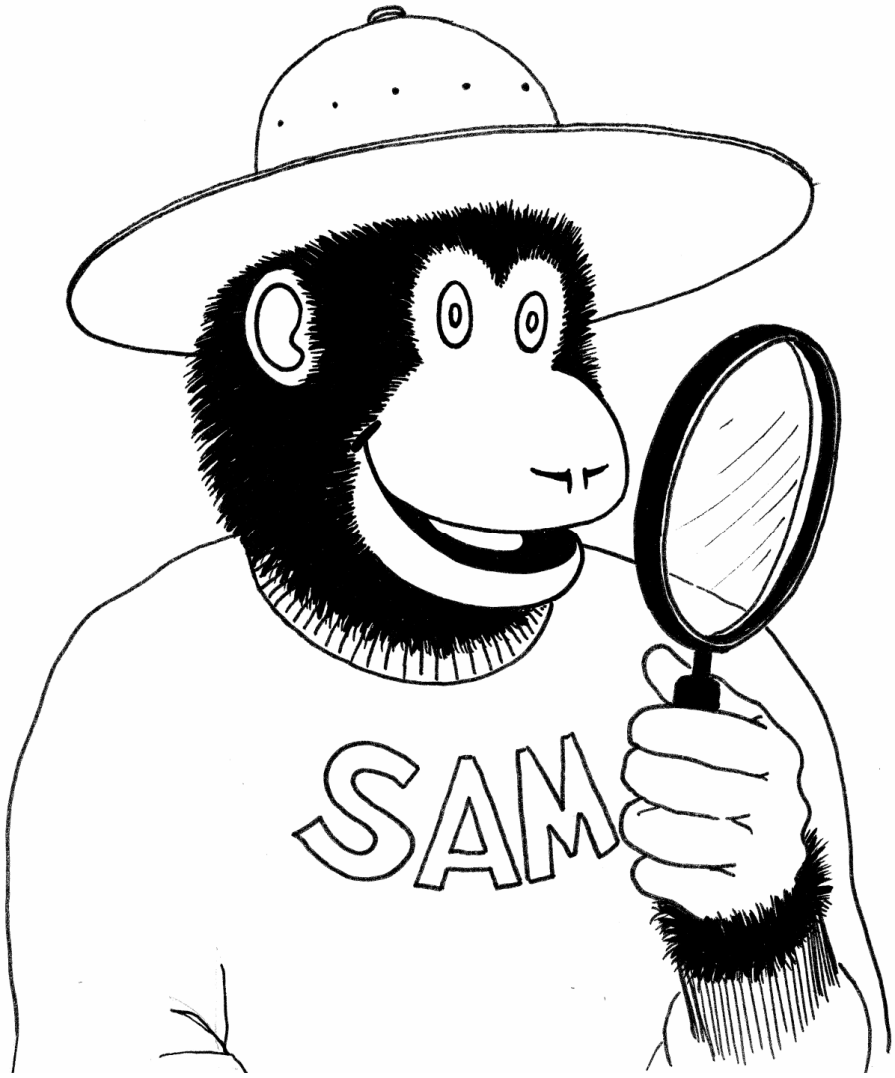
SAM'S SCIENCE ADVENTURE:™ INVESTIGATING HURRICANES

A free sampler



Welcome to your Sam's Science Adventure sampler!

We hope your family will enjoy its adventure into the science of hurricanes. This student booklet accurately reflects the content and layout of our regular adventures. You will find we mix science with history, geography, art and research.

In our signature "treasure boxes" you receive all the supplies needed to complete the activities.

In addition, a typical adventure includes a teacher's guide and a topic related book.

We dedicate this lesson to those who have been affected by hurricanes. Living in a region that experiences hurricanes, we developed this lesson as a way to explain these frightening storms to our children.

We hope your family enjoys discovering hurricanes with us!

Thank you and God bless,

S.A.M.
(Science Adventure Monkey)

Sam's Science Adventures™: Hurricanes

Rick and Michelle Eichhorn
Treasure Box Press, LLC
www.treasureboxpress.com

Special Note:

When we wrote this unit in early 2005, we never imagined a hurricane the magnitude of Katrina would hit the United States and present our nation with such an enormous human and physical challenge.

Such a devastating event has brought an outpouring of prayers, love and kindness for the hurricane victims. May God provide strength and healing to then as they put their lives back together and to and our nation as we continue to aid those in need.

We hope this lesson will help your children understand these powerful storms. In addition, we've placed emphasis on preparations before a storm and the importance of aiding those in need after a natural disaster.

