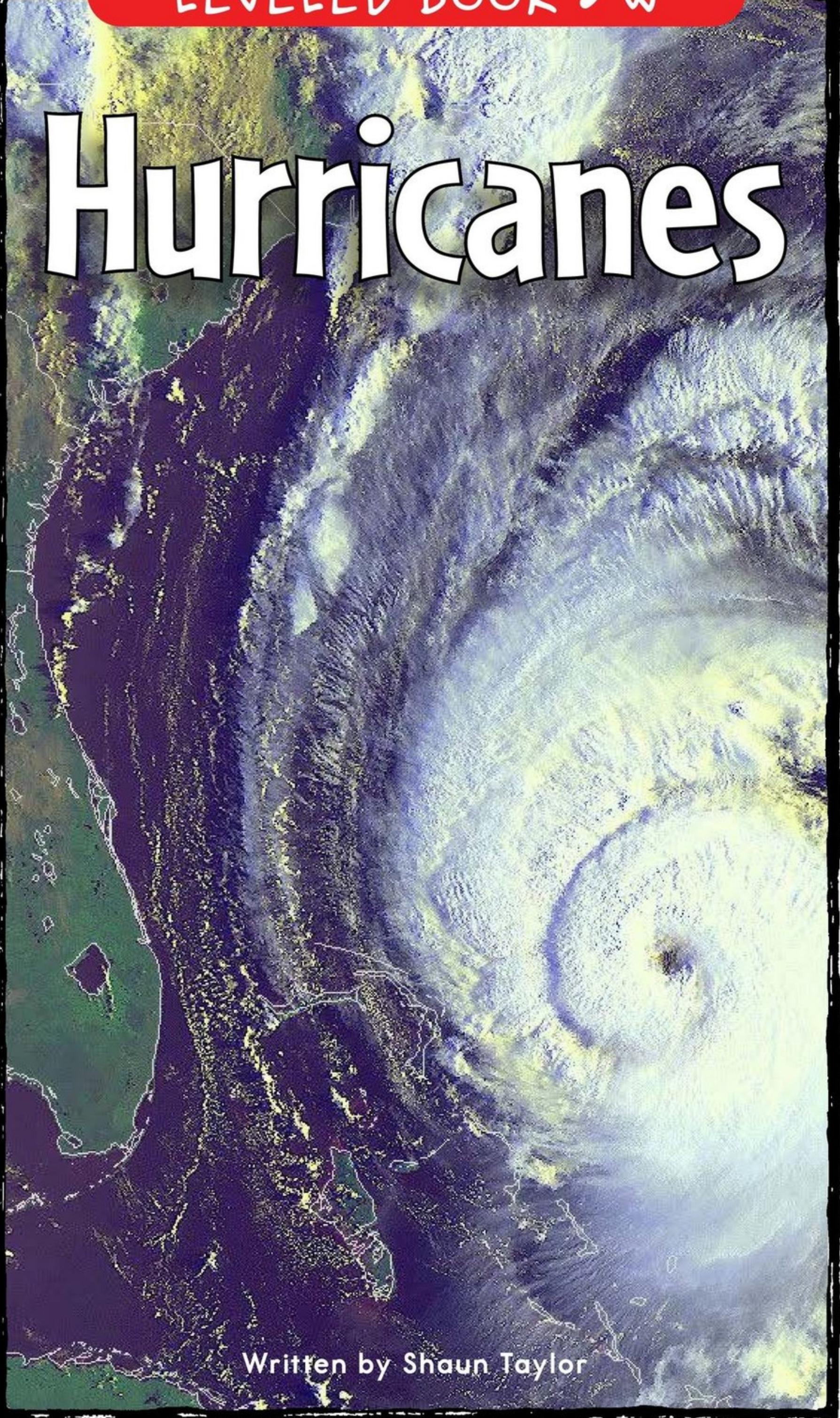


LEVELED Book • W

Hurricanes



Written by Shaun Taylor

Hurricanes



Written by Shaun Taylor
Illustrated by Cende Hill



C-130 Hurricane Hunter

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A Hurricane Is Coming!

"This just in from the National Hurricane Center in Miami. A **hurricane watch** is in effect for the Florida east coast from Florida City north to Flagler Beach, including Lake Okeechobee. Hurricane Frances is about 555 miles east-southeast of Palm Beach and is moving toward the west-northwest at about 14 miles per hour."

The message crackles over a radio at a small Florida cafe. The patrons look outside at a warm, sunny day and then out to sea for any signs of the approaching storm—there are none. However, the television shows a **satellite** image of a gigantic, spiraling storm. A dotted line shows the hurricane's path and a shaded wedge shows where the hurricane might hit the coast.

The people in the cafe have already been hit with one hurricane this season, and they know they must prepare. Some buy more plywood to board up windows. Others get supplies at the grocery store, such as water, food, and batteries.



Hurricane Frances just north of the island of Puerto Rico



High waves from the September 1945 hurricane flood in Miami

The next morning, the wind speed picks up, and the sky clouds over. Some people farther down the coast **evacuate**, or leave their homes to go to safer areas. Winds reach hurricane strength, bending over palm trees as if they are made of rubber. The wind rips roofs off buildings, and flying objects become deadly. High waves and rising water flood low-lying areas on the coast. Falling trees break power lines. Some residents who were not evacuated sit in the darkness of their homes listening to the storm's progress on their battery-powered radios. Finally, the storm moves inland, and the wind slows down; but drenching rains and flooding remain. The next day the sun comes out, and people begin the costly cleanup.

What Is a Hurricane?

We have all experienced wind and rainstorms, but what makes a hurricane different? Hurricanes are gigantic, circular storms that can be hundreds of kilometers wide. When they occur in the Pacific Ocean, they are called *typhoons*. In the Indian Ocean, they are called *severe tropical cyclones*. In the Atlantic Ocean, they are called *hurricanes*. No matter what they are called, winds over hundreds of kilometers per hour, inches of rain, and high seas cause death, and sometimes billions of dollars in damage.

