + (a plus sign) when it is on an area of the screen where data is available. Make sure students can observe that the barometer level can move up and down depending on where the cursor is located. They are not collecting data at this time.



Tech Tip: To observe the barometer levels, students should press their finger to the screen and drag it across the hurricane.

TI-Nspire Navigator Opportunities

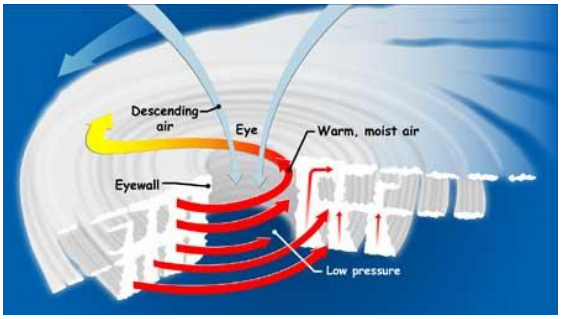
Allow students to volunteer to be the Live Presenter and demonstrate areas on the screen where the cursor changes.

Students should have an intuitive understanding that the barometric pressure rises and falls depending on where the cursor is located on the screen. From their observations, students should conclude that the barometric pressure does not rise and fall randomly, but in a pattern.

Q1. Describe what happens to the barometer as you move the cursor across the screen.

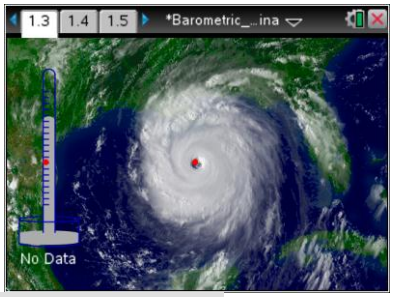
Answer: The barometer changed levels as the cursor was dragged across the screen from left to right. It started at a high level, then dropped as it got closer to the center of the hurricane, then it rose again.

2. Allow students time to look at the diagram to the right showing the structure of a hurricane. Make sure students understand where the land, coast, and the eye of a hurricane are located on the screen.



[http://spaceplace.nasa.gov/hurricanes/]

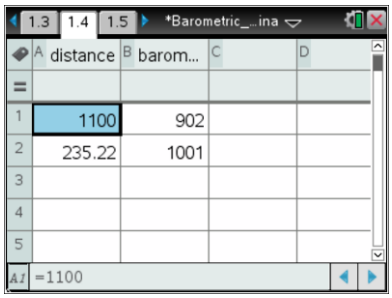
3. Students will be selecting areas of the screen to collect data points. Students need to move the cursor to the eye of the hurricane and select it using ⍾. Then, they should move the cursor to the edge of the coast and select it.



Tech Tip: To record data points, have students lift their fingers from the screen when the barometer changes.

Move to page 1.4.

4. Data will vary from student to student and is dependent on where they placed their cursor. All students should see the same general patterns.



Q2. Complete the table shown below.

Sample answer:

Location of Data Point	Distance (km) From Unknown Location
Eye of Hurricane	**1100**
Coast	**269.22**

Q3. True or False: Based on your data, the eye of Hurricane Katrina is more than 1,500 kilometers away from the coast.

Answer: False

5. At any point, students can select esc to remove data points that have previously been placed. This will also clear the spreadsheet and the scatter plot on pages 1.5 and 1.6.

Tech Tip: To clear data points, have students select > **Hurricane Katrina > Erase Measurements.**

Q4. Notice that Hurricane Katrina has a circular shape. Move the cursor and collect two data points at the outer edges of the hurricane to find its diameter. Complete the table shown below.

Sample answer:

Location of Data Point	Distance (km) From Unknown Location
Right Side	**1556.601**
Left Side	**754.088**

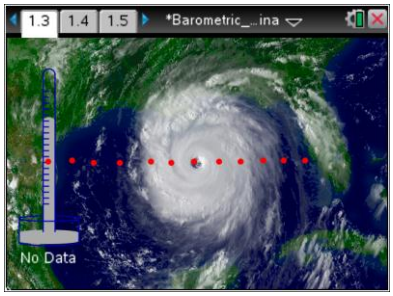
Q5. Based on your data, what is the approximate diameter of Hurricane Katrina?