Vocabulary and spelling:

Equator	storm	swirling	low pressure	high pressure	meteorologist
Hurricane	typhoon	cyclone	Indian Ocean	Pacific Ocean	Atlantic Ocean
Landfall	convection	Northern Hemisphere		Southern Hemisphere	
Satellite	storm surge	evacuate			

Reading Resources:

Non-fiction
(Use as an independent read for grades 7-12 or as a family book to share with all ages.)
Simon, Seymour, **Hurricanes**. Harpercollins, 2003. Great photos!
Simon, Seymour, **Storms**. Harpercollins, 2003. Great photos!
Carpenter, Sharon Maddux, and Toni Garcia Carpenter. **The Hurricane Handbook: A Practical Guide for Residents of the Hurricane Belt**. Tailored Tours, 1993
Davies, Pete. **Inside the Hurricane: Face to Face with Nature's Deadliest Storms**. Holt, 2001
Longshore, David**. Encyclopedia of Hurricanes, Typhoons, and Cyclones**.
Facts on File, 2000.

Picture Books
Polacco, Patricia. **Thunder Cake**. Paper Star, 1997. (Picturebook)
Spier, Peter. **Peter Spier's Rain**. Yearling, 1997. (Picturebook)
Laser, Michael **The Rain.** Simon & Schuster, 1997 (Picturebook)
Demas, Corinne**. Hurricane**! Marshall Cavendish, 2000**.**

Getting Started:

- ***Before beginning this unit, you will want to make copies of the "Clouds and Lightning Cut Out" page and the biography form at the end of this booklet.***

- Discuss storms with your children. Especially with younger ones. What is a rain storm? What happens during rainstorms?
- Even the "mildest" thunderstorm can be frightening to a young child. Here are some ideas for helping ease their wild imaginations and remind them that God always there and in control.

- Help them create a "God Made…" book. Have them draw pictures or find magazine photos. Include pages for:
  God makes the flowers.
  God makes he Sun shine.
  God makes the wind blow.
  God makes the rain.
- Have your child find pictures of plants, fruits, vegetables, trees, etc., that need the rain.
- On a sunny day, make your own thunder by banging around some pots and pans.

- Have older children look up average rainfall amounts for your geographical area. This will help give them perspective as the research specific hurricanes and see the rainfall amounts that can occur in a single storm.
- Start keeping a record of daily wind speeds in your area. One of the projects in the unit is to make an anemometer to measure wind speed. Again, looking at the "typical day's" data in your area will help your child understand the devastation that can occur when winds start to blow over 75 miles per hour.
- Schedule a field trip with a meteorologist. They can be very busy and it may be best to hold the field trip separate from a television station. The visiting meteorologist can still bring some of the instruments they use to gather weather data. Ask when they may be sending up another weather balloon, perhaps you can schedule your visit to coincide with the release.

Bible Memory Verse:

Younger children: "Do not be Afraid." John 14:27

Older children: "Peace I give you...Do not let your hearts be troubled and do not be afraid." John 14:27

Bible Readings:
"Then they cry out to the Lord in their trouble, and he brings them out of their distresses. He calms the storm, so the waves are still. Then they are glad because they are quiet; so He guides them to their desired haven."
Psalm 107: 28-30.

Matthew 8: 23-27

The word hurricane is from the Spanish word Huracan' which means "great wind". You may have heard the words *typhoo*n and *cyclone* used to describe big storms. Each of these words (hurricane, cyclone, and typhoon) is used to describe a powerful, tropical storm.

Hurricane is used to describe these tropical storms in the north Atlantic Ocean, north Pacific Ocean and south Pacific Ocean closer to the United States. Typhoon is used to describe these storms in the north Pacific Ocean closer to Japan. Cyclone describes these large storms in the Indian Ocean and in the south Pacific Ocean around Australia. On the world map on the next page, label the areas of the world with "hurricane" and "typhoon".

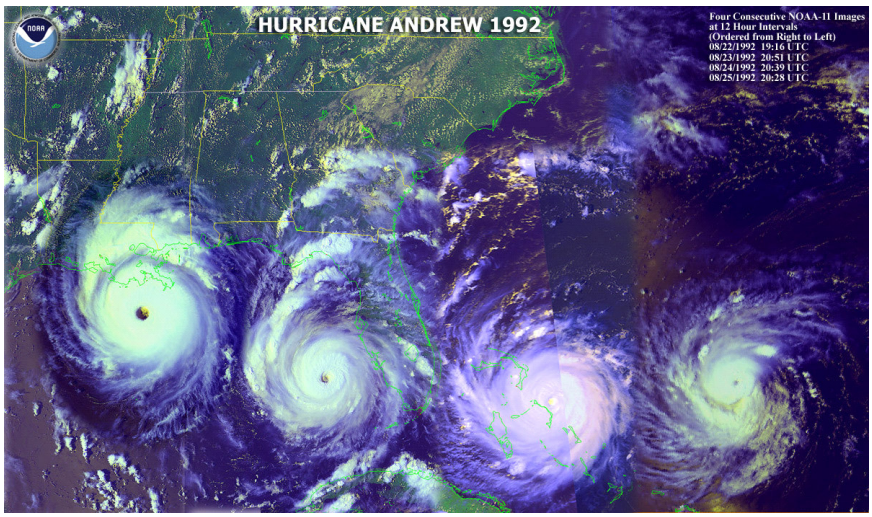
What is a Hurricane?

