Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

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Recipe for a Hurricane

Lesson plan for grades K-2
Length of lesson plan: 50 minutes
Authored by: Paige Lambert, Environmental Science Institute, March 2013

SOURCES AND RESOURCES:

- National Geographic: Young Explorer! http://ngexplorer.cengage.com/ngyoungexplorer/1209/pdfs/teacher-guide-sept_12K.pdf
- Smithsonian: Ocean Portal http://ocean.si.edu/blog/ingredients-hurricane
- Weather Wiz Kids
- http://www.weatherwizkids.com/weather-hurricane.htm
- How to Make Your Own a Pinwheel: http://www.wikihow.com/Make-a-Pinwheel

POTENTIAL TEKS ADDRESSED THROUGH THIS LESSON:

Science
112.11 (b) 2 (A)(B)(D)(E) 3 (B) 4 (B) 6 (A)(D) 8 (A)(B)(C)
112.12 (b) 2 (A)(B)(D)(E) 3 (B) 6 (D) 8 (B)(C)(D)
112.13 (b) 2 (A)(D)(E)(F) 3(B) 6 (D) 8 (C)

PERFORMANCE OBJECTIVES:
Articulate that a hurricane is a large storm that forms above the ocean in warm places

- Identify and understand the spiral motion of a hurricane
- List the main "ingredients" of a hurricane: water, heat from the sun
- List the "products" of a hurricane: wind, waves, clouds, rain
- Understand why hurricanes only occur during warmer seasons (relate to heat and warm ocean water)
- Understand that we name hurricanes

MATERIALS:

Pictures:

- Hurricane Picture Powerpoint (provided at the end of this lesson)
- 1 sheet of Easel paper
- 1 pinwheel per student or group of students (link to making your own is above)
    - One sheet of construction paper per student or group of students

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  - One brad per student or group of students
  - Crayons or markers to decorate if desired
- 1-3 Spinning globes for classroom demonstration
- Sandwich bags; one per student
- Small beads; preferably blue but any color will work. About 20 per student, but does not need to be exact.
- Strips of yellow construction paper; 5 per student
- Confetti; about a spoonful per student
- Short segments of yarn; about 3 per student
- Cotton balls; 4 per student

CONCEPTS AND TERMS

- A **hurricane** is a massive storm whose wind speeds reach at least 74 miles per hour and is driven by heat from warm ocean water.
- Ocean water surface temperatures need to be at least 80 degrees F for hurricanes to form.
- Ocean water and heat from the sun to warm the ocean water are necessary components for a hurricane to develop. Once a hurricane has formed, strong winds, large waves, dark clouds, and heavy rains are all present.
- Because the winter time is colder than summertime, ocean water does not reach a high enough temperature to form hurricanes. The water is only warm enough in the summer and fall. This is why we do not see hurricanes in the winter or spring.
- Hurricanes spin around the center of the storm, called the "eye," in a spiral pattern, similar to the movement of a pinwheel. The spiral pattern comes from wind that "feeds" into the sides of the hurricane.
- Every time a new hurricane develops, a name is assigned to it. Names are given in alphabetical order. The first hurricane to develop is given a name that starts with A (Anna); the second, B (Blake); the third C, (Charlie). If a named hurricane is especially destructive, they retire the name so that it will not be used again.

BACKGROUND

Hurricanes are heat-engines that power through the oceans, picking up intensity as they hurl towards land, constantly being fueled by warm summer waters. These extreme weather systems are invaluable to learn about, as experts predict that hurricanes will only intensify as the century progresses. Intensified hurricanes threaten danger to coastal communities, so understanding their mechanisms can help communities prepare for incoming storms.
Hurricanes are formed when surface waters evaporate and are carried upward and outwards by moving air to cooler temperatures in the troposphere (the lower atmosphere), where the change in

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temperature causes the water vapor to coalesce into storm clouds. Winds coming in from the side of the storm will steer the hurricane and facilitate its growth. Understanding the structure and spiral motion of a hurricane, as well as when and where hurricanes form, is important to appreciating further applications of hurricanes. See Dr. Kerry Emanuel's Hot Science- Cool Talks lecture from minute 2:29 to 11:16 for more information.

