

EDUCATOR'S GUIDE

EVERY DARK CLOUD HAS A SILVER LINING

HURRICANE

Published by nWave Pictures Distribution
Curriculum Developed by Young Minds Inspired

Hurricane.nWave.com

EDUCATOR'S INTRODUCTION

This Educator's Resource Guide is designed for use with students who view the new nWave Pictures Distribution release, **Hurricane**. The guide includes classroom activities for students in grades K-2, 3-5, and 6-8. Before viewing **Hurricane**, use a K-W-L chart to discuss with students what they Know about hurricanes and what they Want to learn. After viewing the film, have students complete the chart by discussing what they Learned about hurricanes.

The film **Hurricane** was produced using images of various storms and hurricanes filmed over a period of five years. "Hurricane Lucy" depicted in the film is a composite of all these various storms.

EDUCATIONAL OBJECTIVES

- To introduce students to the natural phenomenon that is the subject of the film **Hurricane**.
- To inform students about the ways to track and predict hurricanes and learn what to do to protect oneself.
- To make students aware of the impact hurricanes can have on the natural world, both good and bad.
- To educate students about hurricane history.

PRE-VIEWING DISCUSSION QUESTIONS

Create a KWL graphic organizer on the chalkboard/whiteboard, with columns labeled "What I KNOW Already," "What I WANT to Find Out," and "What I LEARNED." Fill in the first column by asking students what they already know about hurricanes. Where do hurricanes usually occur? What kind of damage do hurricanes cause? How are hurricanes measured? Then fill in the second column of the organizer by asking students what they want to find out about hurricanes. Prompt discussion with suggestions such as, How are hurricanes formed? Why do they occur only in some areas? How are hurricanes named? Why is there a hurricane season? Conclude by having students copy the organizer so they can fill in the final column after they have seen the film.

POST-VIEWING DISCUSSION QUESTIONS

- Return to the KWL graphic organizer on the chalkboard/whiteboard to fill in the "What I LEARNED" column. Have students contribute facts and insights from their own notes on the film. What did they learn about hurricanes that most surprised them? What part of the film made them want to learn even more?
- Use the film to clarify students' understanding of how hurricanes form, how they are predicted and measured, and how people can prepare and protect themselves.



NEXT GENERATION SCIENCE STANDARDS

		Grades K-2			
Activity		1	2		
K-ESS3-2	Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.	x	x		
		Grades 3-5			
Activity		1	2	3	
3-ESS2-1	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	x			
3-ESS2-2	Obtain and combine information to describe climates in different regions of the world.		x		
3-ESS3-1	Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.			x	
		Grades 6-8			
Activity		1	2	3	4
MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	x	x		
MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.			x	x

NATIONAL SCIENCE EDUCATION STANDARDS

Earth and Space Science									
	K-2		3-5			6-8			
Activity	1	2	1	2	3	1	2	3	4
Changes in earth and sky	x	x	x	x	x				
Structure of the earth system			x	x	x	x	x	x	

Science in Personal and Social Perspectives									
	K-2		3-5			6-8			
Activity	1	2	1	2	3	1	2	3	4
Changes in environments		x	x		x				
Natural hazards			x	x	x	x	x	x	x
Risks and benefits					x				x

TEACHING NOTES FOR GRADES K-2

ACTIVITY 1

HURRICANE COMING!

Part 1 of this activity challenges students to trace the path taken by the fictional Hurricane Lucy in the film **Hurricane**. Direct students to complete the paragraph describing Lucy's path by filling in the blanks with the correct words from the word bank. Then provide students with copies of the hurricane tracking map included with this Educator's Resource Guide. Have students use the place labels on the map to trace the path described in the paragraph. Older students can use the grid to identify the approximate longitude and latitude or letter/number coordinates of the places where Lucy made landfall.

Answers: Lucy begins as a rain storm in the country of *Senegal* on the continent of *Africa*. Lucy then travels west across the *Atlantic* Ocean. Lucy becomes a hurricane and arrives in *Puerto Rico*. Next, the storm hits the island nation of *Cuba*. Finally, Lucy travels across the *Gulf of Mexico* and makes landfall again in *Louisiana*.

Part 2 of the activity introduces students to different types of emergencies (or natural disasters). Have students circle the names of the emergencies that could occur where they live. Then divide students into small groups and direct each group to research one of the emergencies they have circled. Students can find information on many types of emergencies at <http://www.ready.gov/kids/know-the-facts> and <http://environment.nationalgeographic.com/environment/natural-disasters>.