Hurricanes are very large and powerful storms which form where the climate is hot. They form mostly in "the tropics" - areas around 20 º north and 20 º south of the equator, where the water temperature is at least 80º Fahrenheit. Look at a world map and find "the tropics". On the world map, color the area definted as "the tropics" yellow.

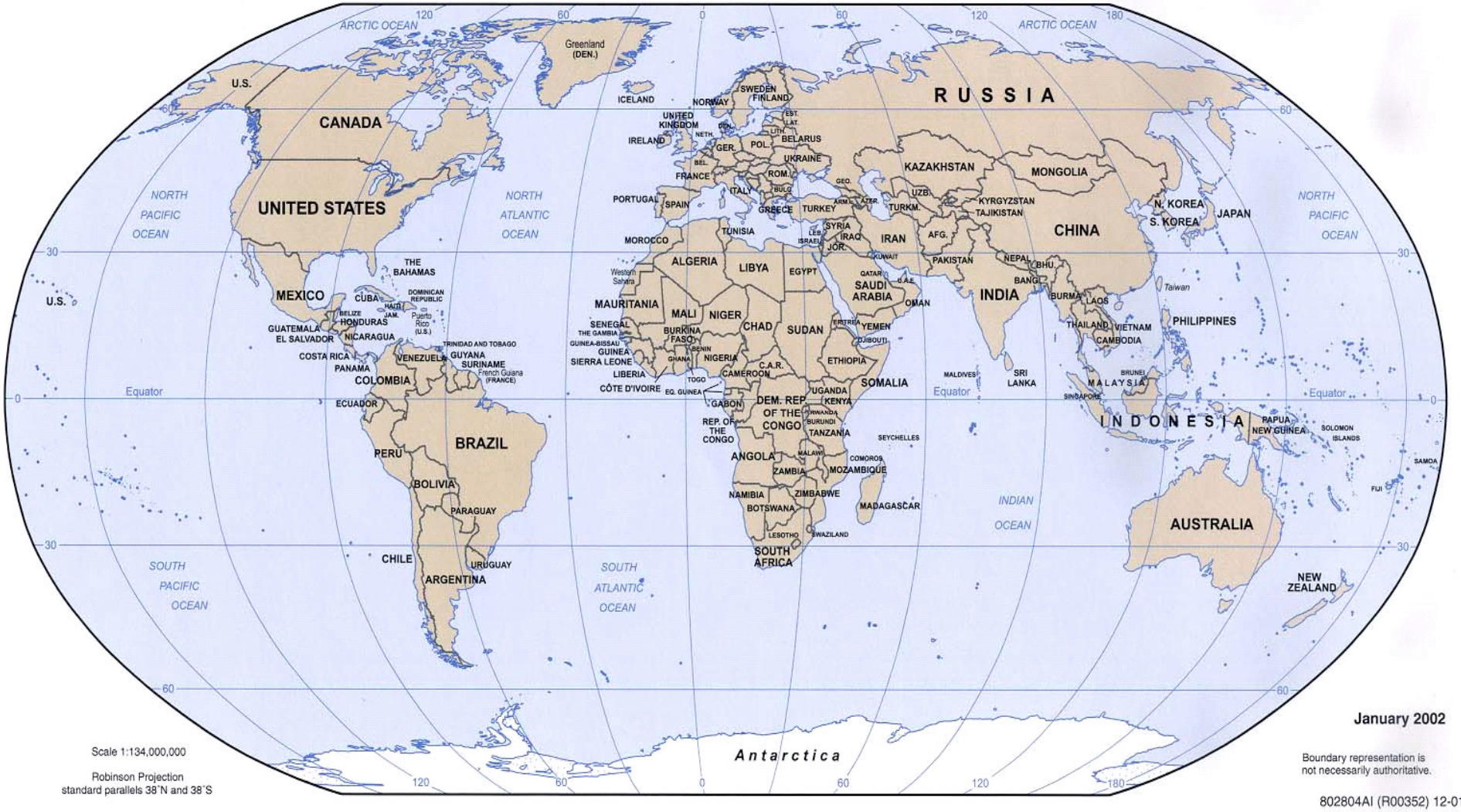
Below are 4 satellite photos of Hurricane Andrew in 1992. The images were taken as Andrew moved toward Florida, across Florida, into the Gulf of Mexico, and toward Louisiana. (Satellite pictures are taken from cameras on satellites put in orbit above the Earth.) The storm looks like a large swirling cloud. When the winds in these tropical storms reach 74 miles per hour, the storm is called a hurricane.