PREPARATION

- Before class, cut out enough strips of yellow paper for each student to take 4 or 5. Strips can be small; one inch x two inch will do.
- Distribute materials to each student
- Gather students together to sit in a discussion circle in a location away from their desks if possible, so that they are not distracted by the materials that have been passed out.

ENGAGE – GENERAL LEVEL (15 minutes)

The instructor should gather the students however they prefer in such a way that facilitates group participation, such as in a circle on the carpet. This portion of the lesson will involve images shown on a projector, so the instructor should ensure that the students can see the screen without obstruction.

Introduce
Open up the topic of hurricanes by presenting the concept of rain. Ask:

- Do you like to play in the rain?
- Where does rain come from?
- What else happens in a rainstorm?

The instructor should lead the conversation towards the facts that rain comes from clouds, and during storms, it is wet and windy outside, and we may also hear thunder and see lightning. The goal is to get the students thinking about what components are present in a storm.

Expand
Next, broach the specifics of a hurricane to the students. Ask:

- What is a hurricane?
- Have you ever experienced a hurricane in person?
- Can anyone name a specific hurricane that they have learned about?

The instructor can then explain to the students that every year when hurricanes begin to form, scientists assign names to the storms. The first storm is given a name that starts with the first letter of the alphabet, which is the letter "A". This first storm might be called "Anna" or "Andrew" or "Adam." The

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next storm to form will be given a name with the next letter in the alphabet, which is the letter "B". This second storm may be called "Blake" or "Brenda" or "Bruce". This pattern continues with every new hurricane that is formed during the hurricane season.

- Interesting fact: If a hurricane hits that causes a lot of damage to our cities and towns, the name of that hurricane is never used again. For example, because hurricane Katrina was so dangerous, scientists will never give another hurricane the name Katrina.

Focus

The instructor will direct the conversation to specifics about hurricanes.
The lesson will have two parts: 1) Focusing on the spinning motion and direction of a Hurricane using a pinwheel exercise, and 2) focusing on Hurricane ingredients and products.

PART 1:

ENGAGE:

PICTURES OF HURRICANES IN NORTHERN AND SOUTHERN HEMISPHERES

Use the Hurricanes PowerPoint (see Sources and Resources) to expose the students to pictures of famous storms that have occurred in the last decade. While flipping through the slides, the instructor should point out the similarities and differences between each storm. Be sure to include:

- Notice how large hurricanes are. Compare the storms to the nearby land features (i.e. hurricane Ike is bigger than the state of Florida).
- Point out the "eye," and explain that this is the calm center of the storm.
- Notice that the first four pictures, which all occur in the northern hemisphere, are hurricanes and the last four pictures, which all occur in the southern hemisphere, are cyclones. Make the students aware that what separates hurricanes from cyclones is the direction that they spin. We will soon be explaining why hurricanes and cyclones spin in different directions.
- Trace the direction of the spin on each hurricane with your finger or a pointer. The hurricanes should be spinning in a counter-clockwise direction. The cycles should be spinning in a clockwise direction.

Students will understand why hurricanes spin in opposite directions in different parts of the Earth. To begin, have the students create their own pinwheel. Step by step directions are provided in "*How to Make Your Own a Pinwheel"* linked under the "Sources and Resources" section. After they have completed their own pinwheels, have the students name it as though they are scientists assigning a name to a hurricane, and allow them to play with their pinwheels for a few moments while drawing a few parallels between their creation and real hurricanes:

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- The rotating, spiral motion
- The differing speeds of the student's breath affecting how quickly or slowly the pinwheel spins, just as the different wind speeds can strengthen or slow a hurricane
- The brad that acts as the center of the pinwheel does not spin, just as the eye of a hurricane is the most calm part of the storm

Next, select a pinwheel and secure it to the metal arm of a globe, just along the equator, so that half of the pinwheel is in the northern hemisphere and half of the pinwheel is in the southern hemisphere.

