It’s a Monster Hurricane!

By

DAVID JUNGBLUT

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Part 3:
HURRICANE KATRINA TEACHING ACTIVITIES

Storm Energy and Convection Cells

The Earth's ground and upper ocean waters are heated by the sun via a process called radiation. As the ground and the ocean water heats up the air that is in contact with the ground or ocean water heats up, this process is called conduction.

Low pressure air that heated up absorbed energy and thermal expansion causes the air to expand and becomes less dense. The air moves upward and heats up other air and in the process called convention and loses energy the air contracts becoming denser. Cold, high pressure air will sink toward the ground to replace hotter, lower pressure air.
When the original air returns a convection cycle is formed. The movement of high pressure air to the ground is called wind. This air now in contact with the surface becomes less dense and expands becoming lower pressure air. The lower pressure air will rise as the higher pressure air pushes it up. As the temperature of this air drops, the air becomes denser and sinks back down, starting the cycle over again.

Small storms, water currents, as well as massive hurricanes, have convection cell processes associated with them and the entire atmosphere and the entire world's ocean have convection cycles as the main driving force of the world's climate. All storms moves air in the same up and down way. It is generally considered that high pressure air mass will sink toward the ground, pushing the up less dense air into the atmosphere. The warm air mass, since it is less dense, can carry evaporated water with it, if water is available to the air mass. The faster the air moves upward, the faster the air reaches the dew point. Cloud formation forms from the condensation of water droplets. The original warm, low pressure air mass is now denser; therefore, it is higher pressure air mass and will start to sink. The descending air complete, the convention cell, also called an "updraft-downdraft couplet."

**Single Cell Thunderstorms** have one convection cell, also called an updraft-downdraft couplet. A small thunderstorm may develop when electrical changes separate in the cloud.

**Multi Cell Thunderstorms** have multiplyable convection cells, with each one having an updraft-downdraft couplet. The leading edge of Multi Cell Thunderstorms can develop different types of winds: squall lines, gust fronts, wind shear, hail, gustnadoes, straight-line winds and weak tornadoes.
Super Cell Thunderstorms have deep rotating updraft that can produce large hail, weak-to-violent tornadoes, and almost always occur near the updraft-downdraft couplet interface. The Super Cell Thunderstorms rotates with different updraft cells merging into an exploding vertically updraft. Cloud walls develop as larger volumes of air are uplifted from the surrounding area.

**Student to draw the following:** Single Cell Thunderstorms, Multi Cell Thunderstorms, and Super Cell Thunderstorms microburst and straight line winds.

**Student activity:** Hurricanes are giving category numbers from one to five based on the wind speed. Do you think this is a good system? Can you come up with a different solution? How much energy is required to change 1 kilogram of water one degree? Can a category system be based on the amount of energy a system has?

**Should We Rebuild New Orleans?**

'Should We Rebuild New Orleans?' was an across-curriculum Interdisciplinary Activities with differentiated instruction activity that 6 teachers taught at the same time at Oakcrest High School. For three days during the school year Oakcrest High School holds co-curricular days. The following is a school wide lesson plans that I wrote that was used as a bases for other teachers teaching other subjects. The lesson planning follows.
<table>
<thead>
<tr>
<th>Will history repeat itself? Should we as a society provide the money necessary to rebuild on flood prone areas of New Orleans or will the cost be too great to preserve the rich history of the wetland city in a global warming era?</th>
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<tbody>
<tr>
<td>Will the conservation of a levee system ever be guaranteed to be safe, no matter what the cost in lives and tax dollars?</td>
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<th>Math</th>
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<td>1. Cost of rebuilding houses</td>
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<td>2. Cost of a new or rebuilt levee system</td>
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<td>3. Cost per resident or tax payer</td>
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<td>4. Cost of inflation</td>
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<td>5. Prediction of where and when microbursts could have occurred</td>
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<td>6. Compass readings to determine angle of damage</td>
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<td>2. Family heritage and future generation</td>
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<td>3. Economical loss in historical buildings and culture of the citizens</td>
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<td>4. Economic status' effect on how families recovered from their loses</td>
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<td>5. Migration of New Orleans residents throughout the U.S.</td>
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<td>6. Insurance question in the &quot;new&quot; New Orleans</td>
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<td>7. Culturally what has been lost</td>
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<td>1. Geology of the area</td>
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<td>2. Design of levees to withstand microbursts or hurricanes</td>
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<td>3. New Orleans and area wetlands</td>
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<td>4. Future flooding prediction in a global warming era</td>
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<th>Languages: present, past and future languages of New Orleans</th>
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<td>1. French</td>
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<td>2. Spanish</td>
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<td>3. English</td>
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<th>Performing Arts</th>
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<td>1. History of music in the Bayou</td>
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<td>2. On the stage</td>
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<td>3. Movies filmed there</td>
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<td>1. Major health issues resulting from tragedy</td>
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<td>2. Eating habits of the Bayou</td>
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One group excelled in this activity b designed and built a new type of level system. See picture on page 72.