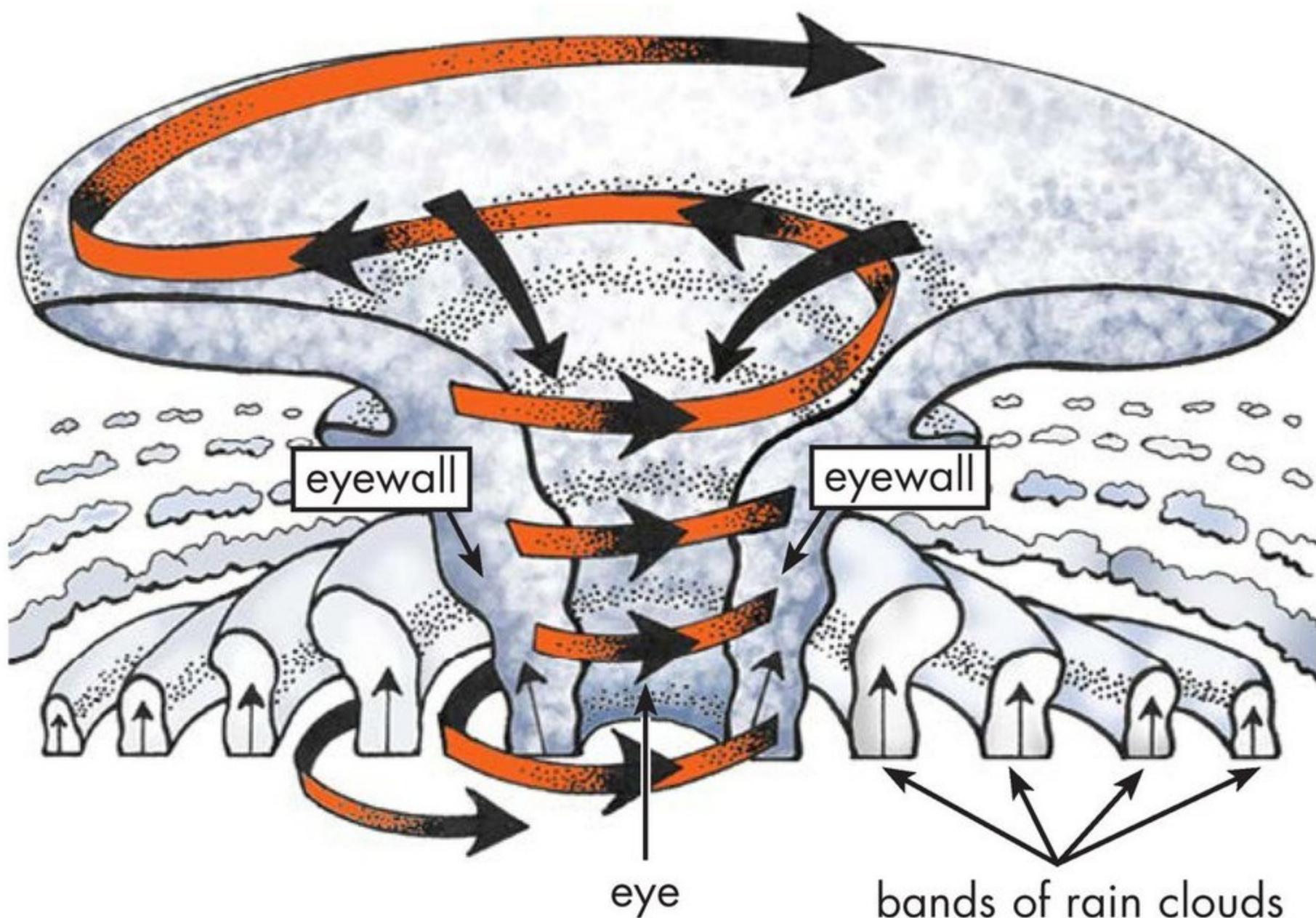


Eye of a hurricane

Do You Know?

According to the National Hurricane Center, the word "hurricane" comes from the name *Hurican*, the Caribbean god of evil. Islands in the Caribbean Sea are often in the path of hurricanes.

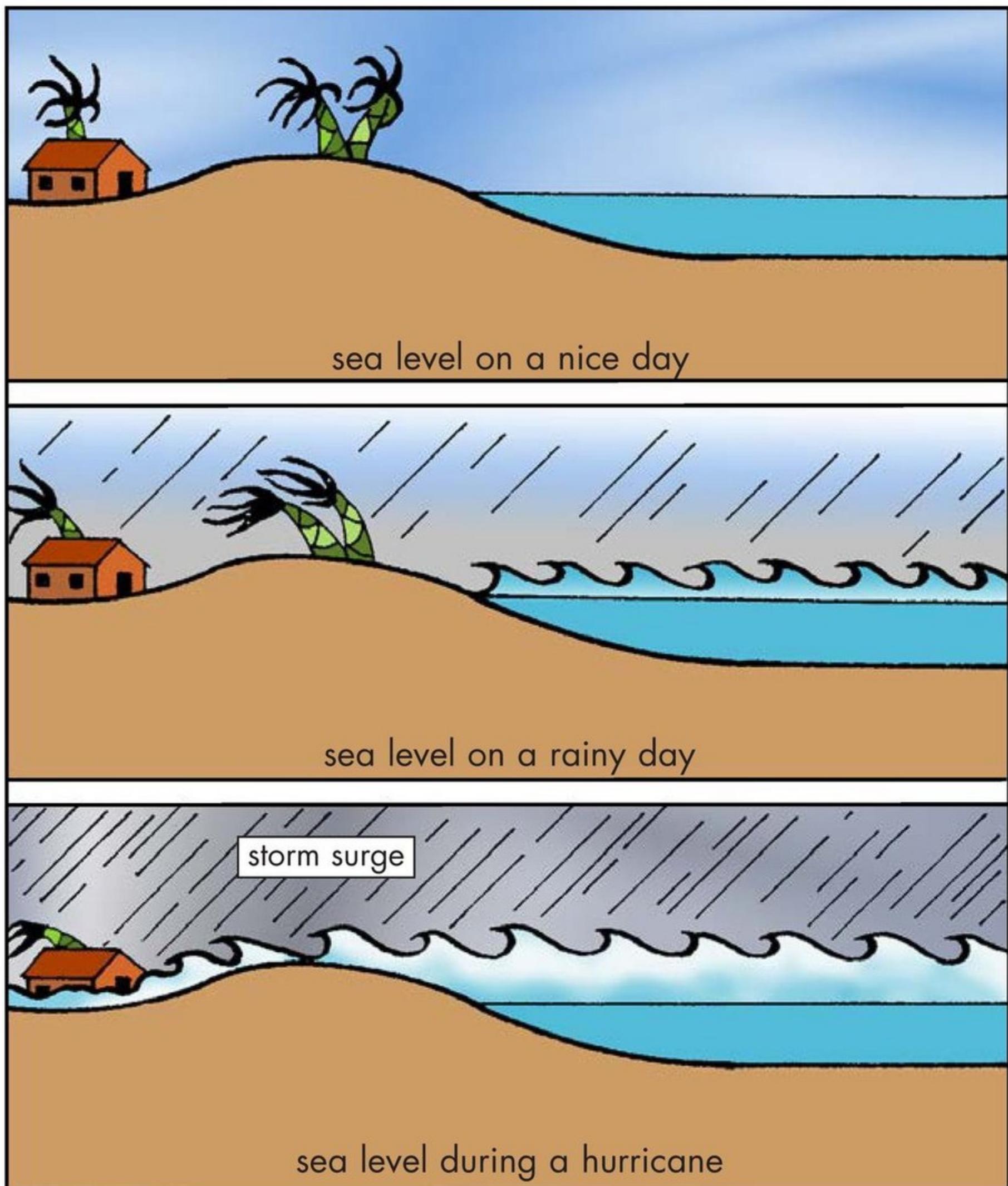
Hurricanes have a distinct **structure** that can be seen on satellite photos. Clouds extend out as spiraling arms for hundreds of kilometers around the center. The center of a hurricane is called the **eye**. Winds become more and more intense from the edge of the storm to the **eyewall**.



Fully formed hurricane

The eyewall is where winds rushing toward the center suddenly turn upward. The upward-moving air rapidly cools, and rain begins to fall. Most of the rainfall occurs in the eyewall. Sometimes rainfall reaches 20 millimeters (0.78 in.) of rain per hour, which can dump about 15–30 centimeters (6–12 in.) on one area over several days.

Yet, inside the eye, it's often calm and sunny. Most hurricane eyes are 30–60 kilometers (20–40 mi.) in diameter. In the eye of a hurricane, the peacefulness will not last long. Soon the eye will move, and then the sudden force of the other side of the storm will hit.