A. 60 kilometers
B. 550 kilometers
C. 800 kilometers
D. 1250 kilometers

Answer: C

Part 2: Analyzing Barometric Pressure

6. Make sure to remind students that the barometer changes as the cursor is moved across the screen. Students will be collecting data from 12 points of the screen image. Students may have an intuitive understanding that barometric pressure is lowest in the central area of the hurricane, but now they will collect data to demonstrate this.



7. Students will be collecting collect data starting from inland and moving east. Make sure they use a systematic approach, spacing data points as evenly as possible. Also make sure they collect data from key points including the coast, the outer edges of the hurricane, and the eye of the hurricane.

   Allow students time to analyze the line graph on page 1.6 resulting from the data collected. If they did not collect a key data point, allow them to clear their data and start over. Allow students time to read the information on the student activity sheet about how hurricanes form. Review any parts that the students do not understand.

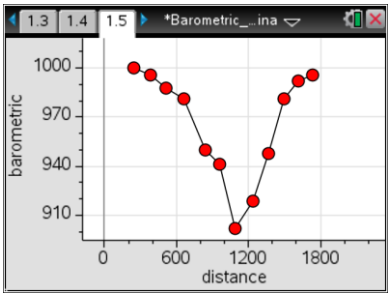
Q6. Go to page 1.4 that shows the spreadsheet with data you collected. Copy your data from the spreadsheet to complete the table shown below.

Sample answer:

Data Point	Distance (km)	Barometric Pressure (mb)
1	76.1006	1007
2	221.384	1001
3	408.176	996
4	574.214	986
5	726.415	968
6	830.139	950
7	961.635	941
8	1093.08	902
9	1224.53	919
10	1335.22	930
11	1487.42	981
12	1667.3	994

Move to page 1.5.

Q7. Look at the line graph. Describe the line graph. Where is barometric pressure highest on the graph? Where is barometric pressure lowest on the graph? In what part of the hurricane is barometric pressure lowest?



Answer: The line graph is a V-shape. Barometric pressure is highest at the beginning and the end of the graph. Barometric pressure is lowest in the middle of the graph. Barometric pressure is lowest in the eye of the hurricane.

Teacher Tip: Student graphs will vary based on data.

How do hurricanes work?

Allow students time to read the information about how hurricanes work on the student activity sheet. Go over any parts that the students do not understand.

Q8. What causes strong winds in a hurricane?

Answer: Winds are the result of high pressure air rushing into the area of low pressure at the center of the hurricane.

Q9. Based on your data, what was the barometric pressure in the eye of Hurricane Katrina?

Sample answer: 902 mb

Q10. Suppose the eye of Hurricane X had a barometric pressure of 975 millibars. Which hurricane was more intense? Why?

Sample answer: Hurricane Katrina was more intense because its eye had a lower barometric pressure.

Part 3: Classifying a Hurricane

From parts 1 and 2, students should now have a formal understanding of how barometric pressure is related to hurricanes. Central pressure is the pressure in the eye of the hurricane. Students should understand that the lower the central pressure of a hurricane, the more intense it is. Go over the Saffir/Simpson Hurricane Scale. Explain any terms students do not understand.

SAFFIR/SIMPSON HURRICANE SCALE

Category	Central Pressure (mb)	Winds (mph)	Damage
1	>980	74-95	Minimal
2	965-979	96-110	Moderate
3	945-964	111-130	Extensive
4	920-944	131-155	Extreme
5	<920	155+	Catastrophic

Q11. Use the data you found in Question 9 for the central pressure of Hurricane Katrina to classify it on the Saffir/Simpson Hurricane Scale. What category was Hurricane Katrina? Explain.

Answer: Hurricane Katrina was category 5 because it had a central air pressure of less than 980 mb.

Q12. Based on the Saffir/Simpson Hurricane Scale, what category is Hurricane X?

Answer: Hurricane X was category 2 because it had a central air pressure between 965 and 979 mb.

Q13. Based on the Saffir/Simpson Hurricane Scale, did Hurricane X cause more or less damage than Hurricane Katrina? Explain.

Answer: Hurricane Katrina caused more damage than Hurricane X because a category 5 hurricane causes catastrophic damage, but a category 2 hurricane causes moderate damage.

TI-Nspire Navigator Opportunities

Use Quick Poll to check for understanding during the course of the activity.

Wrap Up

When students are finished with the activity, pull back the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Analysis questions are written into the student worksheet.