Mike Cline and Kyle Belanger's group designed and made a model for a new levee system.

Superposition Activity

Problem Question: How do you order events in rock strata or during a major sediment process called a hurricane?

Materials: Layered sedimentary rock, straws

Brainstorm the Problem Question:
Point out the sedimentary rock has layered in it. How can use the knowledge to help us understand something important? Brainstorm the relative age of the layers, "relative age to each other." Which one would be older and which one younger? After establishing the relative age of the rocks turn to the Picture 4 and brainstorm the time that different item arrived at the site in relative time.

Activity: Give each student a number of straws and hold the straws in an upright position, then let go. Determine relative age of the straws. Hint:
Which was the last one to arrive on the pile?

Relative Dating Activity
After discussing Relative Dating have student answer the following question:
How was this rock formed?

Picture credit: George Buttrus for this example.

Answers should include:

1. The rock was formed in the horizontal layers (Original Horizontal) or flat.
2. The top layer is younger than the bottom layer.
3. The rock layer was folded at a later time.
   Note: Point out that this shows at least three different time events.

   After students have time to think about the three different time events ask: Does this rock have another time event? Then show the next picture.
Geological Principles of Relative Dating Demonstration

Let's take a closer look at the rock line between layers; it is also an event that was recorded in the rock. It might have been caused by a drying out period or a period of erosion that scoured or weathered the first layer down followed by another period of sedimentation. Four events were recorded in this rock history.

**Hurricane Forensics**

**Teaching Activity: Scientific Method Questions 1**

The Scientific Method Questions that I started with were. Did water do all this damage? Did wind damage the houses before the water flooded them? Can we determine exactly what happened to the houses in this area by using logical approaches?

**Teaching Activity: Picture-Picture an Observation Activity 1**

**Teacher introduction:** Today we are going to look at two pictures that were taken during Hurricane Katrina. Imagine that you are an owner of a house that was on the lot where the two pictures were taken. Your insurance company disallowed your claim because your policy reads “hurricane wind damage” but not “hurricane flood damage.”

**Essential Question:** What effects do hurricanes have on property?

**Students:** Look at each picture and write down your observations about each one.
Then discuss your answers with 3 classmates and write down additional details that you did not notice.

**Students Discussion:** Write down additional details that you did not notice.
Student Discussion: Discuss your answers with 3 classmates and write down additional details that you did not notice.

Teacher: Show the answer photograph with the notations that have been added to help illustrate the important observations and continue discuss until students understand the following.

Picture 1 Description:
1. Lines grooved into the concrete are in the west-southwest to east-northeast direction. One is visible in this picture; it breaks the concrete on parts of the walkway and driveway.
2. Broken concrete can be seen in a number of areas.
3. The tree, on the right side of the lot, is down from impact. Some white areas on the top of the trunk can be seen in this photo.

**Picture 2 Description:** The scraped lines onto the concrete can be seen on the foundation slab.
1. The more impressive lines move in the same direction as the grooved line in picture 1 in the west-southwest to east-northeast direction, marked “A”.
2. The less impressive lines can be seen going at different angles to the more impressive line; the majority are almost parallel to the right side of the foundation wall, marked “B”.
3. Another line is almost at a ninety degree angle to the foundation wall, marked “C.” Near to this line the foundation wall is broken.