FOLLOW UP:

Students can visit Historical Hurricane Tracks on the NOAA website at <https://coast.noaa.gov/hurricanes> and search the hurricane history of a location in their home state or that of a famous hurricane that interests them. What can students tell by looking at the lines that represent the hurricanes? (*How many storms there were in the search years and that the storms move in generally the same direction.*) Select a location in another state in the United States and check the hurricane history for that state. What differences do students notice? (*There may be more or fewer storms represented by lines.*) Why might those differences exist? (*Coastal areas are most affected by hurricanes since the storms lose strength over land. Hurricanes affect the eastern and southern coasts of the United States.*)

ACTIVITY 2

WHAT WILL HAPPEN?

In this activity, students use simple items to model the formation of a hurricane and observe the outcome. For this activity you will need a bowl of water and a straw for each pair of students and a pair of safety goggles for each student.

After you have gathered supplies and divided students into pairs, explain that they will be modeling the winds that form a hurricane, as they saw in the film. Give one copy of the activity sheet to each pair of students. Direct students' attention to the chart on the sheet and explain that they will do three experiments modeling different wind speeds. In each experiment, they will blow air through the straw across a bowl of water, first by blowing gently, then with some force and finally, as hard as they can.

Explain to students that they will take turns where one partner is blowing through the straw and the other is writing down observations on the sheet. They should repeat this process for each trial. Before students begin, invite them to think about what they might see during each of the trials. Have them write their predictions in the appropriate box on the sheet. Guide a discussion of their predictions.

Students should be able to connect the amount of energy that they expended to the amount of wind and water movement. Students should understand also that the harder they blew, the more energy there was in the system and the more the water moved. If necessary, explain to students that the stronger the wind in a hurricane, the greater the water movement, and the greater the damage caused by the storm surge when a hurricane reaches land.

(This activity is based on the NOAA Hurricane Formation lesson at <https://coast.noaa.gov/psc/sea/grade/lesson-2-hurricane-formation.html>)

FOLLOW UP:

Have students visit NOAA's SciJinks website at <http://scijinks.jpl.nasa.gov/menu/games/hurricanes-and-storms/>, where they can explore games about hurricanes and storms.



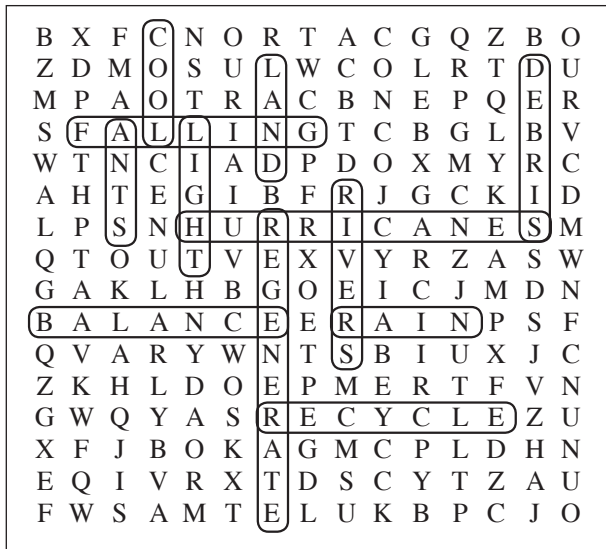
TEACHING NOTES FOR GRADES 3-5

ACTIVITY 1

RAINFOREST EFFECTS

In this activity, students learn about the effects of a hurricane like the fictional Lucy in the film *Hurricane* on a tropical rainforest. The film pictures the dynamic changes that take place in the El Yunque rainforest in Puerto Rico as Lucy passes through it, affecting trees, plants, and various species of animals.

Have students recall what they saw in the film to complete this word search, using the word bank on the activity sheet. The correct answers are shown in italics below and are circled in the puzzle.



Large, old trees are in the greatest danger of *falling* in a hurricane. When that happens, the cleared areas in the forest give young seedlings a chance to grow because *light* can now reach the forest floor.

Freshwater shrimp living in the rainforest will eat leaf *debris* that remains after the hurricane, clearing the *rivers* that make up their habitat.

In the film, we see a colony of *ants* form a raft to survive after their nest was submerged. They float off to colonize new *land*.

Hurricanes are as important to forests as are light and water. They bring *rain*, *cool* the ocean, *regenerate* the forests, *recycle* heat, and restore the Earth's *balance*.