- Blow air over the top of the pinwheel (to simulate wind in the northern hemisphere) and have the students note that the pinwheel spins counterclockwise.
- Blow the air over the bottom of the pinwheel (to simulate wind in the southern hemisphere) and have the students note that the pinwheel spins clockwise.

Ensure that the students understand that the opposite spinning motions is influenced by the wind patterns in the northern and southern hemispheres.

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PART 2:

ENGAGE: HURRICANE INGREDIENTS AND PRODUCTS

Next, the class should collaborate on a recipe consisting of what ingredients are needed to make a hurricane and what happens as a result of the formation of a hurricane. If students are unfamiliar with what the term “ingredients” are, explain that ingredients are special parts that make up one final creation, like bread, peanut butter, and jelly making up a sandwich.
Brainstorm by setting up a large sheet of paper on an easel, and make a list of the ingredients we need to create a hurricane, and make a separate list for the products after a hurricane is formed. Lead the students so that the list includes:

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- Ingredients
  - Water / The Ocean
    - To become clouds and rain
  - The Sun
    - To warm the water so that it transfers to the air to become clouds
- Products
  - Wind
    - To "drive" the storm
  - Waves
    - Produced by winds
  - Clouds
    - To hold water that evaporated from the warm ocean water
  - Rain
    - To bring evaporate water back to the ground

Bring attention to the fact that the water is warmed by the sun. Ask the students to think about how it is warm outside during the summer and cold outside during the winter. Using this information, and what we learned about how hurricanes need the water to be warm to form, ask the students:
When do hurricanes form: during the summer or the winter?

EXPLORE

Overview: The students will follow the recipe that they developed together as a class. Step by step, they will add their "ingredients" which will be symbolized by different common objects, followed by "products", together forming a representation of what a hurricane essentially is.

Instructions:
The arrangement of the students to participate in the activity is up to the instructor's discretion. It is suggested that students are broken up into small groups of 4 or 5 and gathered around tables with the designated materials set in the middle of the table for the students to select from. Another option may be to keep students at their own desks and distribute enough materials to complete their bag to each student.

Have the students follow along as the instructor creates their own "Hurricane in a Bag" so that the class is synchronized and collectively participating.
Step 1: Open your sandwich bag.
Step 2: Grab a small handful of beads, and drop them into the bag. These beads will be the ocean water for our hurricane.

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Step 3: Count out 5 strips of yellow paper. The yellow paper stands for the heat from the sun that will warm our water.
Step 4: Close the bag and shake it up to represent these two ingredients interacting with each other.
Step 5: Open the bag so that products can be added.
Step 6: Count out 4 cotton balls. Drop them into the bag. The cotton balls represent clouds holding rain.
Step 7: Drop a spoonful of confetti into the bag to represent raindrops that fall from the clouds.
Step 8: Drop a few pieces of yarn into the bag. This will represent waves.
Step 9: Blow a little air into the bag to represent the wind, and then close your bag.
Step 10. Remember that scientists give hurricanes names. As a scientist, you now get to pick out a special name for your hurricane similar to how you named your pinwheel.

EXPLAIN (5 minutes)
Review what students discovered during the "Hurricane in a Bag" activity.
Present the following questions to the students:

- What do the beads stand for?
- What do the yellow strips stand for?
- What do the cotton balls stand for?
- What does the confetti stand for?
- What does the yarn represent?
- Why did we blow air into our bags?

Ask a few students to share what they named their hurricane with the class.

ELABORATE (10 minutes)
Now that the students have learned about the motion of a hurricane and which direction the storms turn in both hemispheres, pass one copy of the map printed below to each student. Have the students draw a hurricane in the Gulf of Mexico, and have them draw in the direction of this hurricane's spin using arrows. Remind the students that the Gulf of Mexico is in the northern hemisphere. Collect the maps when the students are finished.

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The Gulf of Mexico

Draw a hurricane entering the Gulf. Be sure to include arrows to show which direction this hurricane spins. Remember that the Gulf of Mexico is in the northern hemisphere.