Hurricanes form in areas near the equator during the hottest times of the year—summer and early fall. In fact, the official hurricane season is from June 1st to September 30th in the Northern Hemisphere and December 1st to June 30th in the Southern Hemisphere. Remember, the two hemispheres experience summer at opposite times during the year.

A hurricane can be hundreds of miles across. The average size is 300 miles. Use a map to measure a distance of 300 miles from your house. How long would it take you drive 300 miles? Even though hurricanes are extremely powerful, they are slow movers and don't always move in a straight line. Hurricanes move at about 10 to 20 miles per hour. Next time you are in your car, ask whoever is driving the car to drive 10 miles an hour.



Hurricane Andrew made landfall (came onshore) in Florida, moved across Florida, into the Gulf of Mexico and made landfall, again, in Louisiana. Look at the US map at the end of this unit and locate Florida, the Gulf of Mexico and Louisiana. Hurricane Floyd caused $26,500,000,000 worth of damage. It holds the record as the hurricane causing the most damage.



Scale 1:134,000,000

Robinson Projection
standard parallels 38°N and 38°S

January 2002

Boundary representation is not necessarily authoritative.

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How do these powerful storms form?

Let's first answer the question…"What is wind?" The air around us is warmed by the Sun. When the air is warmed, it expands and rises. If you live in a 2 story house, have you ever noticed during the summer how much warmer it feels on the upper floor compared to the bottom floor, especially during the heat of the afternoon? When this warm air rises, cooler air moves into fill the empty space. This moving air is wind.

Let's demonstrate how this happens by using hot water and cold water.

Activity: Mixing Temperatures

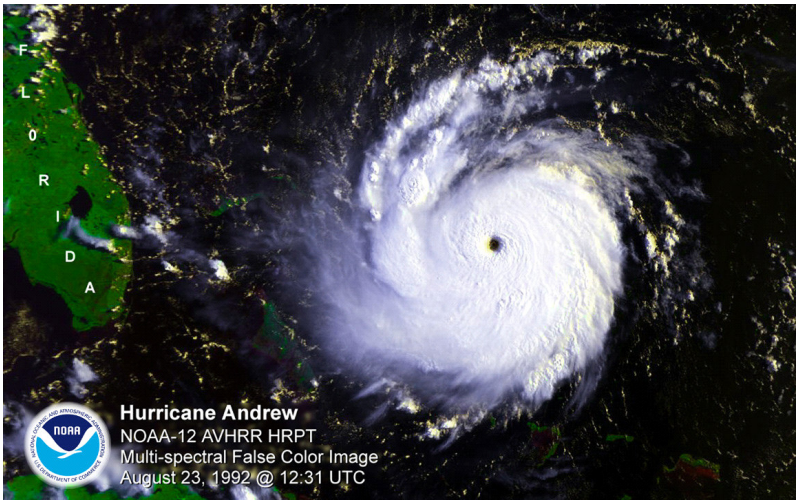
A 1-cup measuring cup.
2 small glass containers that will hold 1 cup each of water
A bowl with ice and water
Red food coloring
Blue food coloring
A drinking straw
A strong flashlight
Ruler, scissors

1. Cut the straw into a 2" length. Set aside.
2. Fill the first glass container with 1 cup of cold water. Place this container in the bowl of ice water to further cool it down and keep it at a cool temperature. Place several drops of blue food coloring into the cup of cold water and stir. Note: After dropping the food coloring into the cold water, watch how it moves. Don't stir it right away. Observe how it mixes with the water. You will want to make it a nice deep blue color.
3. Fill the 1-cup measuring cup with water to the 1 cup mark. Place in a microwave and heat for 3-4 minutes...until it boils.
4. Remove and place a dish or cover over the cup to prevent rapid cooling.
5. Measure one cup of water into the second glass container. Microwave for 3-4 minutes...until the water boils. Place several drops of red food coloring into this cup of boiling water. Note: After dropping the food coloring into the hot water, watch the movement of the food coloring. Did it move more quickly than the blue food coloring in the cold water?
6. Now, you will have 1 cup of cold water colored blue, 1 cup of hot water colored red, and 1 cup of hot water (left clear) in a bowl.
7. Turn on the flashlight and place it behind the clear cup of water so it shines through the cup and you can see the red and blue water as you begin to drop the colored water into the hot water.
8. Next, you will drop 1 drop of cold water into the 1 cup of clear, hot water. To do this, place the straw in the cold water and place your finger over the top of the straw. Difference in air pressure between the inside and outside of the straw will cause some of the red water to rise into the straw.
9. Keeping your finger over the top of the straw, move the straw 1/8" down into the clear water. **Slowly move your finger so 1 drop** of the blue water goes into the clear water. Watch the drop of blue? Where did it go? Notice how quickly it moves through the hot water to the bottom.
10. Do this 3 times, drop by drop, with the blue water.