You might conclude the activity by grouping students into three teams and asking them to summarize how a hurricane can have both positive and negative impacts on the growth and habitat of the trees, the shrimp, or the ants in the rainforest.

ACTIVITY 2

HURRICANE TRACKING

In the film *Hurricane*, students follow the fictional journey of Hurricane Lucy as the storm travels from its origins in the plains of Africa to its death over land in the southeastern U.S. In 2005, Hurricane Katrina devastated New Orleans and its surrounding areas. Part 1 of this activity enables students to compare these two hurricanes using the hurricane tracking map included with this Educator's Resource Guide.

Introduce the activity with a brief overview of Hurricane Katrina using information at www.nhc.noaa.gov/outreach/history/#katrina. Give students the activity sheet and copies of the hurricane tracking chart. Help orient the students to latitude and longitude shown on the chart. Students can then trace the path of Hurricane Lucy from the film using the location names on the chart. Then have students use the longitude and latitude information given for Katrina to plot its path. Ask students what similarities and differences they notice between the two hurricanes.

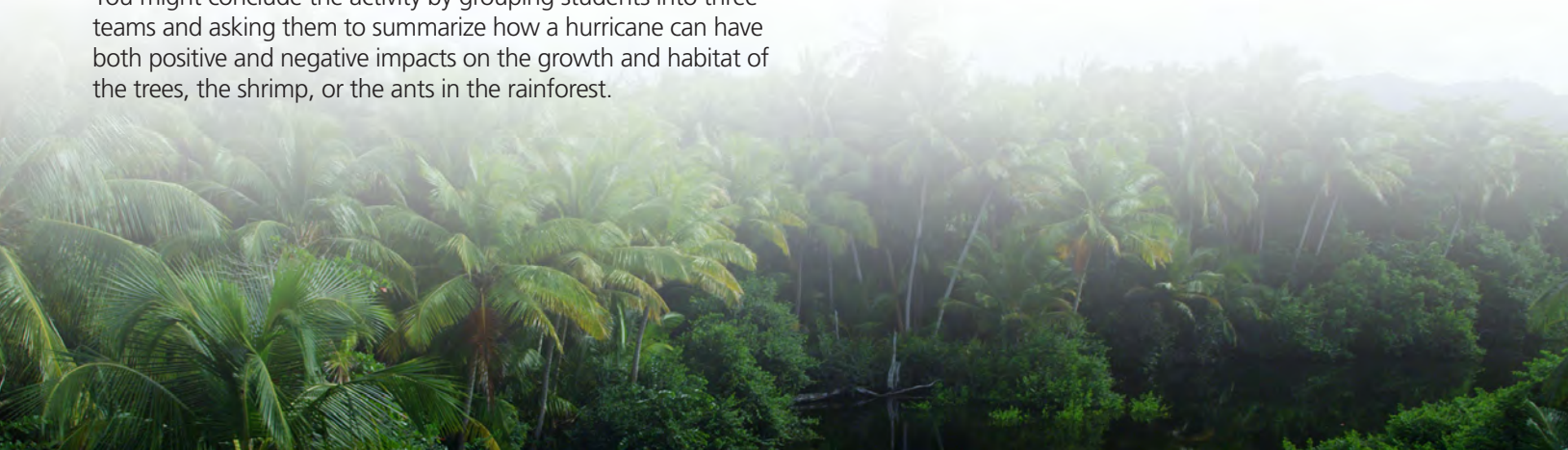
In Part 2 of the activity, students use their tracking maps to calculate approximately how far and how fast Katrina traveled each day. If time permits, have students research and track another famous hurricane to compare how far and how fast it traveled.

(This activity is adapted from Follow that Hurricane! at <http://celebrating200years.noaa.gov/edufun/book/FollowthatHurricane.pdf>)

FOLLOW UP:

To learn more about hurricanes, students can research these topics:

- **Saffir Simpson Hurricane Scale**
www.nhc.noaa.gov/aboutsshws.php
- **Naming Hurricanes**
www.nhc.noaa.gov/aboutnames_history.shtml
www.nhc.noaa.gov/aboutnames.shtml#atl
- **The Most Extreme Hurricanes**
www.nhc.noaa.gov/dcmi.shtml



TEACHING NOTES FOR GRADES 3-5

ACTIVITY 3

MEASURING THE WAVE

In this activity, students use simple items to model effects of wind speed and water depth on the height of waves during a hurricane and then observe the outcome.