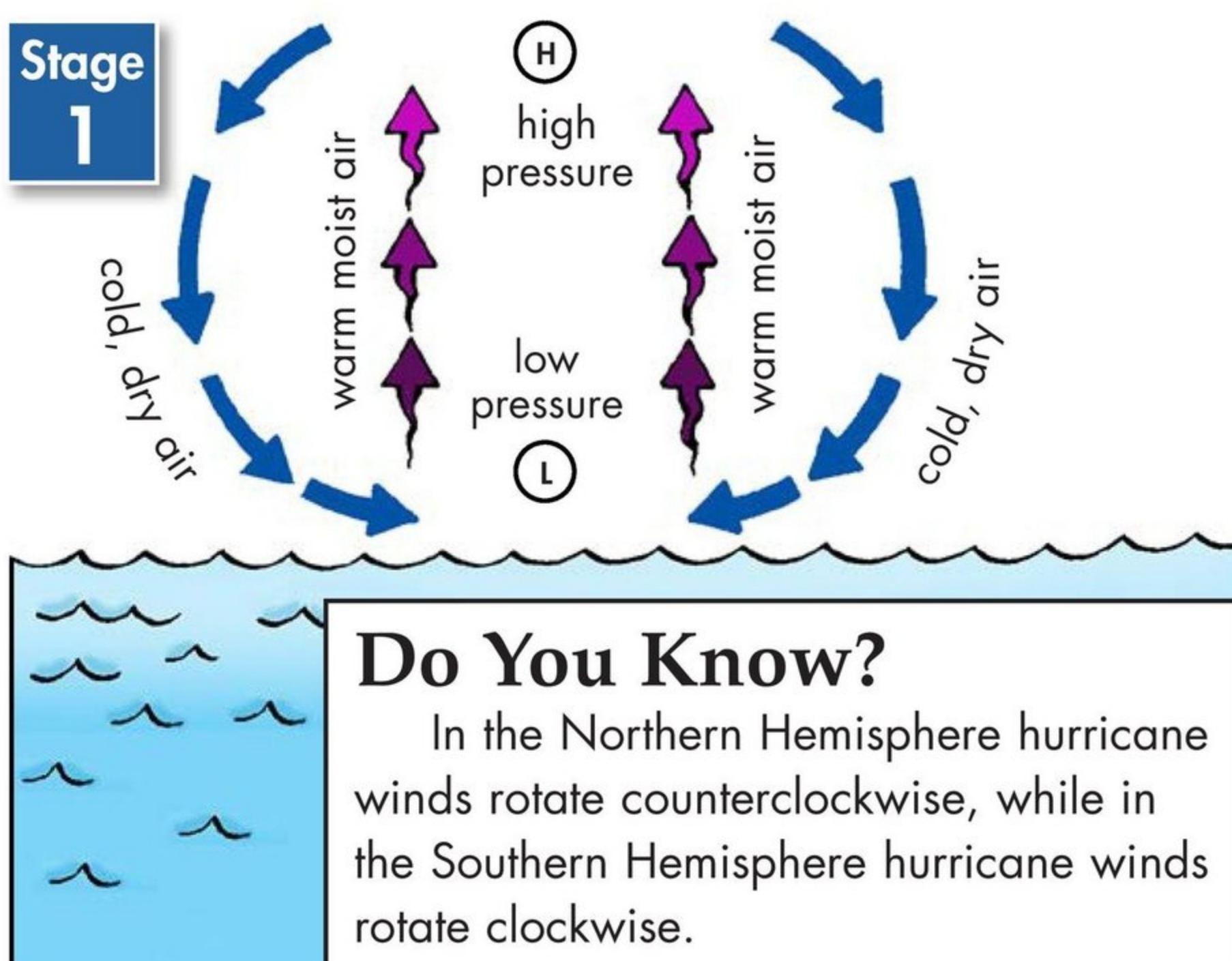
As hurricanes approach shore, the combination of high winds and low **air pressure** actually raises the level of the sea around the storm higher than normal. Scientists call this a **storm surge**. It extends for miles around the center of a hurricane and floods any low, coastal land. Flooding caused by a storm surge is a major source of property damage from hurricanes.

How Hurricanes Form

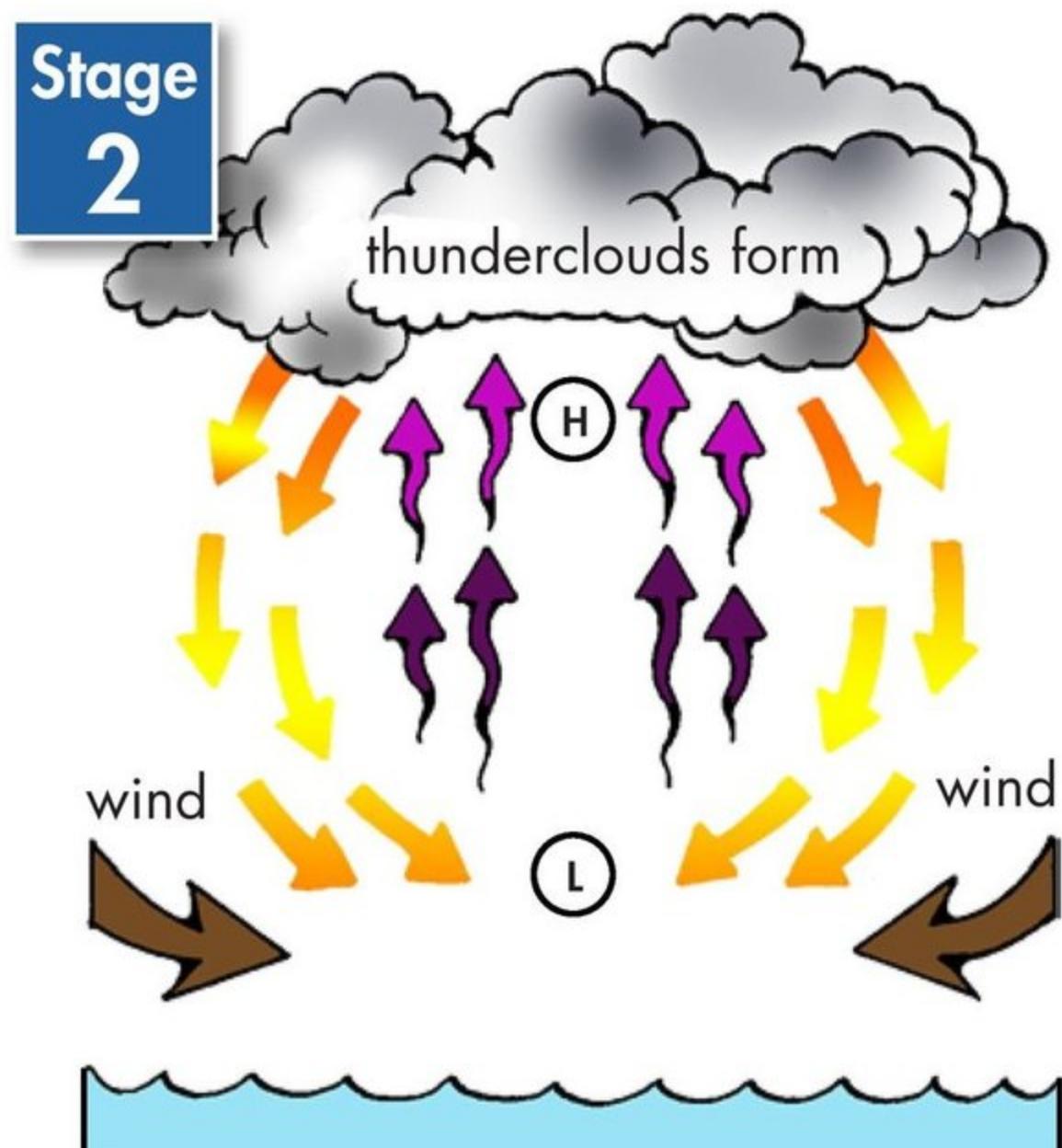
Hurricanes form over **tropical** oceans worldwide. These tropical storms tend to be seasonal. They usually form in the summers of the Northern and Southern Hemispheres.

The storms form when energy from the Sun heats ocean water near the equator.