Source: http://www.worldatlas.com/aatlas/infopage/gulfofmexico.htm

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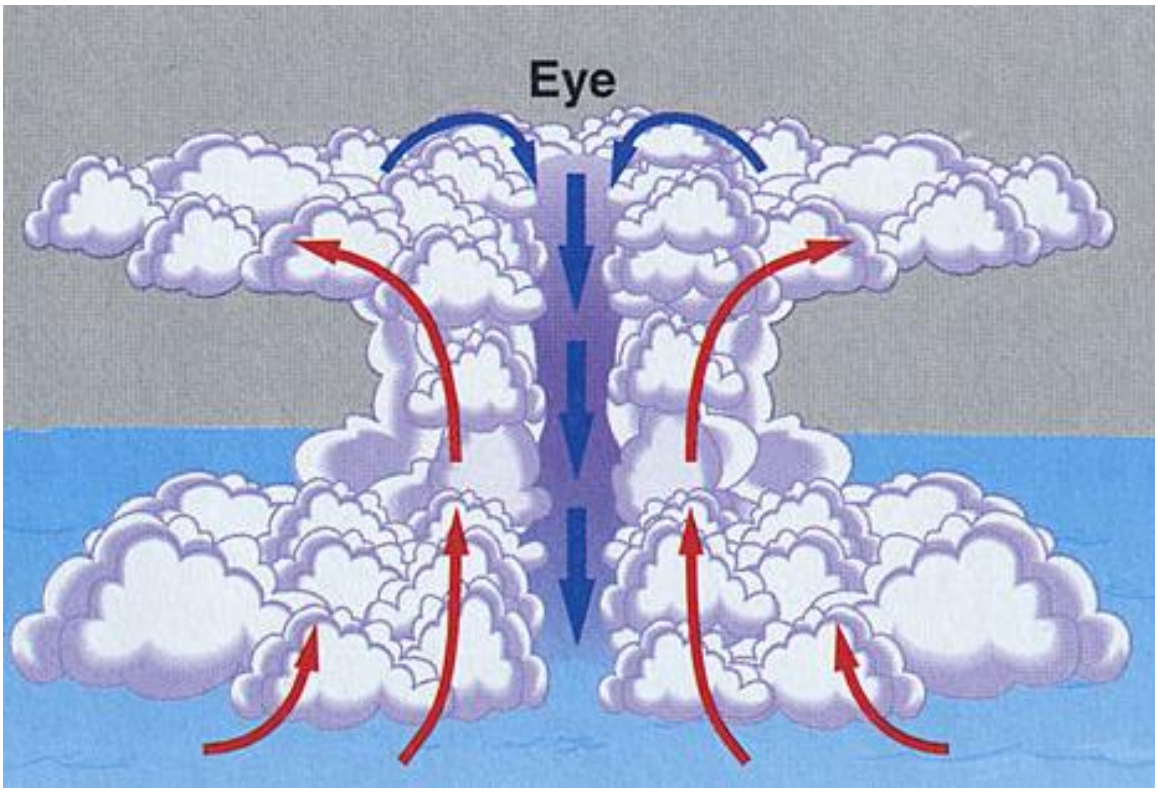
EVALUATE Have students decide which category ("Ingredients" or "Products") that each of the words in the word bank below should be placed. Then, cut out the words and glue them onto the picture of the hurricane according to where you will see these ingredients and products occur.

Source: www.whoi.edu



INGREDIENTS **PRODUCTS**

WORD BANK:

OCEAN WATER	HEAT FROM THE SUN	WIND
CLOUDS	RAIN	WAVES

Super Storms

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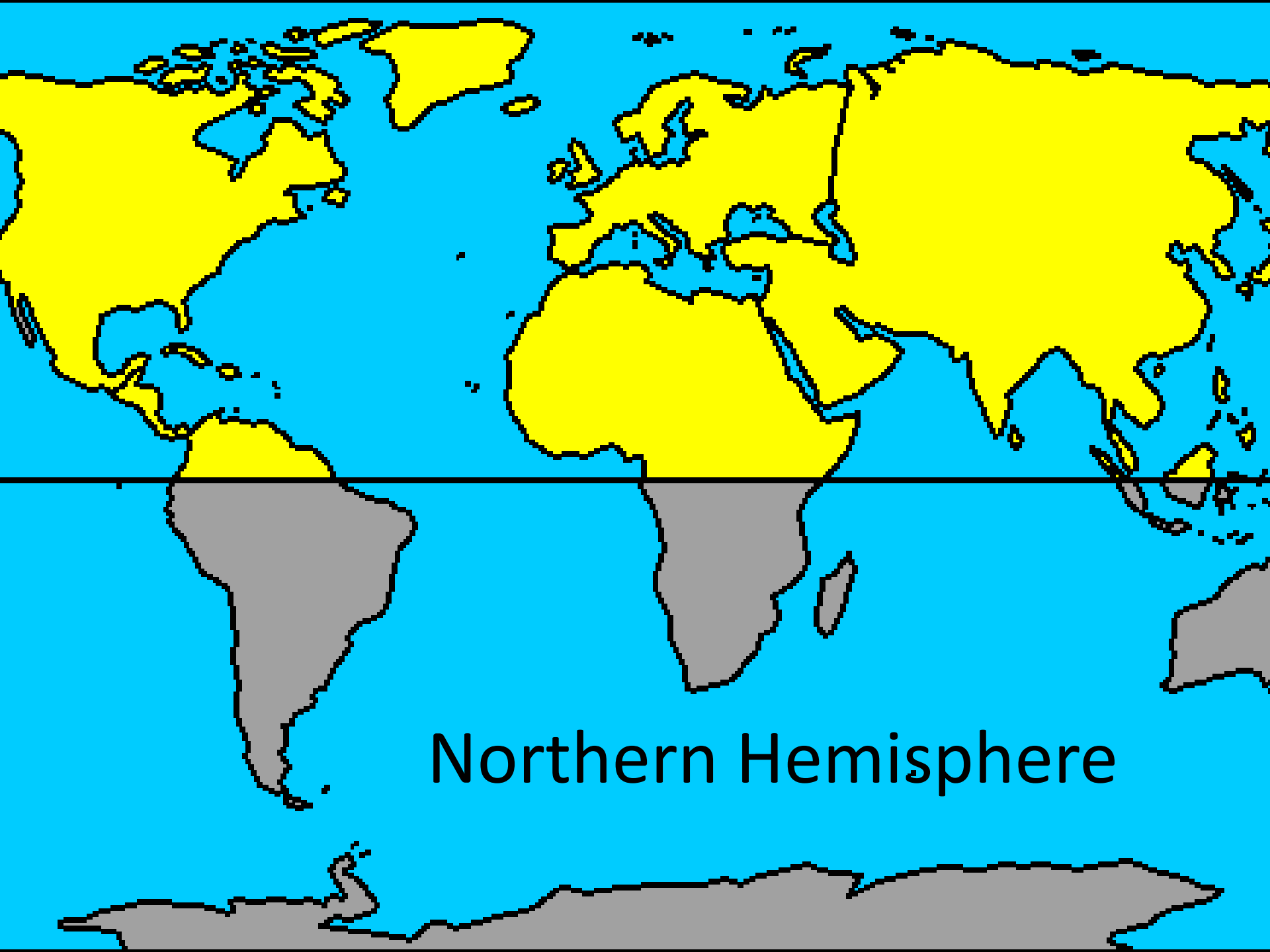
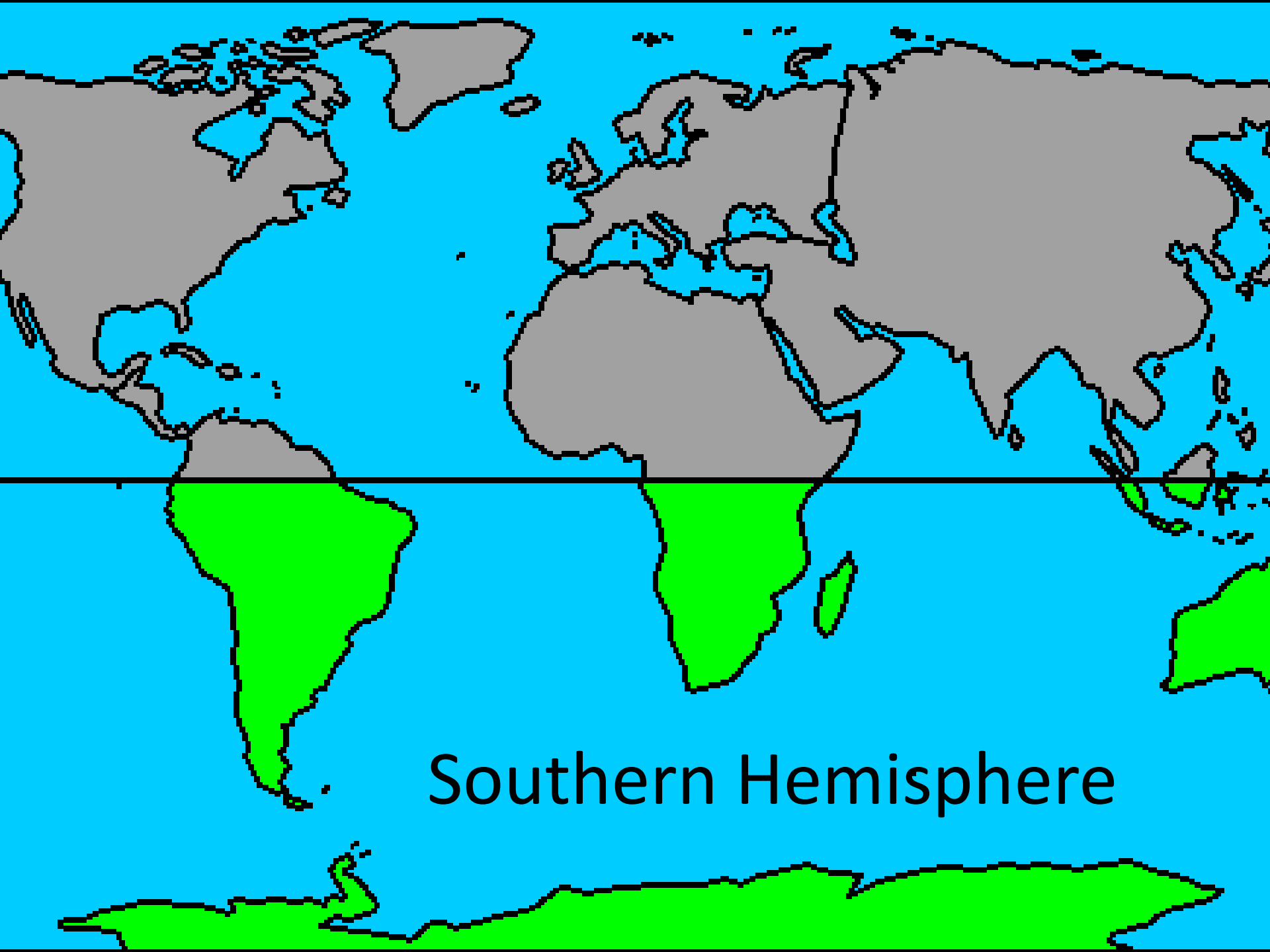