**Students:** Now think like a scientist. What effects do hurricanes have on property?

Students’ answers might include: The same object that moved over the lot in Picture 1 made the marks in the same direction on Picture 2. Since three lines can be seen in different directions, the house must have been hit from three different directions during the storm.

More hurricane forensic pictures with description can be found at my website: [www.hurricanekatrinastudy.com](http://www.hurricanekatrinastudy.com).

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**Hurricane Air and Satellite Image Lab**

**Procedure:** Go to: [http://ngs.woc.noaa.gov/katrina/](http://ngs.woc.noaa.gov/katrina/) and look at the NOAA Hurricane Katrina Air Photos’ website.

1. Click on index map.

2. Click on the third box from the red line. (You are now looking at Gulfport.)

3. Click on the pier picture and count the number of tractor trailer boxes you can find on the east side (right side) of the pier. (None or a few will be found).

4. Count the number of tractor trailer boxes you can find on the north of the pier. (A few will be found).

5. Count the number of tractor trailer boxes you can find on the left side of the pier. (This will take a long time with a lot being the most common answer).

6. Find the motel building, fourth box from the left the pier. Look between the buildings. Locate the tracker trailer box. Draw a line from it to the pier. See picture on page 81.
The pier and the trailer line would go through building. This shows that the trailer move west, north and then east to its final position.

7. Discuss the satellite picture from Google Maps and the close up image with the NOAA image taken just after the hurricane. See pictures on pages 82 and 83.
**Density and Buoyancy Lab**

**Introduction:** After students have some time working with density and determining different mass of similar shaped objects.

**Procedure:**
1. Place similar shape rectangular wood and metal objects in plastic container. Ask students to predict which ones will move first when water is added.
2. Add water slowly; note the movement of some and not the others.
3. Observe that some of the wood rectangles do to start to float first and others do not, I ask the students why.
4. Student will come up with different density of wood. Show the less dense wood block float higher than more dense wooden ones.
5. Relate the rectangular shape wood to the tracker trailer boxes in Gulf Port Pier as it is today on MapQuest.
**Predict:** What would happen to the trailer boxes if the wind came from different directions? How about the water? So what can we predict about the boxes during Hurricane Katrina?

**Conclusion:** The first tracker trailer boxes off would be less dense or lighter in the water. They would float higher or have better buoyancy and in water and have a potential to travel the longest distance but also could travel to a new resting place faster and travel to more quickly. They could have starting flooding off the pier early and travel to a new resting place fast or travel west and then back when the eye wall storm surge hit. The more dense ones being less likely to travel very far and possible sink faster. The medium weight boxes would have the potential somewhere between those fasters to arrive and the slowest. They may have been the most traveled boxes.

I order the blocks similar to the tracker trailer boxes on Gulf Port Pier then add water.
The blocks are floating at different heights or not floating at all.

**Student activity:** Compare the results with pictures from Gulfport Pier today and from Hurricanes Katrina with the results from the previous lab.

**Horizontal, Tornado, Microburst, Straight-line Winds and Storm Surge Flooding Lab**

**Objective:** Today we are going to look at the horizontal winds, tornado winds, straight-line winds and storm surge flooding to see if we can reproduce which type of event fits best with the evidence we examined.

**Materials:** Construction paper, tape, 15 Popsicle sticks for each house to be made, fan, vacuum cleaner, leaf blower, tub, clothes pins, and water.

**Procedure:**
1. Build a three-dimensional house.
2. Place the house in a town-like setting.
3. Surround the town with clothes pins to represent trees.
4. Test the speed and velocity for a fan, vacuum cleaner and leaf blower.
5. Record your observation in Table I.
6. Direct the fan toward the town setting to represent horizontal wind.
7. Draw how the town and trees were affected.
8. Reset the town and repeat with the vacuum to represent a tornado event.
9. Reset the town and repeat with the leaf blower to represent a downburst and straight-line winds event. See picture below.
10. Place the town setting in a tub and add water to represent a storm surge event and test the different wind events. See picture below.
Activity: Compare your results with the following picture to determine which type of event(s) best represent(s) what happened in the picture.