Warm, moist air evaporating from the ocean is lighter than the cold, dry air above it. The warmer air pushes up through the cooler air, which then sinks down to take the place of the warmer air. The process creates a low-pressure area called a **tropical depression**.

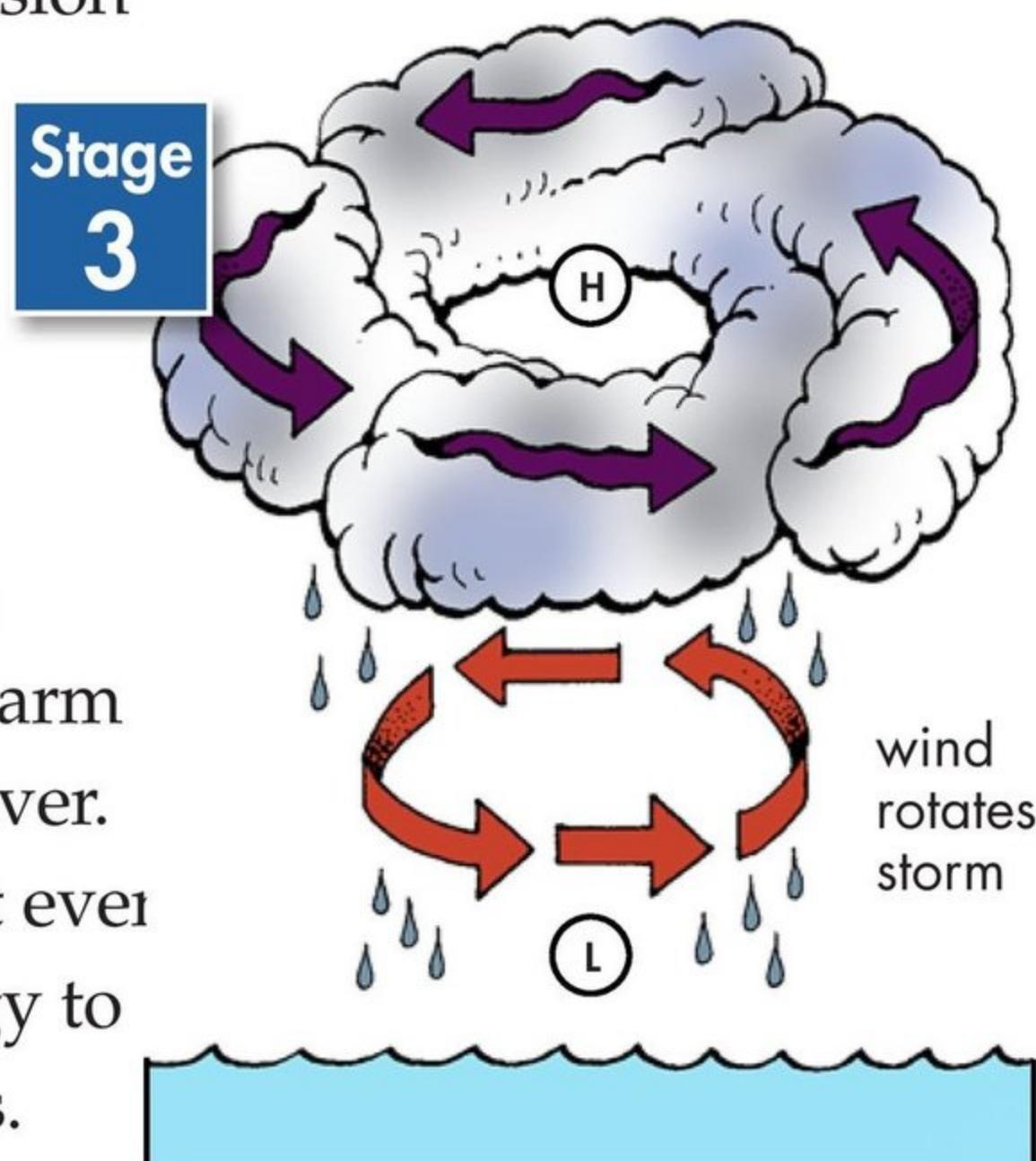


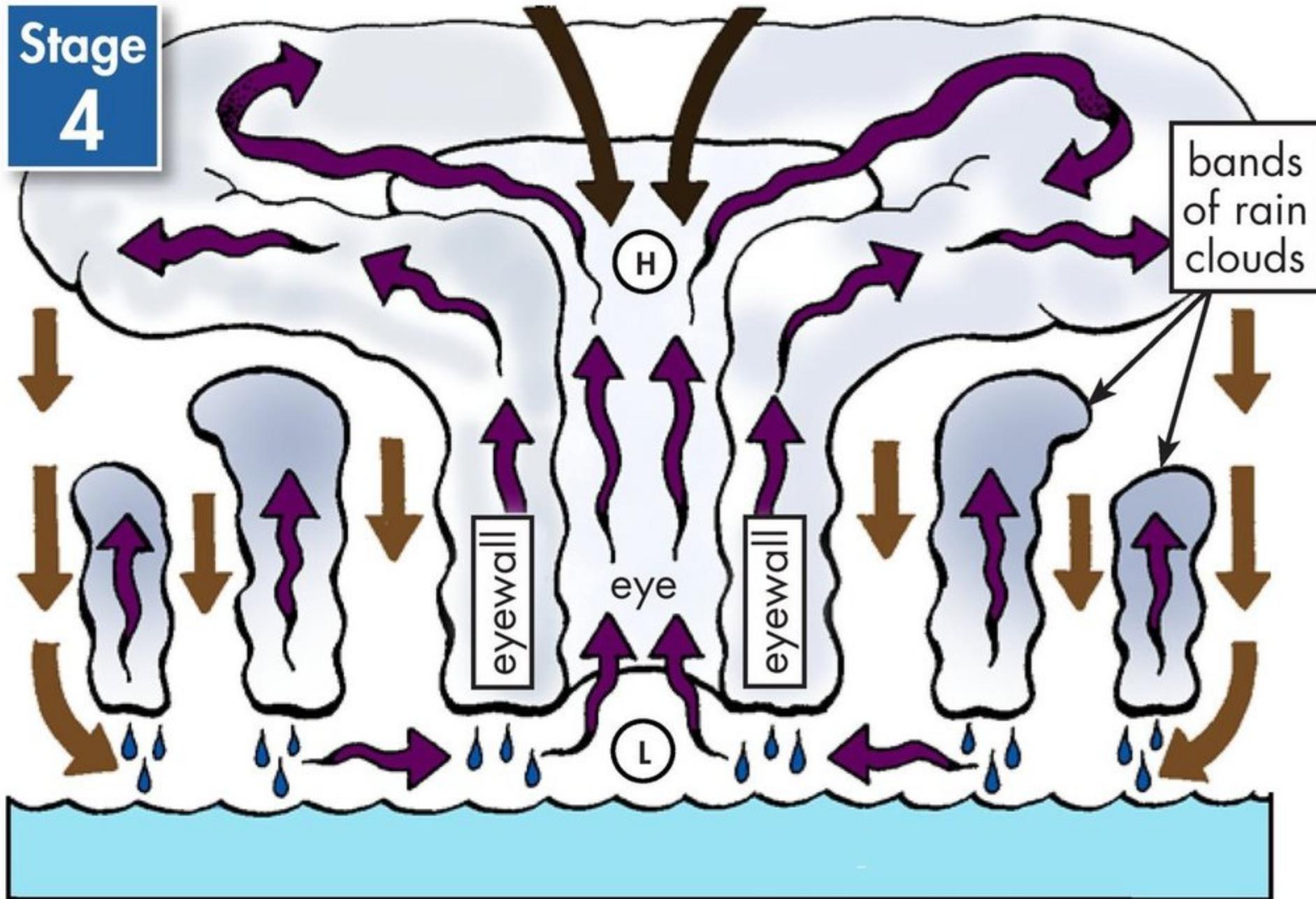
As the warm, moist air rises, it cools and **condenses**, a process that creates clouds and releases heat energy. Soon giant thunderclouds form.