11. Then, do the same procedure with the red water into the clear water.
12. What happens to the hot (red) water when it is dropped into the clear, hot water?

What is happening: The cold water drops through the hot water to the bottom and the hot water stays near the top. Air does the same thing. The warm air in a storm moves to the top and the cold air remains at the bottom. The rising of warm air and the movement of cold air into its place is called convection. Storms then form out of the strong, warm air.

Once the warm air rises and the cool air rushes in, winds form. Remember, the Earth is always spinning. The rushing winds in these storms begins to move in a spiral as they respond to the spinning of the Earth. But, what's really interesting is the direction in which the clouds spiral.



. Photo courtesy the NOAA

In the photograph above you can see the spiral form of the clouds. Hurricane Andrew was in the Northern Hemisphere where hurricane clouds rotate (or spin) counter clockwise. In the Southern Hemisphere, hurricane clouds rotate clockwise (in the direction a clock moves). On the world map in this unit, locate the Northern and Southern Hemispheres. If you want to watch this counter clockwise spinning in your home, fill a sink with water, then remove the plug. When the water level gets very low, you can see the water rotating in a counter clockwise (or clockwise if you are in the Southern Hemisphere).

Teacher note: This difference in rotation direction is due to the Coriolis force. This is a great research project for your older students (through 12th grade!).

Once these rotating winds reach74 miles per hour, a hurricane is formed. The heavy rains may also have thunder and lightning.

So, hurricanes need 3 ingredients to form:

1. Ocean water that is at least 80º F.
2. Air above the Earth filled with moisture.
3. Winds moving at a high speed in the same direction above the Earth.

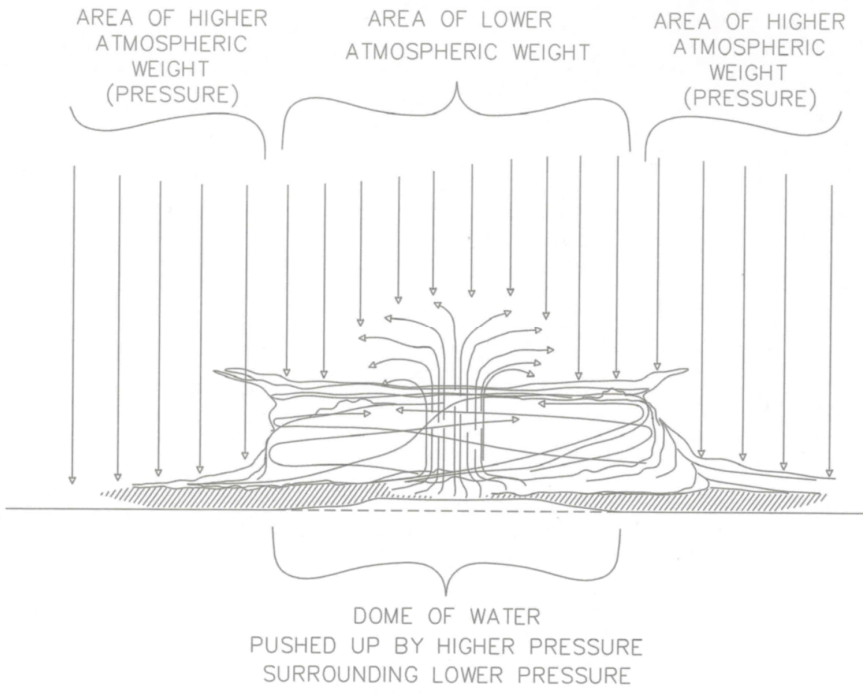
What A Hurricane Brings!

Which of the following do you think causes the most damage during a hurricane and is the deadliest part of a hurricane? Circle your answer.

A. Strong winds
B. The storm surge—ocean water levels that can rise 10 to 20 feet higher than normal tide.
C. Heavy rains and flooding.

The answer is B. The storm surge is the most dangerous part of a hurricane. However, strong winds and flooding are extremely dangerous. The storm surge is not a giant wave. Storm surge is the rapidly rising level of the sea level. Storm surges in hurricanes have raised the sea level as high as 20 feet above normal sea level. That is as high as a 2 story building! It can happen quickly and catch people off guard.