You will need the following items for each pair or small group of students: 9" x 13" glass baking dish, flexible straw, ruler, dark-colored marker, duct tape, and access to water. After gathering supplies and dividing students into pairs, explain that they will be modeling the different wave heights that occur during a hurricane, as they saw in the film. Give one copy of the activity sheet to each pair of students. Direct students' attention to the chart on the sheet and explain that they will do experiments modeling three different wind speeds at two different water depths.

Then have students follow this procedure:

Figure A: Place the baking dish on a desktop. Bend the straw into a 90-degree angle. Place the straw inside the baking dish in the middle of one of the shorter sides, so that the shorter end of the straw faces straight up, touching the side of the dish, and the longer end is suspended about half an inch over the bottom of the dish. One open end of the straw will stick straight up, and the other will face the opposite 9" side of the dish. Tape the straw to the inside of the dish to hold it in place. Pour water into the dish until it reaches just below the straw. One partner should then blow gently into the end of the straw that is sticking straight up, creating "wind" over the water in the dish. The other partner should observe the water at the opposite end of the straw and mark the wave height on the outside of the dish. Have students measure and record the wave heights, beginning their measurements from the desktop. Students should repeat the procedure two more times, blowing harder each time, and record their measurements on the sheet.

Figure B: Have students remove the water from the dish, move the straw up near the top of the dish, and refill the dish with water until it reaches just under the straw. Then have them repeat the procedure to compare wave height in deeper water. Finally, each student should write a report describing the experiment in detail, reporting the results, and stating the conclusions he or she drew from the results. Have students share their reports.

(This activity is adapted from Hurricane! at www.discoveryeducation.com/teachers/free-lesson-plans/hurricane.cfm)

FOLLOW UP:

Have students visit NOAA's SciLinks website at <http://scilinks.jpl.nasa.gov/menu/games/hurricanes-and-storms/>, where they can explore games about hurricanes and storms.

EXTENSION ACTIVITY: BEING PREPARED

After viewing the film *Hurricane*, students are likely to gain increased awareness of the dangers caused by hurricanes. The film depicted different responses from people in Cuba – some loaded up their belongings and evacuated, while others built a shelter and tried to ride out the storm. Invite students to discuss their thoughts about preparing for a natural disaster, either hurricanes if they occur your area or other natural disasters.

What kinds of warnings would they receive? When might the warnings come? From whom? If they had to evacuate, what would they pack? What could they do to prepare ahead of time? What things could they do to help their family and community prepare, and then to do the clean-up afterwards? Visit the websites below with students to give them tools to help their families be prepared for a hurricane or other natural disaster.

- **NOAA Hurricane Preparedness Week**
www.nws.noaa.gov/com/weatherreadynation/hurricane_preparedness.html
- **Ready.gov**
<https://www.ready.gov>
- **Ready.gov for Kids**
<http://www.ready.gov/kids>
- **FEMA Emergency Supply List**
<https://www.fema.gov/media-library/assets/documents/90354>
- **FEMA Family Communication Plan**
<https://www.fema.gov/media-library/assets/documents/34330>



TEACHING NOTES FOR GRADES 6-8

ACTIVITY 1

CORAL REEFS: TEMPERATURE CHECK

In this activity, students learn about the role of hurricanes in correcting the water temperature balance that, in a too-warm environment, can harm Earth's coral reefs, some of which lie in traditional hurricane tracking locations.

Coral reefs die in water that is too warm. When a hurricane impacts coral reefs, there can be a mix of unfavorable and favorable outcomes: While the hurricane's eyewall can destroy entire coral reefs, other reefs nearby can be saved because the storm draws heat from the ocean. This brings nutrients and cold water to the surface, which helps rescue and support these reefs.

After students watch the film *Hurricane* and review information about the concept of global heat balance found at <https://weather.com/storms/hurricane/news/hurricane-landfall-benefits-2016> as well as background on coral reefs found on the websites listed below, have them answer the questions on the activity sheet.

Coral reefs begin to form when free-swimming coral larvae attach to submerged rocks, forming a limestone base around their structure. In a process of "skeleton building," younger larvae pile new skeletons on old ones, working slowly to form a coral reef.

Coral reefs are threatened by a whole host of human-related factors that can include overfishing, pollution, agricultural runoff, and poor land use, as well as climatic factors that include rising sea levels, increasing ocean temperatures, etc.