Wind begins to rotate, or spin, around the low-pressure area.

The wind starts blowing harder, and when it reaches about 62 kilometers per hour (39 mph), the tropical depression becomes a **tropical storm**. Tropical storms can grow into hurricanes if they soak up more heat energy from the warm oceans they pass over. Some storms don't ever gain enough energy to become hurricanes.





If a tropical storm does gain more energy, wind speed picks up and thick spiral bands of clouds spread out from the center of the storm. When wind speeds are greater than 119 kilometers per hour (74 mph), the storm officially becomes a hurricane.

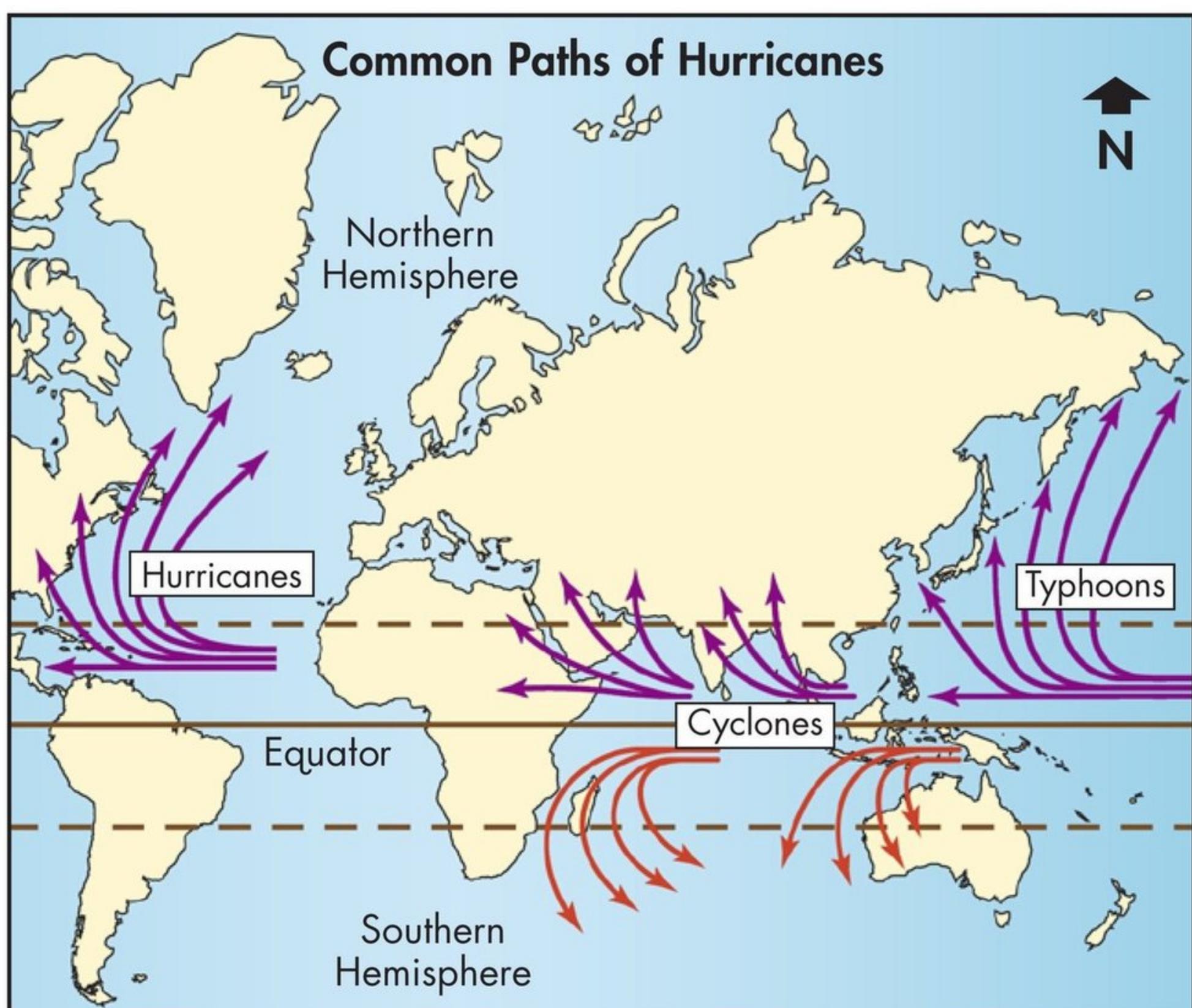
Naming System

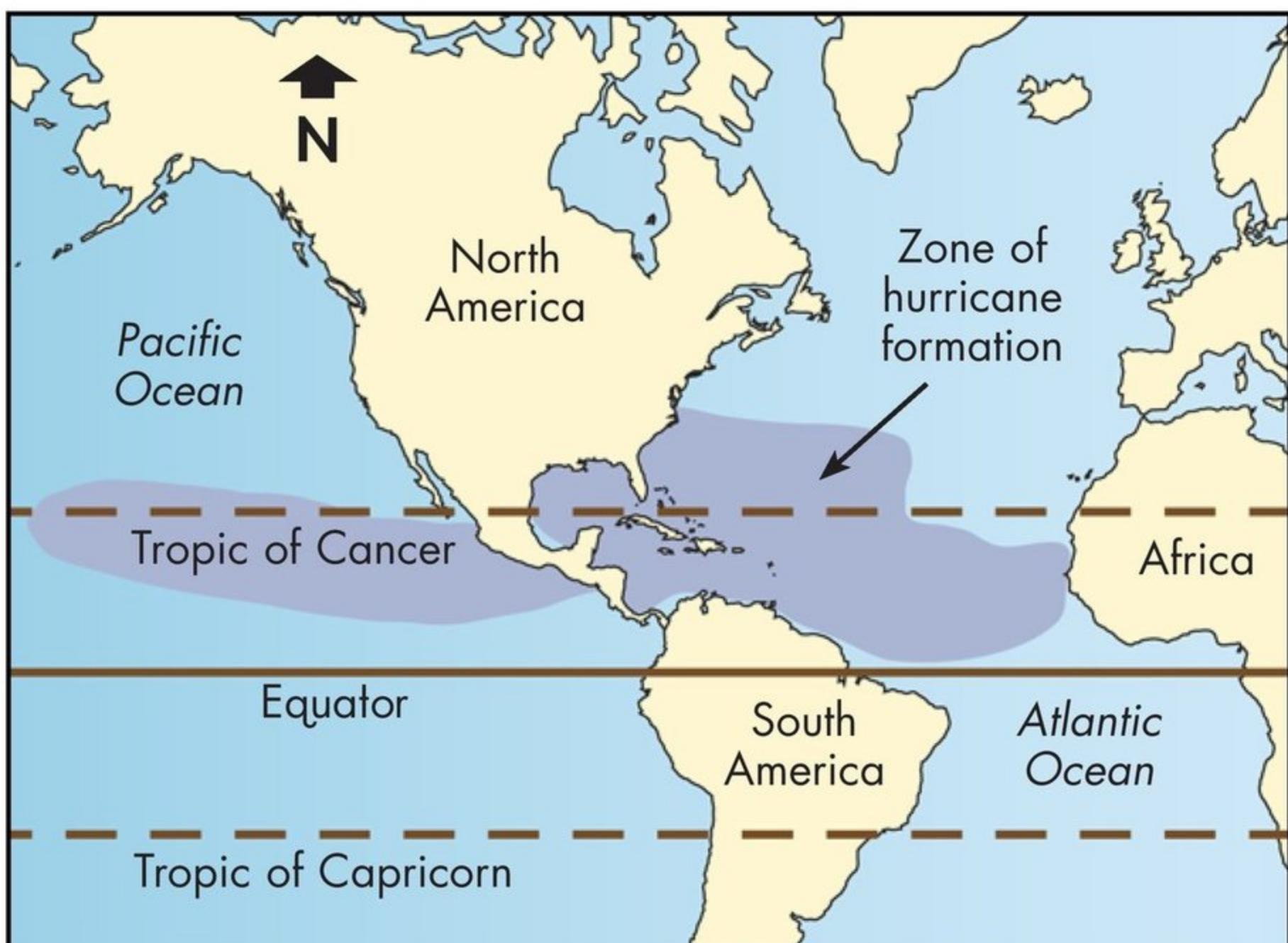
When a tropical storm officially becomes a hurricane, it is given a name. The yearly name lists for each region of the globe reflect all nationalities because hurricanes affect people in many countries. Here were the names for Atlantic Ocean hurricanes for 2010:

Alex	Hermine	Otto
Bonnie	Igor	Paula
Colin	Julia	Richard
Danielle	Karl	Shary
Earl	Lisa	Tomas
Fiona	Matthew	Virginie
Gaston	Nicole	Walter

Generally, hurricanes in the Northern Hemisphere move west, then north, and then they turn toward the northeast. This path takes hurricanes away from the equator and away from the warm ocean water that fuels them. In the Southern Hemisphere hurricanes typically travel west, south, and then turn southeast, which also takes them away from warm ocean water.

As hurricanes move over cooler water and over land, they lose much of their energy. The wind slows down, and the storms eventually **disperse**.





Where Hurricanes Form

Central America, islands in the Caribbean, and the East Coast of the United States are hit by hurricanes almost every year. Rarely do hurricanes hit the U.S. West Coast. Atlantic Ocean hurricanes get started southeast of the Caribbean Sea. In the Pacific Ocean typhoons most often hit Asia and Indonesia. In the Indian Ocean, severe tropical cyclones affect Australia, the Middle East, parts of Asia, and the eastern coast of Africa. During hurricane season (which can last six months or more), meteorologists keep a careful watch on tropical depressions and tropical storms hundreds of kilometers offshore to see if any will become hurricanes.

How Hurricanes Are Classified

A tropical storm has **sustained** winds of 62–119 kilometers per hour (39–74 mph). When a tropical storm has sustained winds greater than 119 kilometers per hour (74 mph) it is classified as a hurricane.

Meteorologists classify hurricanes according to their **intensity** using the Saffir-Simpson Hurricane Scale. The scale goes from 1 to 5 and helps describe the kind of damage and dangers of each category of hurricane.

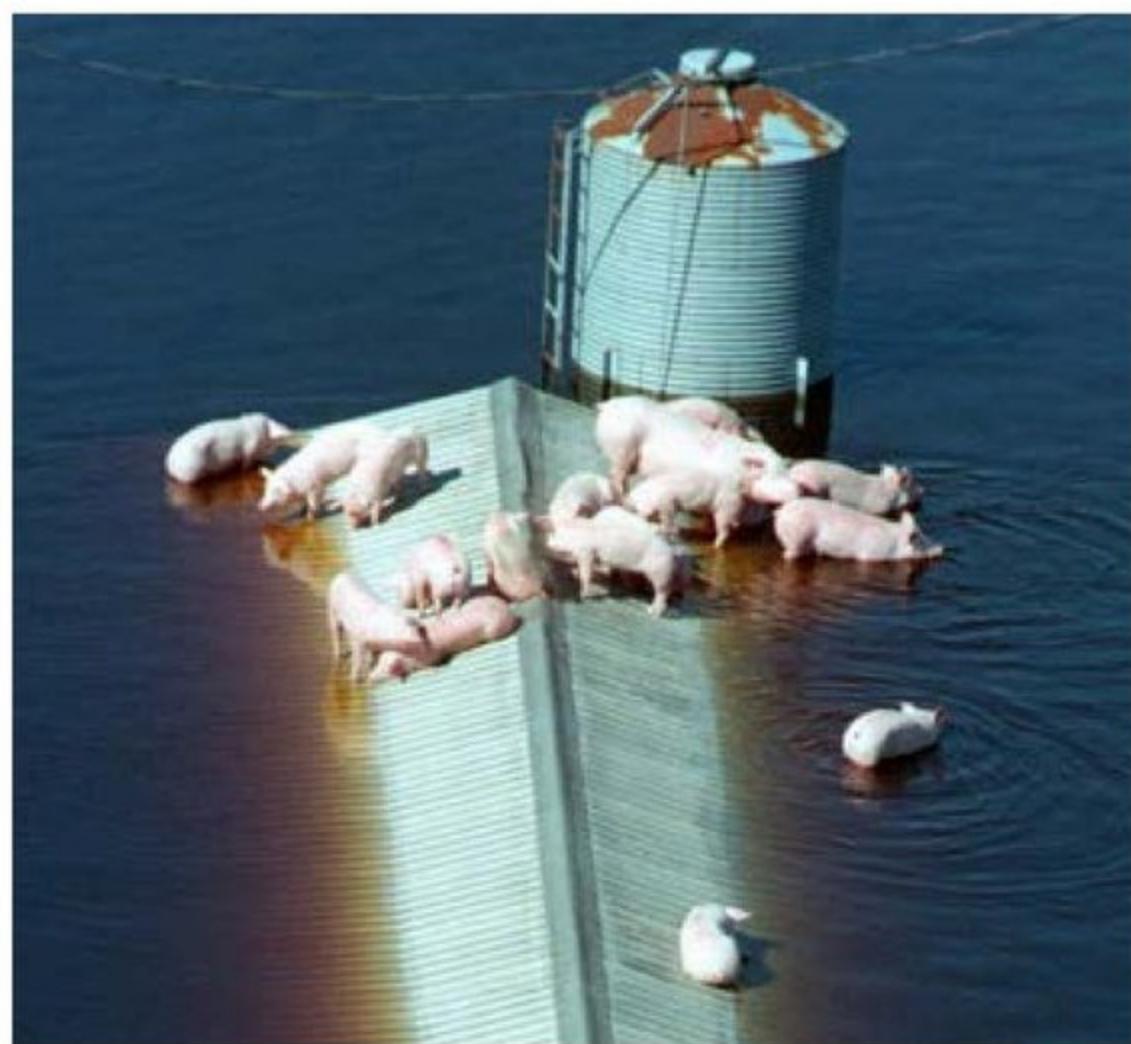
Category One hurricanes have winds of 119–153 kilometers per hour (74–95 mph). They cause little damage to buildings and minor damage to vegetation.



Damage from Dolly, a Category One hurricane

Category Two hurricanes have winds of 154–177 kilometers per hour (96–110 mph). They tear away roofing material, damage doors and windows of buildings, and uproot plants. Boats in unprotected areas often break away from docks.

Category Three hurricanes have winds of 178–209 kilometers per hour (111–130 mph). They cause structural damage to small buildings and destroy mobile homes. Areas lower than 1.52 meters (5 ft.) above sea level may be flooded as far as 13 kilometers (8 mi.) or more inland.



Flooding from Floyd, a Category Two hurricane, stranded these pigs on a roof.



The 400-mile wide path of Katrina, a high Category Three, resulted in massive flooding and 1,800 deaths.

Category Four hurricanes have winds of 211–249 kilometers per hour (131–155 mph). They cause building walls to collapse and major erosion of beaches. Areas lower than 3 meters (10 ft.) above sea level may be flooded, requiring massive evacuation of residential areas as far as 9 kilometers (6 mi.) inland.



Charley, an intense 2004 Category Four, destroyed thousands of homes.

Category Five hurricanes have winds of greater than 249 kilometers per hour (155 mph). The strongest hurricanes cause extensive damage to houses and industrial buildings. Massive evacuation of residential areas on low ground within 8–16 kilometers (5–10 mi.) of the shoreline may be required.



In 1992, the winds from Andrew, a Category Five, caused crippling damage over a wide area.

Historic Storms

The most destructive hurricanes have been powerful and slow moving. Many have destroyed major cities in their paths. Here are some famous hurricanes, typhoons, and cyclones.

Name	Ocean (Areas Most Affected)	Year	Deaths
Calcutta*	Indian (India)	1864	70,000
Galveston*	Atlantic (United States)	1900	6,000–8,000
Vera	Pacific (Japan)	1958	5,000
Bangladesh*	Indian (Bangladesh, India)	1970	300,000–500,000
Thelma	Pacific (Philippines)	1991	5,101–8,000+
Mitch	Caribbean (Caribbean, Central America)	1998	11,000–18,000
Katrina	Central Gulf Coast (United States)	2005	1,800+

*No actual name given. Labeled by area worst hit.

Source: <http://hurricanes.noaa.gov>

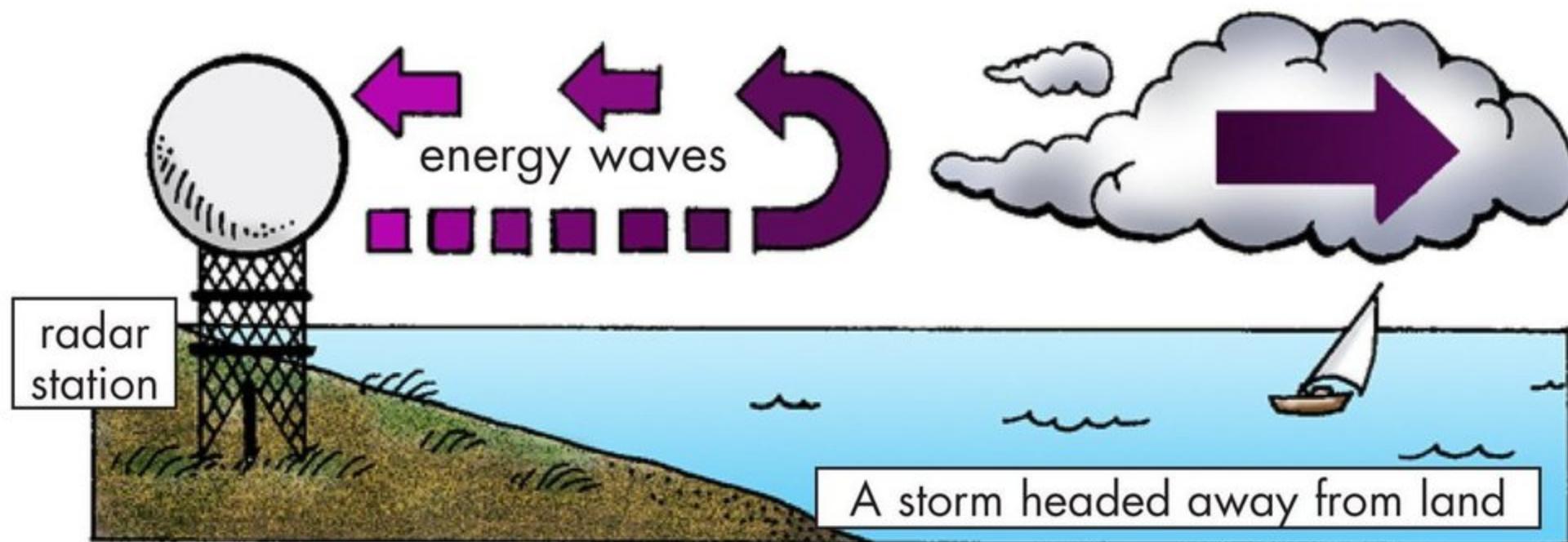
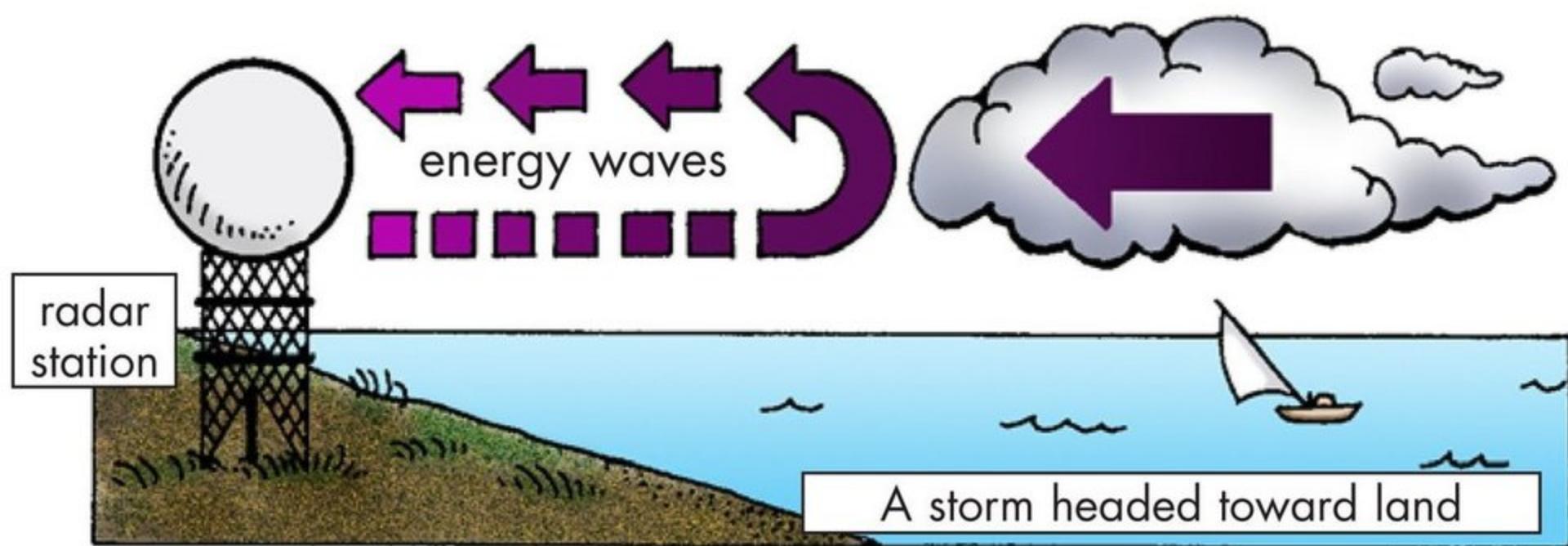
How We Study Hurricanes

We use satellites to locate and track tropical depressions, tropical storms, and hurricanes while they are far out at sea. Satellites orbiting high above Earth take frequent pictures of a hurricane. Scientists study the differences in the pictures to measure changes in a storm's movement and intensity. High clouds within strong hurricanes show up on pictures from satellites as colder than the surrounding area.

The most dramatic hurricane study tool is the "Hurricane Hunter." This is a specially designed aircraft that flies into the eye of a hurricane to make direct measurements of temperature, moisture, wind speed, and direction.

C-130 Hurricane Hunter





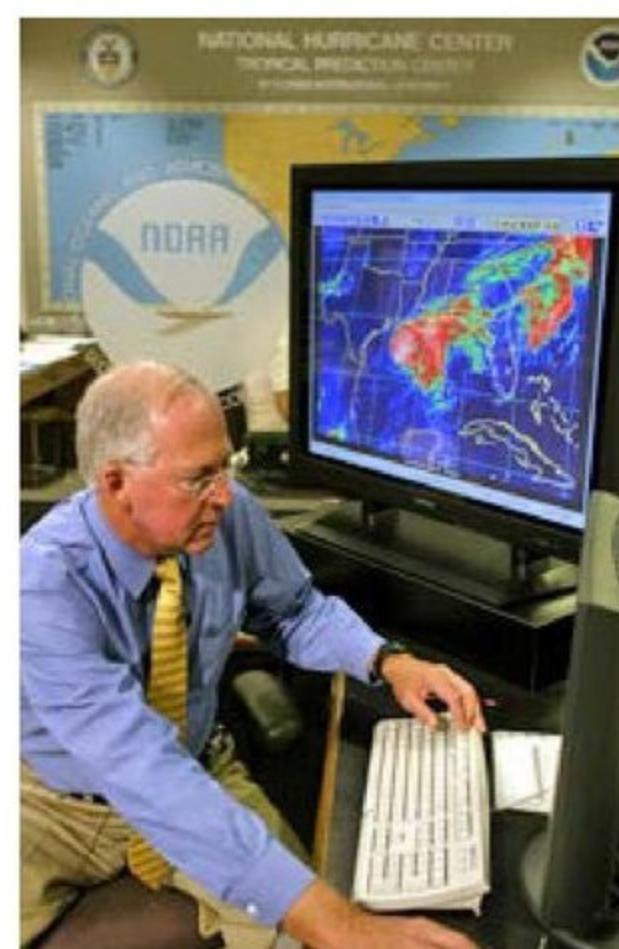
Doppler radar also helps track storms.

Weather forecasters on television news programs use it to show local rainfall. Wide-range Doppler radar shows a hurricane's wind speed as it approaches land.

Doppler radar stations send out short bursts of energy waves. Rain and clouds reflect these waves back to the station. Rain and clouds coming toward land from a hurricane reflect back different waves than rain and clouds headed away from land. A computer analyzes the differences in the waves to create a model of a storm. Scientists use the model to show the speed and direction of a storm.

How We Predict Hurricanes

Computers are used to predict hurricane movements. Thousands of measurements are typed into supercomputers to predict where a storm will go. As computers improve, we will be able to more accurately predict where hurricanes will hit land. This will save lives and reduce unnecessary evacuations. But computers will never be 100 percent accurate because weather systems are **chaotic** and are often difficult to predict.



Specialists tracking a hurricane's path warn residents to evacuate.

Some researchers believe it is possible to stop hurricanes from forming or to redirect them. One possible way to do this is by seeding clouds in broad areas where hurricanes are born. During seeding, airplanes spray a fine mist of salt powder, which helps water condense out of the air. This would create many small clouds that would use up the energy that might be tapped by a single large storm to become a hurricane. The problem is that in order to be effective, clouds would have to be seeded over areas the size of Texas. No one yet has come up with a plan that would prevent a hurricane from forming.

How to Prepare for Hurricanes

These steps can help protect lives and property during a hurricane.

- Have a family evacuation plan. Include in the plan when to leave, where to go, how you will get there, and what to do if your family becomes separated.
- Keep emergency supplies such as a first aid kit, flashlight, drinking water, and canned food.
- Keep a battery-powered radio to listen to if the power goes out. Follow the instructions you receive over the radio with each elevated warning.
- Keep your car's gas tank full in case you need to evacuate.
- If you are in the path of a hurricane and you have time, protect your house by nailing plywood over windows. Tie down loose objects outside.
- Leave as soon as you are ordered to evacuate.





Conclusion

Hurricanes are an awesome display of nature's power. Satellites can tell us much about these storms, such as the direction a hurricane is moving and what areas need to be evacuated. We may be able to predict the path of hurricanes, but it is unlikely that we will ever be able to stop them. We can protect ourselves by planning where and how we build our homes, by keeping emergency supplies, and by being prepared to evacuate if necessary.

Explore More

On the Internet use www.google.com to find out more about topics presented in this book. Use terms from the text, or try searching for glossary or index words.

Some searches to try: *hurricanes, storm surge, or typhoons*.

Glossary

air pressure (<i>n.</i>)	the pressure of air in the atmosphere (p. 8)
Caribbean (<i>adj.</i>)	of or relating to the region in the Atlantic Ocean located between North and South America (p. 13)
chaotic (<i>adj.</i>)	random, without an orderly pattern (p. 20)
condenses (<i>v.</i>)	changes from gas to liquid or from one substance to a denser form (p. 10)
disperse (<i>v.</i>)	to break up or scatter (p. 12)
evacuate (<i>v.</i>)	to move people out of danger (p. 5)
eye (<i>n.</i>)	the center of something, such as a hurricane (p. 6)
eyewall (<i>n.</i>)	the wall of clouds and rain around the eye of a hurricane (p. 6)
hurricane watch (<i>n.</i>)	a formal warning that hurricane conditions are possible in the area of the watch (p. 4)
intensity (<i>n.</i>)	the degree of force or strength (p. 14)
satellite (<i>n.</i>)	a vehicle that orbits the Earth (p. 4)
storm surge (<i>n.</i>)	a quick rise of the ocean's level, caused by strong winds and a drop in air pressure during a hurricane (p. 8)
structure (<i>n.</i>)	the relationship of parts in how something is constructed (p. 6)
sustained (<i>adj.</i>)	kept up without stopping (p. 14)
tropical (<i>adj.</i>)	of, or occurring in, the tropics (p. 9)
tropical depression (<i>n.</i>)	a low-pressure weather system with sustained cyclonic winds of less than 62 kilometers per hour (39 mph) (p. 9)

tropical a low-pressure weather system with
storm (n.) sustained cyclonic winds of 62–119 kilometers per hour (39–74 mph) (p. 10)

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Editor's note: *Cyclones that form in the tropics are called different names in different parts of the world. In the Atlantic Ocean they are called hurricanes, in the Pacific Ocean, typhoons, and in the Indian Ocean, severe tropical cyclones. This book will use the word hurricane to describe them all.*

Hurricane names					
2007	2008	2009	2010	2011	2012
Andrea	Arthur	Ana	Alex	Arlene	Alberto
Barry	Bertha	Bill	Bonnie	Bret	Beryl
Chantal	Cristobal	Claudette	Colin	Cindy	Chris
Dean	Dolly	Danny	Danielle	Don	Debby
Erin	Edouard	Erika	Earl	Emily	Ernesto
Felix	Fay	Fred	Fiona	Franklin	Florence
Gabrielle	Gustav	Grace	Gaston	Gert	Gordon
Humberto	Hanna	Henri	Hermine	Harvey	Helene
Ingrid	Ike	Ida	Igor	Irene	Isaac
Jerry	Josephine	Joaquin	Julia	Jose	Joyce
Karen	Kyle	Kate	Karl	Katia	Kirk
Lorenzo	Laura	Larry	Lisa	Lee	Leslie
Melissa	Marco	Mindy	Matthew	Maria	Michael
Noel	Nana	Nicolas	Nicole	Nate	Nadine
Olga	Omar	Odette	Otto	Ophelia	Oscar
Pablo	Paloma	Peter	Paula	Philippe	Patty
Rebekah	Rene	Rose	Richard	Rina	Rafael
Sebastien	Sally	Sam	Shary	Sean	Sandy
Tanya	Teddy	Teresa	Tomas	Tammy	Tony
Van	Vicky	Victor	Virginie	Vince	Valerie
Wendy	Wilfred	Wanda	Walter	Whitney	William

Hurricanes

Level W Leveled Book

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