To understand the formation of the storm surge, let's discuss air pressure. Air is always pressing down on us. It is hard to feel the air between the surface of the Earth and space pressing down on us, but it is! Look at the drawing below. In a hurricane, the warm air is quickly moving up and it takes weight off of whatever is below it. So, instead of a high pressure pressing down on us, there is lower pressure. This area of lower pressure in the hurricane is surrounded by higher pressure on the outside of the hurricane. This caused a dome of water to rise in the hurricane (where the lower pressure is located). This dome of water is the rising sea level—the storm surge.



Activity: A Dome of Water

Items to gather -
A large mixing bowl filled with water. Let it sit and reach room temperature.
Plastic food wrap
Clear packing tape
1 foot length of fishing wire included in this lesson packet.

Note: You will be covering the mixing bowl with plastic food wrap. You will want to use only one piece to cover the bowl. Therefore, the bowl should not be so large that it requires two pieces of plastic wrap to cover the top of the bowl.

1. Fill the mixing bowl 3/4 full of water. Let is sit and reach room temperature.
2. Important! Cut a piece of plastic wrap that is large enough to sit on top of the surface of the water, cover all sides of the bowl, and drape over the sides of the bowl. The goal is to have the plastic wrap serve as a seal on the surface of the water and sides of the bowl. You should have enough plastic wrap to press against the sides of the bowl and up over the rim. Secure the plastic wrap on the outside of the bowl. Again, the plastic wrap could form a thin covering directly on the surface of the water without any air pockets. The wrap should also be directly against the sides of the glass bowl and over the rim to make a tight seal.
3. Using a several pieces of packing tape, tape the fishing line in the center of the water/plastic wrap. You are going to want to pull up GENTLY.
4. Slowly pull up on the fishing line. You will the plastic wrap rise and the water come up with it. This simulates the dome of water that forms in a hurricane. However, the dome (or storm surge) is a much larger area.

What is happening.

Before you pulled up on the fishing line, the air pressure across the entire surface of the water and plastic wrap was the same. However, as you pulled up on the fishing wire (to simulate the rising warm air in a hurricane), the pressure on the surface of the water right under the fishing line became lower (the air pressure was pulling up at this point). However, the pressure around the edges of the water remained higher than the pressure right at the center, causing the water under the fishing line to rise up. This area of rising water simulates the storm surge in a hurricane.

Challenge Yourself!

When you look at a satellite photo of a hurricane, you will notice the center of the hurricane appears to be a circle. This is called the eye of the storm. Research the eye of a hurricane. What is the eye? What are the winds like at the eye of the storm?

Next, research how and why hurricanes weaken.

Who Tracks and Measures Hurricanes

Scientists and meteorologists from around the world track and measure hurricanes. In the United States the National Weather Service Hurricane Prediction Center and the Tropical Prediction Center are two groups that follow and measure tropical storms and hurricanes.

Meteorologists tracking hurricanes measure wind speed, humidity, air pressure and temperature. Scientists believe hurricane winds have exceeded 200 miles per hour. They don't know for certain because the high winds break the anemometers when the winds reach about 150 miles per hour. An anemometer measures wind speed.

Air pressure measurements are taken using a barometer. Dropping air pressure means bad weather is approaching. The barometer was invented by Evangelista Torricelli

Meteorologists categorize hurricanes based on the top wind speed. In addition, expected storm surge is also listed in each category. The Saffir-Simpson scale is used to categorize hurricanes. There are 5 categories of hurricanes. Check out these categories at http://www.nhc.noaa.gov/aboutsshs.shtml. They are also printed on the back of the hurricane tracking map in this lesson packet.

Activity: Tracking Tropical Storms

Visit the website for the National Oceanic and Atmospheric Administration (NOAAA). Use their enclosed tracking chart to chart the movement of tropical storms and hurricanes.

Activity: Make a Simple Anemometer

Gather the following: 4 small paper cups (the small "Dixie cup" size.
2 strips of corrugated cardboard (an old shipping box), cut approx. 3" x 8"
Scissors, a permanent marker, ruler, stapler, push pin, sharp pencil with an eraser, modeling clay

1. Carefully cut off the rolled edge of the paper cup to remove some of the weight.
2. Make a mark on one of the cups with the marker.
3. Cross the cardboard strips so they make a plus sign. Staple them in the middle several times.
4. Staple the cups to the ends of the cardboard strips—the cups should all face the same direction.
5. Using the ruler and pencil, drfaw lines from the outside corners of where the cardboard strips come together to the opposite corners. The middle of the "plus" sign is where the pencil lines cross.
6. Push the pin through the center mark and attach the cardboard with the cups into the eraser of the pencil. Place the other end of the pencil into the modeling clay to make a stand for your anemometer.