The impact of hurricanes on tropical rainforests and coral reefs is similar, in that while negative consequences result from damage inflicted by the hurricane, positive outcomes can include regeneration and resurgency of younger life forms, thus preserving and extending the resiliency of the rainforest and/or coral reef.

BACKGROUND ON CORAL REEFS

- **Where are Reef-Building Corals Found?**
http://oceanservice.noaa.gov/education/kits/corals/coral05_distribution.html
- **Natural Threats to Coral Reefs**
http://oceanservice.noaa.gov/education/kits/corals/coral08_naturalthreats.html
- **Human-Caused Threats to Coral Reefs**
http://oceanservice.noaa.gov/education/kits/corals/coral09_humantthreats.html

FOLLOW UP:

Have students investigate the positive and negative environmental/ecological effects of hurricanes using online resources such as those listed below. Students can also research current thinking on how increasing climate change might affect the strength of hurricanes, their frequency each year, and their impact on natural and built environments.

- **The Benefits of Natural Disasters: Floods, Volcanoes, and Hurricanes**
<https://owlcation.com/stem/The-Benefits-and-Disadvantages-of-Some-Natural-Disasters-Floods-Volcanoes-and-Hurricanes>
- **5 Things Hurricanes Can Do That Are Actually Good**
<https://weather.com/storms/hurricane/news/hurricane-landfall-benefits-2016>

ACTIVITY 2

HURRICANE HISTORY

In this activity, students will act as hurricane researchers, each student (or pair, if you prefer) focusing on a specific historical hurricane. Explain to students that they will generate a collection of data for significant hurricanes in history. Assign each student a hurricane from the list of notable storms at the National Hurricane Center: www.nhc.noaa.gov/outreach/history/. Ask students to use the activity sheet to organize and record their notes, researching their assigned hurricane using the information and links on the National Hurricane Center website as well as specific tracking information for their storm found at <https://coast.noaa.gov/hurricanes/>. Give students a copy of the hurricane tracking map included with this Educator's Resource Guide and have them use it to plot their hurricane's longitude and latitude and answer the computation questions on the activity sheet.

Once students have completed their research, invite them to consider and discuss why their storm took the path it did. Then have students pool their information to create "Worst of" lists for the various parameters they researched, such as highest storm surge, costliest, etc. Which hurricane stands out as the most significant?

FOLLOW UP:

Students can visit the Tropical Cyclone Climatology page at www.nhc.noaa.gov/climo/#returns to find extensive historical data, featuring maps and graphs, about hurricane trends such as areas of origin, return periods, trends over 100 years, etc.



TEACHING NOTES FOR GRADES 6-8

ACTIVITY 3

STORM SURGE

In the film *Hurricane*, students see the effects of the storm surge and learn that it can be the most devastating part of a hurricane. In this activity, students perform an experiment to model a storm surge.

Begin this activity by sharing with students the basics of storm surge or having them research it online:

- **Storm Surge Overview**
<http://www.nhc.noaa.gov/surge/>
- **Introduction to Storm Surge**
www.nws.noaa.gov/om/hurricane/resources/surge_intro.pdf
- **Storm Surge**
<http://nationalgeographic.org/encyclopedia/storm-surge/>

Next gather the materials needed for the experiment:

- Long plastic container such as an under-bed storage container
- Milk jug or pitcher
- Sand
- Water
- Sponges (to be cut up and placed to represent the marsh)
- Block of wood to generate wave energy
- Markers
- Paper towels for clean-up

1. Pour sand into the large plastic container so that it is filled to one half. Shape the sand to represent the land. The empty part of the container represents the ocean.
2. Create a winding river down the center of the sand by running your finger through it. Add creeks branching off from the river.
3. Put pieces of sponge into the sand on either side of the river, near the ocean side, to represent salt marshes.

4. Slowly add water to the ocean side of your container. You should add enough water to enter the mouth of the river.
5. On the outside of your container, use a marker to place a mark every inch from the ocean edge all the way up the river. The mark at the edge of the land should be the 0 mark. Label each mark 0, 1, 2, 3, etc.
6. Use the block of wood to create gentle waves by moving it in an up-and-down motion on the water.
7. Observe what happens to the marshes and the land. Record the distance these normal waves are felt inland in the chart under Observations for gentle waves. Answer questions 1 and 2.
8. Next create a medium storm by generating waves with a stronger force. Do this by pushing the block of wood up and down into the water with more force than before – but not too strongly. Observe what happens in your model. Record the distance inland the effects of the storm were felt in the chart under Observations for medium storm waves and answer questions 3 and 4.
9. Next, create a hurricane storm surge by pushing water from the ocean onto the mainland by using the block of wood forcefully. At the same time, pour additional water into the model to represent the heavy rainfall during a hurricane. Complete questions 5 through 9 for the storm surge observation.
10. Prepare your conclusion.