Northern Hemisphere


Hurricane Katrina 2005

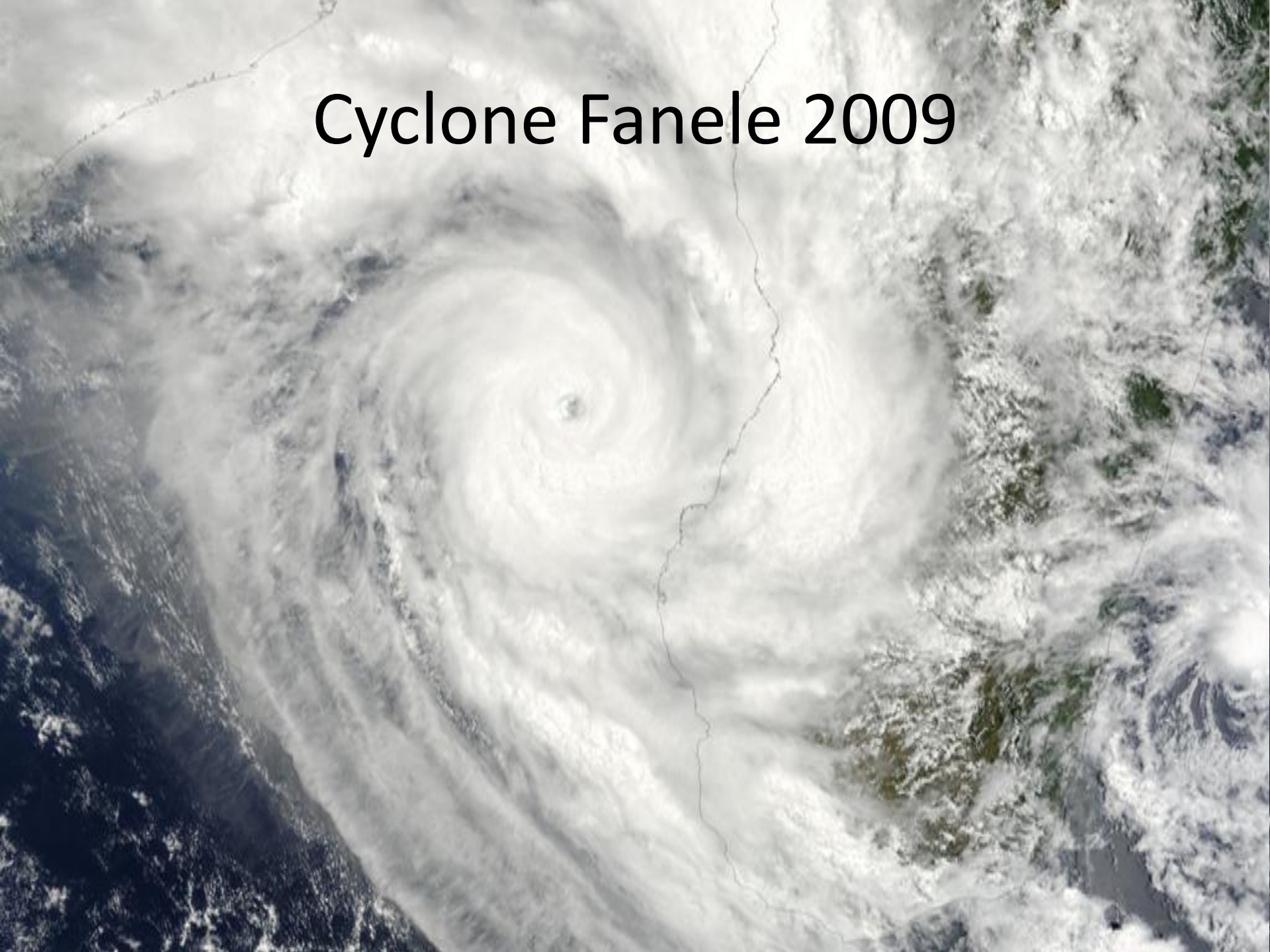
Hurricane Rita 2005


Hurricane Ike 2008


Hurricane Sandy 2012

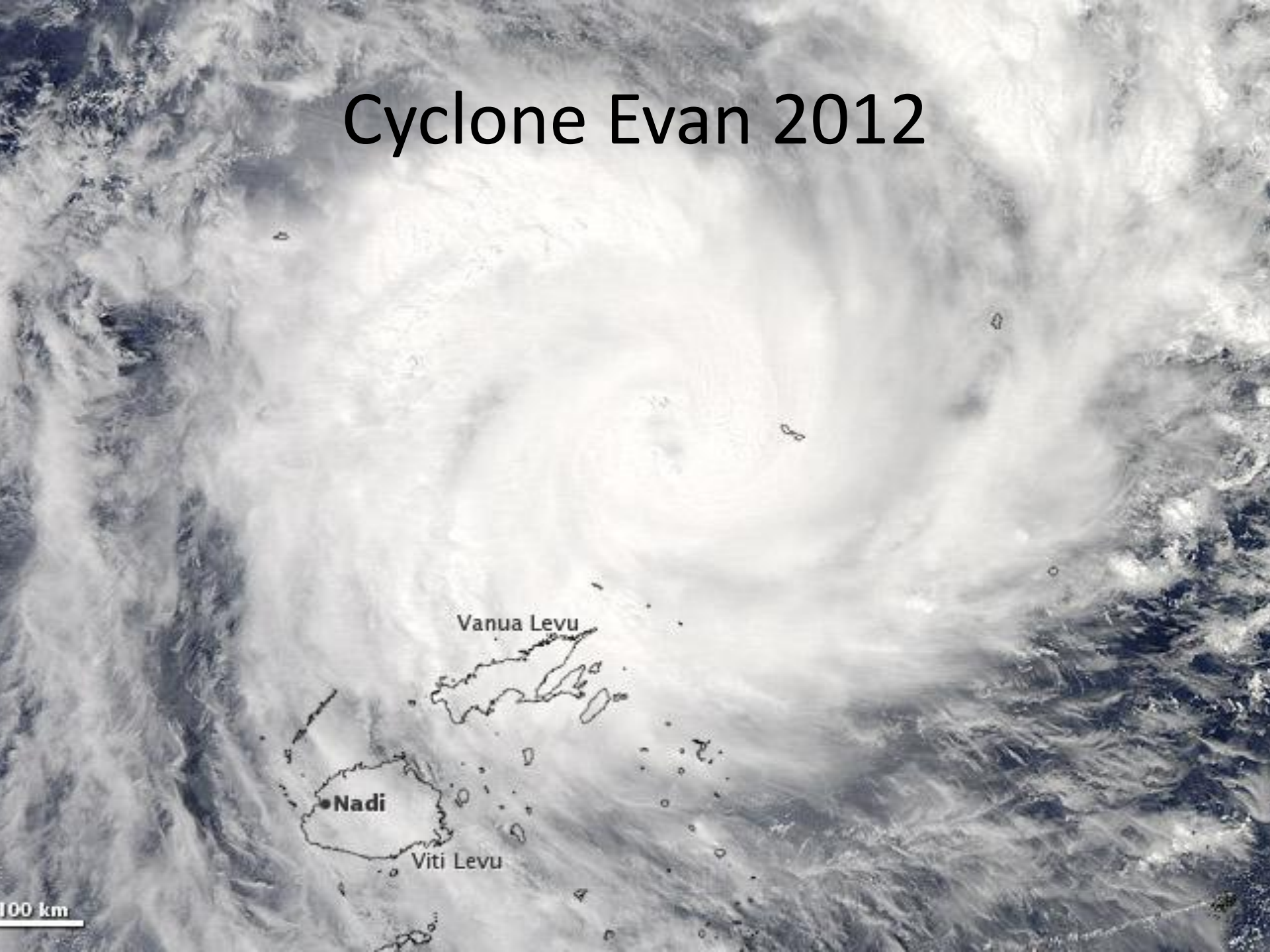

Southern Hemisphere

Cyclone Fanele 2009



Cyclone Gael 2009

Cyclone Evan 2012



Cyclone Freda 2012

Sources

- earthobservatory.nasa.gov
- http://eoimages.gsfc.nasa.gov/images/imagerecords/80000/80007/evan_amo_2012351.jpg
- http://www.sciencenewsline.com/news/images2/2013010116170009w.jpg
- http://www.panoramio.com/photo/58117168
- http://www.katrina.noaa.gov/images/katrina-08-28-2005.jpg
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