You won't be able to measure the exact miles per hour, but you can count the number of rotations per minute. However, you can get a good approximation of how many rotations it takes to measure 1 mph. Take your anemometer into the car. Drive 10 mph and hold the anemometer out the window. Count the number of times it turns. Then, divide this number by 10. You now have an estimate of how many revolutions make 1 mile per hour.

Now, have fun measuring on different days, at different times of the day. Do trees block the wind and affect your measurements?

Activity: Build a More Challenging Anemometer

This is a great project for older children. Visit http://www.geocities.com/thesciencefiles/anemometer/anemometer.html to build a more involved anemometer using a protractor, tennis ball and fishing wire. The design comes from 'The Amateur Scientist' in an old issue of "The Scientific Magazine"

Activity: Wind Art

Contact your local newspaper and ask if they have any roll ends of paper available for pick up. Cover an area of floor and wall with this paper (You may want to do this outside but be cautious of water and use a heavy duty extension cord that is safe for outdoor use.) Have your children drip paint in front of a hair dryer and onto the paper. You can also do this with large pieces of contruction paper or cut a paper grocery bag so it lays flat.

Activity: Storm Clouds

Gather the following:

Cut outs of cloud and lightning shapes
Crayons, scissors, glue
Thread or thin string
White paper

NOTE: To make a sky full of storm clouds, make copies of the cut-out sheet using heavy cardstock.

1. Cut out the clouds and lightning bolts .
2. On several clouds and lightning bolts write the Bible verse "He calms the storm so the waves are still." Place 2-3 words on each. (Use a dark marker or pencil.) After they are colored, hang them close together to make a completed verse.
3. On the white paper, make raindrop shapes, color blue and cut them out.
4. Hang each cloud, bolt and raindrop from a piece of thread or string.
5. Attach the threads to the ceiling or make a mobile by attaching them to a wire coat hanger.

Challenge your children who can read to find additional Bible verses that they find comforting during life's storms. Make a sky full of clouds!

Animals and Hurricanes

If you have a pet (or pets) and live in a hurricane area, how would you plan to take care of your pet if a hurricane is predicted for your area? (If you don't live in a hurricane area, you can still make a plan. Imagine you have just moved to south Florida and own a dog or cat or even an iguana.) What would you need to do to protect your pet(s) from a such a strong storm? If you are going to leave the area with your pets, what items for your pet would you need to take? List your ideas for evacuating your pet in the area below.

_____

_____

_____

_____

_____

_____

_____

Hurricane Facts

- **Hurricane** Ginger in 1971 holds the record for most days as a hurricane (20) and tropical cyclone (28).
- In 1998, 4 hurricanes were active at the same time. They were Georges, Ivan, Jeanne and Karl.
- On average a category 4 or stronger hurricane strikes the United States once every 6 years

How Hurricanes are Named

Any tropical storm with winds over 39 miles per hour is given a name by the National Hurricane Center in the United States. Hurricanes weren't always given names. At first, they were given numbers. In 1953, meteorologists started giving them names. The first names were all girl names. This was because hurricane has the "her" sound at the beginning of the word, In 1979, male names were added.

Now, there are 6 complete lists of names from A to Z. Each list is used every six years. If a storm is especially strong, the name will be "retired". This means it is removed from the list and not used again. Andrew (remember the satellite photograph of Hurricane Andrew) is a retired name.

In the space below, create your own list of hurricane names. The official listings from the National Hurricane Center skip the letters Q, U, W, X, Y, and Z because it can be difficult to find six names that start with these letters.

A: _____

B: _____

C: _____

D. _____

E: _____

F: _____

G: _____

H: _____

I: _____

J: _____

K: _____

L: _____

M: _____

N: _____

O: _____

P: _____

R: _____ T: _____

S: _____ V: _____

Important Precautions After a Hurricane

Hurricanes bring rain, high waters, and wind which can bring down power lines, contaminate water, and back up sewage systems. Here are some things people in a hurricane affected area must do after a hurricane. Some of these may apply to your area of the world when heavy rains from a rainstorm bring flooding.

- If waters continue to rise, evacuate immediately.
- Do not play, drive or walk through flooded areas. You don't know how deep the water is and it may be moving faster than you think.
- Wear shoes...you cannot see through the murky water and you may step on something sharp.
- Use bottled water for drinking and cooking.
- If you use tap water, boil it first. However, do not use boiled water for pregnant women, children or babies.
- Any food (including food in cans, bottle or plastic) that have come into contact with flood waters should not be eaten. Throw them away.
- If sewage backs up in the home, remove items made of cloth, such as couches and rugs. These items cannot be thoroughly disinfected.
- Bees, wasps, snakes, fire ants, and other animals have lost their homes and may be dangerous. Be cautious about moving items where animals could be hiding.
- Unfortunately, sometimes animals do not survive such powerful storms. Avoid touching any deceased animals. Contact an adult. They should wear gloves and use a shovel to move the animal.