(This activity is adapted from The Surge of the Storm at http://secoora.org/classroom/virtual_hurricane/surge_of_the_storm)



TEACHING NOTES FOR GRADES 6-8

ACTIVITY 4

TO REBUILD OR RELOCATE?

In the film *Hurricane*, students witness different responses to a hurricane – evacuating, gathering supplies, boarding up windows, staying put. However, the concept of coastal resource management is about decisions made not in the face of a hurricane, but rather in the weeks, months, and years between hurricanes. NOAA's National Center for Coastal Ocean Science describes a "human dimension" of coastal resource management (https://coastalscience.noaa.gov/research/scem/human_dimensions), which focuses on the impacts and long-term consequences of human participation in coastal ecosystems. In this activity, students research the human dimension and use what they learn from their research as well as what they learned from the film *Hurricane* to engage in a role-playing activity.

In the activity, students debate whether people in Puerto Rico, Cuba, and Louisiana should rebuild their communities to better withstand the destructive force of a hurricane or relocate to another, safer area. Begin this activity by explaining to students that they will be debating the question: Should communities rebuild in hurricane-prone areas? Students will gather information from the Internet as well as from the film. Direct students to the website above by explaining the human dimension of coastal resource management. Have students take notes on their activity sheet with information they find about rebuilding in a hurricane prone area. Students can then recall details from the film that support either side of the argument. Decide upon the debate format or use one found at the International Debate Education Association at <http://idebate.org/training/resources/all>. Then start your debate.

FOLLOW UP:

After Hurricane Katrina in 2005, there was a lot of discussion about the safety or practicality of building in an area so prone to hurricanes. Students can research the rebuilding in the aftermath in New Orleans to learn more about the factors involved in these decisions.

(This activity is adapted from I'll Stay Here If It Kills Me! at http://oceanservice.noaa.gov/education/lessons/if_it_kills_me.html)

EXTENSION ACTIVITY: BEING PREPARED

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www.nws.noaa.gov/com/weatherreadynation/hurricane_preparedness.html
- **Ready.gov**
<https://www.ready.gov>
- **Ready.gov for Kids**
<http://www.ready.gov/kids>
- **FEMA Emergency Supply List**
<https://www.fema.gov/media-library/assets/documents/90354>
- **FEMA Family Communication Plan**
<https://www.fema.gov/media-library/assets/documents/34330>

RESOURCES

Hurricane Preparedness Week Information

www.nws.noaa.gov/com/weatherreadynation/hurricane_preparedness.html

NASA Space Place

spaceplace.nasa.gov/hurricanes/en/

National Geographic Hurricanes 101

video.nationalgeographic.com/video/101-videos/hurricanes-101

National Hurricane Center

www.nhc.noaa.gov/

NOAA Hurricane Research Division

www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html

Science Kids Weather Facts

www.sciencekids.co.nz/sciencefacts/weather/hurricane.html

SciJinks: Educational website from NOAA and NASA

scijinks.jpl.nasa.gov/

Typhoon, Hurricane, Cyclone: What's the Difference?

news.nationalgeographic.com/news/2013/10/131023-typhoon-hurricane-cyclone-primer-natural-disaster/

U.S. Coast Guard: Storm Classification

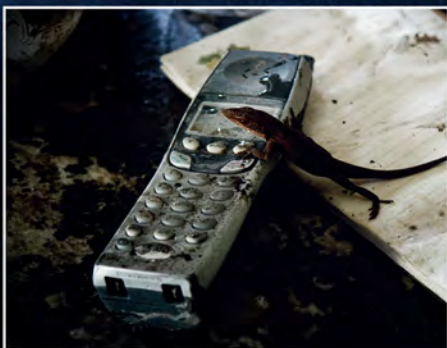
www.uscg.mil/lantarea/camslant/hurricane/classification.asp



EVERY DARK CLOUD HAS A SILVER LINING

HURRICANE

A film by
Cyril Barbançon, Andy Byatt and Jacqueline Farmer



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