Animals and Hurricanes

When a large, devastating hurricane hits an area, not only do people lose their homes, but animals may lose their homes to the wind and water.

In 1999 Hurricane Floyd hit the state of North Carolina and 3 million farm and domestic (pets) animals were lost! As a result, a group called SART—State Animal Response Team was started.

SART helps establish plans for rescuing animals during a storm by providing emergency shelters, food, medicine, veterinary care, and plans for returning animals to their owners after the storm. SART chapters are located in Alabama, Connecticut, Florida, Georgia, Massachusetts, Maine, New Jersey, New York, Pennsylvania, South Carolina, Virginia. What do you notice about the location of these states? However, there are SART chapters in Colorado and Kansas. These states may not have hurricanes, but they do experience other natural disasters such as tornadoes and large snowstorms. (Information courtesy the North Carolina Department of Health and Human Services.)

If you have a pet (or pets) and live in a hurricane area, how would you plan to take care of your pets? (If you don't live in a hurricane area, use your imagination. Imagine you have just moved to south Florida and own a dog or cat or even an iguana!) What would you need to do to protect your pet(s) from a such a strong storm? If you are going to leave the area and take your pets, what items for your pet would you need to take? List your ideas for evacuating your pet.

Helping Others in an Emergency

There are many church and community groups that spend all of their time and efforts helping people in need. These groups become very active before, during and after a natural disaster, such as hurricane.

The American Red Cross is one such service organization. If you have Internet access, visit their website at www.redcross.org. On the left side of the screen is a link entitled "Get Prepared". Then, click on the link "Prepare at Home". Review the various items they have listed for preparing your family for an emergency.

If you have any elderly relatives or neighbors, perhaps you can help them come up with a disaster preparedness plan.

Activity: Public Service Information

Congratulations! You have a new job as a member of an emergency response team. Your first assignment is to create a brochure showing people how to prepare for a hurricane. Do some research, get creative and let people know what to do to prepare.

Activity: Calling 9-1-1

Teach younger children how to call 911 and give their name and address. This could be a life saver during any type of emergency, not just a hurricane.

His Words to Help Us During a Storm

Read Matthew 8: 23-27 as a family. Sometimes our lives are filled with personal "storms". Discuss ways we can handle these storms. It may be helpful for older children to write about a time when they were experiencing a personal storm (i.e. a difficulty with a friend, the death of a beloved pet, etc.) How did the Lord help them get through the storm? Did they have specific Bible verses that helped them?

Biography Time!

Clara Barton was the founder of the American Red Cross. Make a copy of page 18 and complete with information about Clara Barton.

Abstract Storms

Artists use nature to inspire their work. Claude Monet painted beautiful flower gardens. Van Gogh was inspired by star filled skies when he painted "Starry Night".

Pictured below is a painting by Wassily Kandisky entitled "Storm". Why do you think he named this painting "Storm"? It is an example of abstract art.

Abstract art is a different way of representing the subject of the painting. Look at Kandinsky's work "Storm" pictured here. How does this painting "describe" a storm? What parts of a storm do you see in the painting?

_____

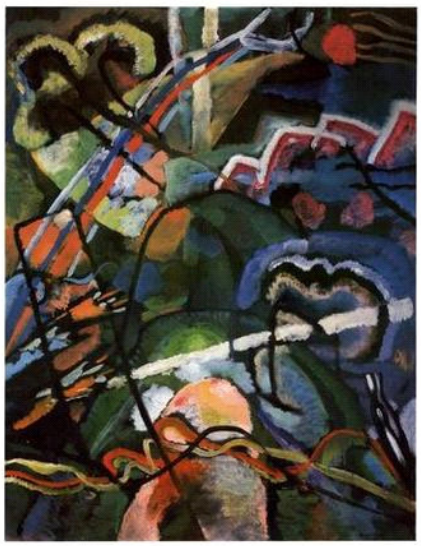
_____

_____

If you live near an art museum, visit the museum and study the example of abstract art.
Use the white cardstock and crayons, color pencils, watercolors, or chalks, to paint your own abstract painting of a hurricane.

Activity Extenders

- Make your own barometer to measure air pressure. Visit http://kids.earth.nasa.gov/archive/air_pressure/barometer.html for instructions.
- Check out a book from the library on first aid and learn some of the basics. Put together a first aid kit to carry in your car.
- For older students, check out the search and rescue organizations in your area. Ask to visit a meeting.
- Take a Red Cross class. They offer babysitter training, first aid, CPR, and other classes.



Famous Person

Name:

Place of birth:

Date of birth:

Place of death:

Date of death:

If a scientists, branch of science studied:

Important contributions or discoveries/inventions: