Hurricane Basics

For More Information

Websites:
NOAA - www.noaa.gov
National Hurricane Center - www.nhc.noaa.gov

National Hurricane Center Public Affairs
(305) 229-4404

National Weather Service Public Affairs
(301) 713-0622

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Hurricane Fast Facts

- A "hurricane" is the most severe category of the meteorological phenomenon known as the "tropical cyclone."
- Tropical cyclones are low pressure systems that have thunderstorm activity and rotate counterclockwise. A tropical cyclone that has winds of 38 mph (33 kt) or less is called a tropical depression. When the tropical cyclone's winds reach 39-73 mph (34-63 kt), it is called a tropical storm. When the winds exceed 74 mph (64 kt), the storm is considered to be a hurricane.
- The Saffir-Simpson Hurricane Scale defines hurricane strength by categories. A Category 1 storm is the weakest hurricane (winds 74-95 mph or 64-82 kt); a Category 5 hurricane is the strongest (winds greater than 155 mph or 135 kt).
- The category of the storm does not necessarily relate directly to the damage it will inflict. Lower category storms (and even tropical storms) can cause substantial damage depending on what other weather features they interact with, where they strike, and how slow they move.

Anatomy of a Hurricane

- Typical hurricanes are about 300 miles wide although they can vary considerably in size.
- The eye at a hurricane's center is a relatively calm, clear area approximately 20-40 miles across.
- The eyewall surrounding the eye is composed of dense clouds that contain the highest winds in the storm.
- The storm's outer rainbands (often with hurricane or tropical storm-force winds) are made up of dense bands of thunderstorms ranging from a few miles to tens of miles wide and 50 to 300 miles long.
- Hurricane-force winds can extend outward to about 25 miles in a small hurricane and to more than 150 miles for a large one. Tropical storm-force winds can stretch out as far as 300 miles from the center of a large hurricane.
- Frequently, the right side of a hurricane is the most dangerous in terms of storm surge, winds, and tornadoes.
- A hurricane's speed and path depend on complex ocean and atmospheric interactions, including the presence or absence of other weather patterns. This complexity of the flow makes it very difficult to predict the speed and direction of a hurricane.
- Do not focus on the eye or the track–hurricanes are immense systems that can move in complex patterns that are difficult to predict. Be prepared for changes in size, intensity, speed, and direction.

How Tropical Cyclones are Observed

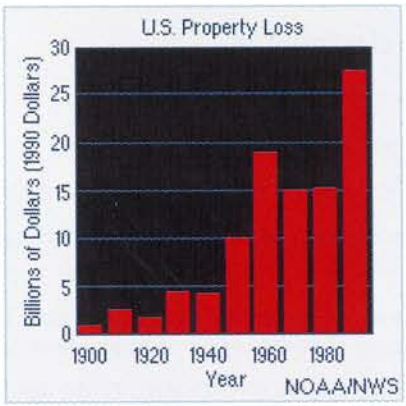
- *Direct* measurements of tropical storm and hurricane dimensions and wind speeds are taken primarily by reconnaissance aircraft, although ships and buoys also take important measurements. Once a hurricane is near and/or on land, Automated Surface Observation Systems (ASOS) provide surface conditions, and radio sondes take upper air measurements.
- *Indirect* observational methods include satellite imagery and Doppler radar. In particular, satellites have greatly improved our ability to monitor and understand hurricanes. Radar data are important once the storm comes close to shore and after landfall for forecasting hurricane-related weather.

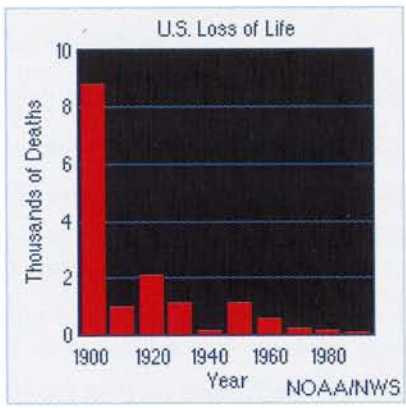
http://hurricanes.noaa.gov
www.nws.noaa.gov
www.noaa.gov

Hurricane Basics

There is nothing like them in the atmosphere. Born in warm tropical waters, these spiraling masses require a complex combination of atmospheric processes to grow, mature, and then die. They are not the largest storm systems in our atmosphere or the most violent, but they combine these qualities as no other phenomenon does.

In the Atlantic Basin, they are called hurricanes, a term that echoes colonial Spanish and Caribbean Indian words for evil spirits and big winds. These awesome storms have been a deadly problem for residents and sailors ever since the early days of colonization. Today, hurricane damage costs billions of dollars. During this century, 23 hurricanes have each caused damage in excess of $1 billion (adjusted for inflation). Damage from Hurricane Andrew (1992) alone was estimated at more than $25 billion in South Florida and Louisiana and undoubtedly would have been higher had the storm hit Miami directly.





Thankfully, the number of people injured or killed during tropical cyclones in the United States has been declining, largely because of improvements in forecasting and emergency preparedness. Nonetheless, our risk from hurricanes is increasing. With population and development continuing to increase along coastal areas, greater numbers of people and property are vulnerable to hurricane threat. Large numbers of tourists also favor coastal locations, adding greatly to the problems of emergency managers and local decision makers during a hurricane threat.

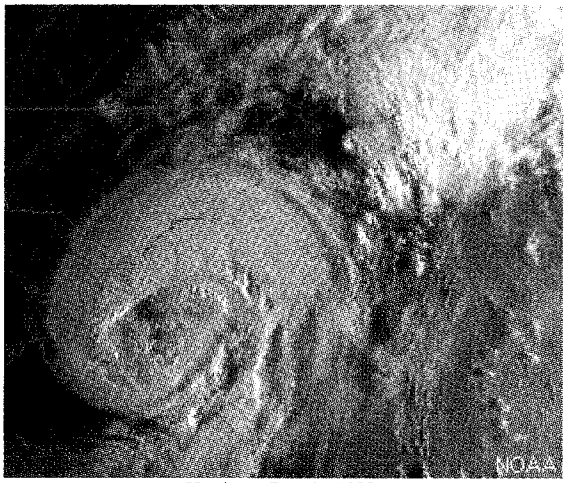
Hurricanes cannot be controlled, but our vulnerability can be reduced through preparedness. Local decision makers must make difficult choices between public safety and possible economic losses when faced with a hurricane, but these decisions will be solid if they are based on an understanding of hurricanes, their hazards, the value and limitations of forecasts, and a good decision-making process.

The Richelieu Apartments before Hurricane Camille

The Richelieu Apartments after Hurricane Camille

Hurricane Basics

The ingredients for a hurricane include a pre-existing weather disturbance, warm tropical oceans, moisture, and relatively light winds aloft. If the right conditions persist long enough, they can combine to produce the violent winds, incredible waves, torrential rains, and floods we associate with this phenomenon.



Hurricane Bonnie, 1998

Each year, an average of ten tropical storms develop over the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Many of these remain over the ocean. Six of these storms become hurricanes each year. **In an average 3-yearperiod, roughly five hurricanes strike the United States coastline, killing approximately 50 to 100 people anywhere from Texas to Maine.** Of these, two are typically major hurricanes (winds greater than 110 mph).

What is a Hurricane?

A hurricane is a type of tropical cyclone, which is a generic term for a low pressure system that generally forms in the tropics. The cyclone is accompanied by thunderstorms and, in the Northern Hemisphere, a counterclockwise circulation of winds near the earth's surface. Tropical cyclones are classified as follows:

Tropical Depression	An organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds* of 38 mph (33 kt**) or less
Tropical Storm	An organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds of 39-73 mph (34-63 kt)
Hurricane	An intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph (64 kt) or higher

* Sustained winds are defined as a 1-minute average wind measured at about 33 ft (10 meters) above the surface.
** 1 knot = 1 nautical mile per hour or 1.15 statute miles per hour. Abbreviated as "kt".

Hurricanes are categorized according to the strength of their winds using the Saffir-Simpson Hurricane Scale A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the strongest. **These are relative terms, because lower category storms can sometimes inflict greater damage than higher category storms, depending on where they strike and the particular hazards they bring.** In fact, tropical storms can also produce significant damage and loss of life, mainly due to flooding.

Hurricane Names

When the winds from these storms reach 39 mph (34 kt), the cyclone is given a name. Years ago, an international committee developed six separate lists of names for these storms . Each list alternates between male and female names. The use of these easily remembered names greatly reduces confusion when two or more tropical cyclones occur at the same time. Each list is reused every six years, although hurricane names that have resulted in substantial damage or death are retired.

Why Hurricanes Are Named

Experience shows that the use of short, distinctive given names in written as well as spoken communications is quicker and less subject to error than the older more cumbersome latitude-longitude identification methods. These advantages are especially important in exchanging detailed storm information between hundreds of widely scattered stations, airports, coastal bases, and ships at sea.

The use of easily remembered names greatly reduces confusion when two or more tropical storms occur at the same time. For example, one hurricane can be moving slowly westward in the Gulf of Mexico, while at exactly the same time another hurricane can be moving rapidly northward along the Atlantic coast. In the past, confusion and false rumors have arisen when storm advisories broadcast from one radio station were mistaken for warnings concerning an entirely different storm located hundreds of miles away.

Present Procedure in the North Atlantic, Caribbean, and Gulf of Mexico

The Tropical Prediction Center near Miami, FL, keeps a constant watch on oceanic storm-breeding areas for tropical disturbances that may herald the formation of a hurricane. If a disturbance intensifies into a tropical storm —with rotary circulation and wind speeds above 39 miles per hour—the Center will give the storm a name from one of the six lists below. The Center uses a new set of names each year beginning with the first name in the set. After the sets have all been used, they are reused. For example, TPC is reusing the 2005 set in 2010. The letters Q, U, X, Y, and Z are not included because of the scarcity of names beginning with those letters. TPC retires a name after a major land-falling storm with major economic impact. For example, Katrina will be retired this year after its devastating impact.

The name lists have an international flavor because hurricanes affect other nations and are tracked by the public and weather services of many countries. Names for these lists are selected from library sources and agreed upon at international meetings of the World Meteorological Organization.

The Six-Year List of Names for Atlantic Storms

2005	2006	2007	2008	2009	2010
Arlene	Alberto	Andrea	Arthur	Ana	Alex
Bret	Beryl	Barry	Bertha	Bill	Bonnie
Cindy	Chris	Chantal	Cristobal	Claudette	Colin
Dennis	Debby	Dean	Dolly	Danny	Danielle
Emily	Ernesto	Erin	Edouard	Erika	Earl
Franklin	Florence	Felix	Fay	Fred	Fiona
Gert	Gordon	Gabrielle	Gustav	Grace	Gaston
Harvey	Helene	Humberto	Hanna	Henri	Hermine
Irene	Isaac	Ingrid	Ike	Ida	Igor
Jose	Joyce	Jerry	Josephine	Joaquin	Julia
Katrina	Kirk	Karen	Kyle	Kate	Karl
Lee	Leslie	Lorenzo	Laura	Larry	Lisa
Maria	Michael	Melissa	Marco	Mindy	Matthew
Nate	Nadine	Noel	Nana	Nicholas	Nicole
Ophelia	Oscar	Olga	Omar	Odette	Otto
Philippe	Patty	Pablo	Paloma	Peter	Paula
Rita	Rafael	Rebekah	Rene	Rose	Richard
Stan	Sandy	Sebastien	Sally	Sam	Shary
Tammy	Tony	Tanya	Teddy	Teresa	Tomas
Vince	Valerie	Van	Vicky	Victor	Virginie
Wilma	William	Wendy	Wilfred	Wanda	Walter

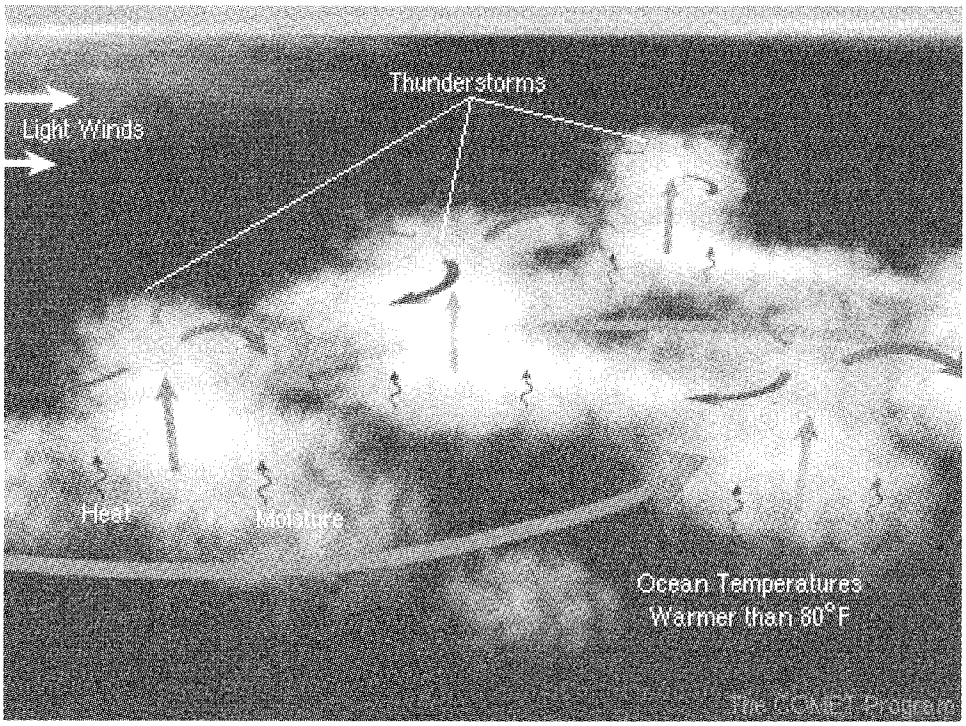
Origin and Life Cycle

The Birth of a Tropical Cyclone

Tropical cyclones form over warm waters from pre-existing disturbances. These disturbances typically emerge every three or four days from the coast of Africa as "tropical waves" that consist of areas of unsettled weather. Tropical cyclones can also form from the trailing ends of cold fronts and occasionally from upper-level lows.

The process by which a tropical cyclone forms and subsequently strengthens into a hurricane depends on at least three conditions shown in the figure below

1. **A pre-existing disturbance** with thunderstorms
2. **Warm (at least 80°F) ocean temperatures** to a depth of about 150 feet
3. **Light upper level winds** that do not change much in direction and speed throughout the depth of the atmosphere (low wind shear)



Heat and energy for the storm are gathered by the disturbance through contact with warm ocean waters. The winds near the ocean surface spiral into the disturbance's low pressure area. The warm ocean waters add moisture and heat to the air which rises. As the moisture condenses into drops, more heat is released, contributing additional energy to power the storm. Bands of thunderstorms form, and the storm's cloud tops rise higher into the atmosphere. If the winds at these high levels remain relatively light (little or no wind shear), the storm can remain intact and continue to strengthen.

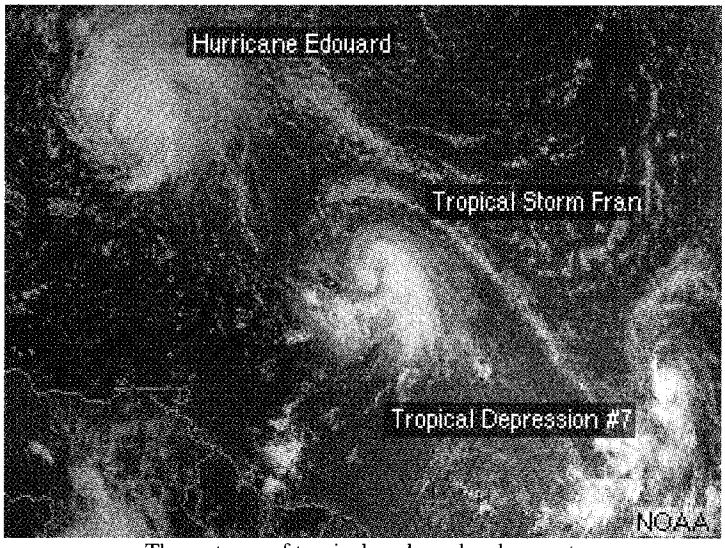
Origin and Life Cycle (cont.)

Stages of Hurricane Development

Growth and Maturity

In these early stages, the system appears on the satellite image as a relatively unorganized cluster of thunderstorms. If weather and ocean conditions continue to be favorable, the system can strengthen and become a **tropical depression** (winds less than 38 mph or 33 kt). At this point, the storm begins to take on the familiar spiral appearance due to the flow of the winds and the rotation of the earth.

If the storm continues to strengthen to **tropical storm** status (winds 39-73 mph, 34-63 kt), the bands of thunderstorms contribute additional heat and moisture to the storm. The storm becomes a **hurricane** when winds reach a minimum of 74 mph (64 kt). At this time, the cloud-free hurricane eye typically forms because rapidly sinking air at the center dries and warms the area.



Three stages of tropical cyclone development

During their life span, hurricanes can last for more than two weeks over the ocean and can travel up the entire Atlantic Coast.

The Storm's End

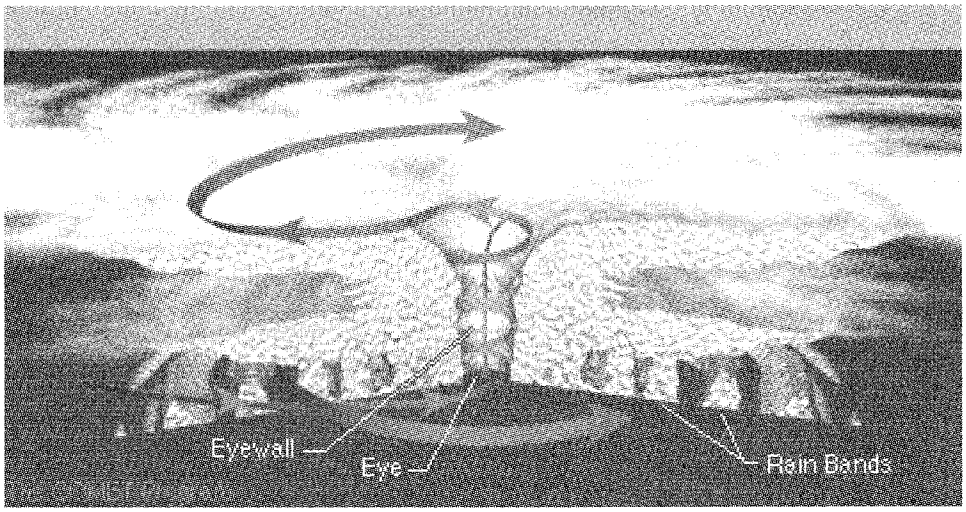
Just as many factors contribute to the birth of a hurricane, there are many reasons why a hurricane begins to decay. Wind shear can tear the hurricane apart. Moving over cooler water or drier areas can lead to weakening as well. Landfall typically shuts off the hurricane's main moisture source, and the surface circulation can be reduced by friction when it passes over land. Generally, **a weakening hurricane or tropical cyclone can reintensify if it moves into a more favorable region or interacts with mid-latitude frontal systems.**

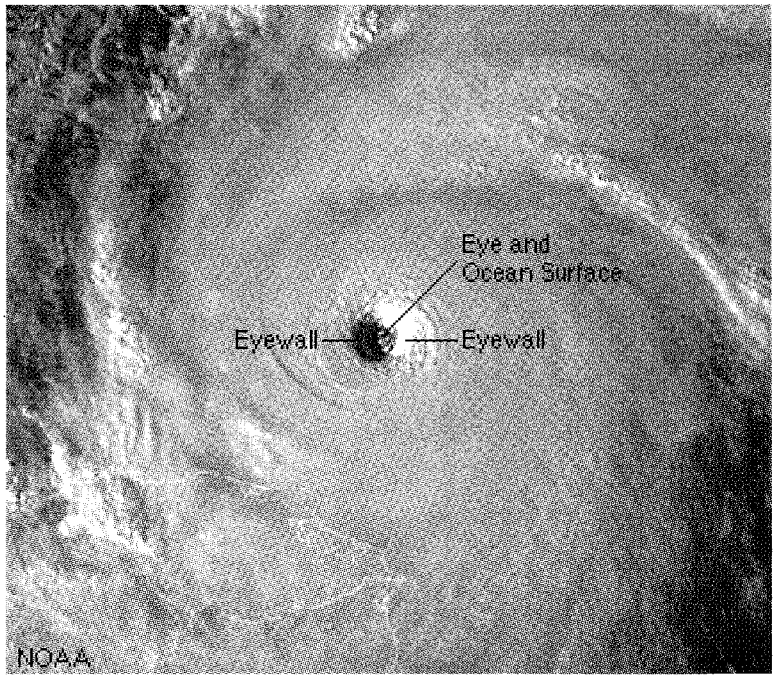
Structure

Contrary to how many weather maps appear, a hurricane is more than a point on a weather map, and its path is more than a line. **It is a large system that can affect a wide area, requiring that precautions be taken far from where the eye is predicted to come ashore.**

Hurricane Structure

The main parts of a hurricane are the rainbands on its outer edges, the eye, and the eyewall.
Air spirals in toward the center in a counter-clockwise pattern, and out the top in the opposite direction. In the very center of the storm, air sinks, forming the cloud-free eye.





Details of the hurricane eye's structure

The Eye

The hurricane's center is a relatively calm, clear area usually 20-40 miles across. People in the midst of a hurricane are often amazed at how the incredibly fierce winds and rain can suddenly stop and the sky clear when the eye comes over them. Then, just as quickly, the winds and rain begin again, but this time from the opposite direction.

Structure (cont.)

The Eyewall

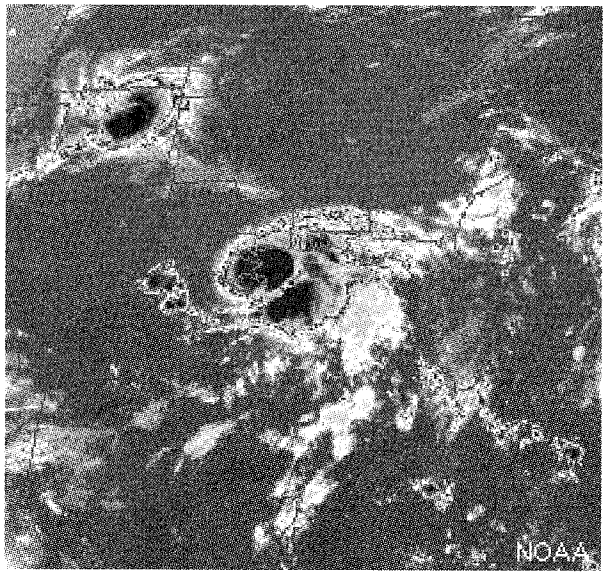
The dense wall of thunderstorms surrounding the eye has the strongest winds within the storm. Changes in the structure of the eye and eyewall can cause changes in the wind speed, which is an indicator of the storm's intensity. The eye can grow or shrink in size, and double (concentric) eyewalls can form.

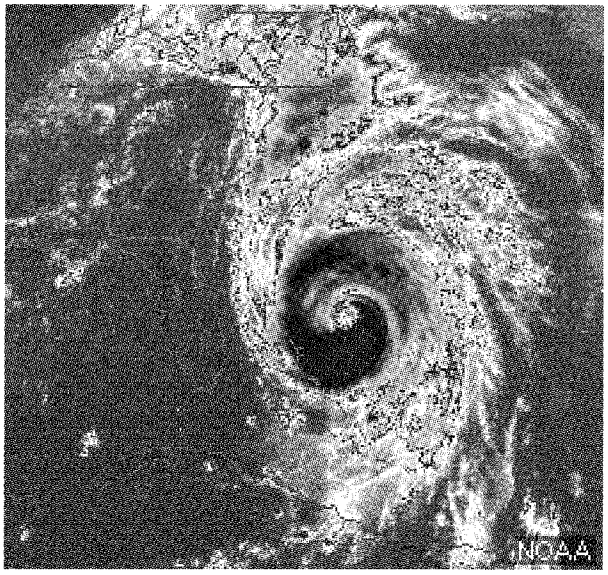
The Spiral Rainbands

The storm's outer rainbands (often with hurricane or tropical storm-force winds) can extend a few hundred miles from the center. Hurricane Andrew's (1992) rainbands reached only 100 miles out from the eye, while those in Hurricane Gilbert (1988) stretched over 500 miles. These dense bands of thunderstorms, which spiral slowly counterclockwise, range in width from a few miles to tens of miles and are 50 to 300 miles long. Sometimes the bands and the eye are obscured by higher level clouds, making it difficult for forecasters to use satellite imagery to monitor the storm.

Hurricane Size

Typical hurricanes are about 300 miles wide although they can vary considerably, as shown in the two enhanced satellite images below. Size is not necessarily an indication of hurricane intensity. Hurricane Andrew (1992), the most devastating hurricane of this century, was a relatively small hurricane.



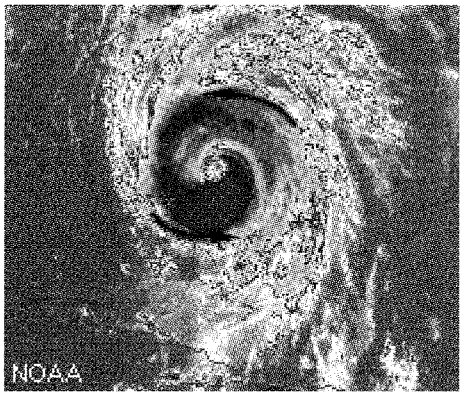


Hurricane Danny (left) in 1997 and Hurricane Fran in 1996 show the variability in hurricane size

Hurricane destructive winds and rains cover a wide swath. **Hurricane-force winds can extend outward to about 25 miles from the storm center of a small hurricane and to more than 150 miles for a large one. The area over which tropical storm-force winds occur is even greater** , ranging as far out as almost 300 miles from the eye of a large hurricane.

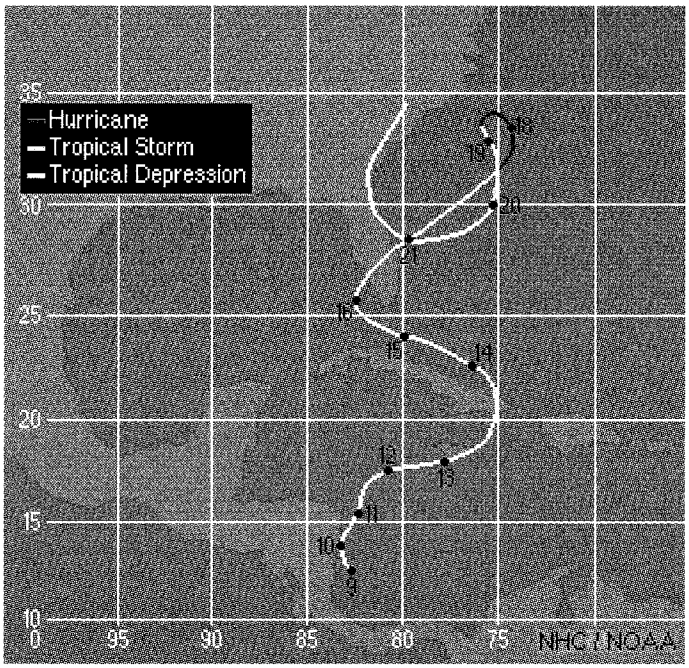
Structure (cont.)

Hurricane Circulation and Movement



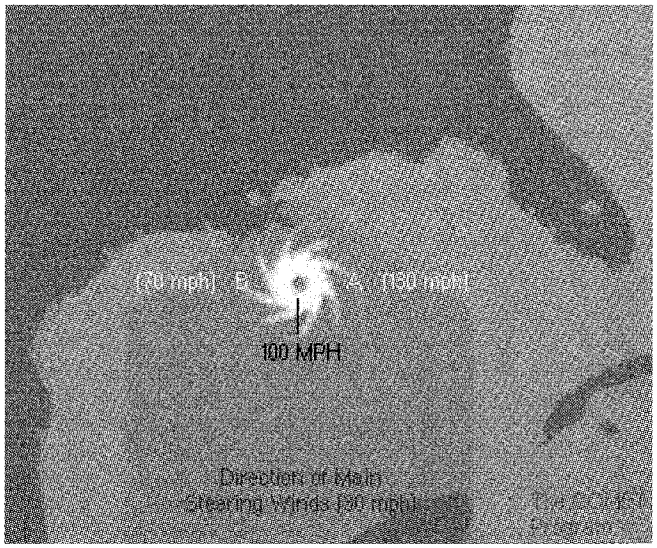
In the northern hemisphere, hurricane winds circulate around the center in a counter-clockwise fashion. This means that the wind direction at your location depends on where the hurricane's eye is. A boat on the northern edge of the orange area in Hurricane Fran would experience winds from the east, while a boat on the southern edge would have westerly winds.

A hurricane's speed and path depend on complex interactions between the storm with its own internal circulations and the earth's atmosphere. The air in which the hurricane is embedded is a constantly moving and changing "river" of air. Other features in that flow, such as high and low pressure systems, can greatly alter the speed and the path of the hurricane. In turn, it can modify the environment around the storm. Typically, a hurricane's forward speed averages around 15-20 mph. However, some hurricanes stall, often causing devastatingly heavy rain. Others can accelerate to more than 60 mph. Hurricane Hazel (1954) hit North Carolina on the morning of 15 October; fourteen hours later it reached Toronto, Canada where it caused 80 deaths. Some hurricanes follow a fairly straight course, while others loop and wobble along the path These seemingly erratic changes are difficult to forecast and will be discussed in more detail in the **Forecasting** section of this module.



Track of Hurricane Gordon, 1994

The Right Side of the Storm

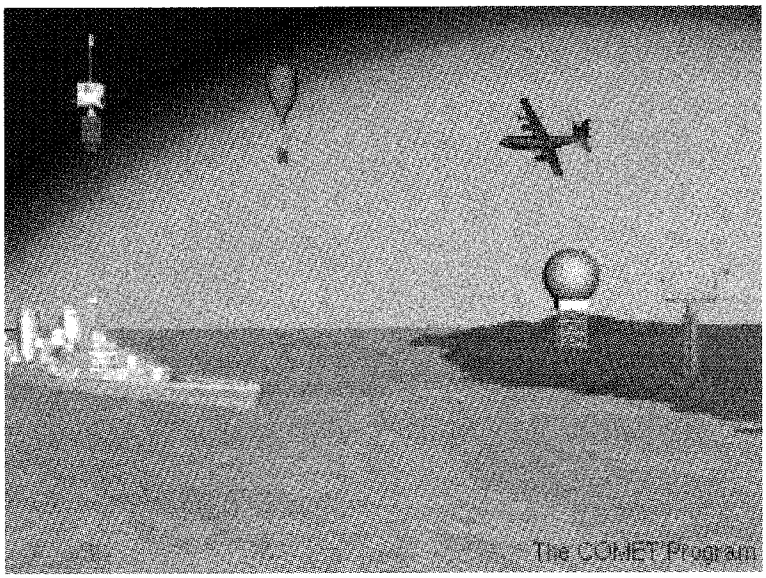


As a general rule of thumb, **the hurricane's right side (relative to the direction it is travelling) is the most dangerous part of the storm** because of the additive effect of the hurricane wind speed and speed of the larger atmospheric flow (the steering winds). The increased winds on the right side increase the storm surge. Tornadoes are also more common here.

Looking at the figure above, pretend you are standing behind the hurricane with your back to the steering flow. In this case, the right side is the eastern section of the hurricane. (If it were travelling east to west, the right side would be the north section.) The winds around the hurricane's eye are moving in a counterclockwise fashion. At Point A, the hurricane winds are nearly in line with the steering wind, adding to the strength of the winds. For example, if the steering currents are 30 mph and the average hurricane winds are 100 mph, the wind speed would be 130 mph at Point A. On the other hand, the winds at Point B are moving opposite those of the steering wind and therefore slow to 70 mph (100 - 30 mph). Incidentally, National Hurricane Center forecasts take this effect into account in their official wind estimates.

Observation

NOAA's National Weather Service (NWS) has several tools to monitor hurricanes. While they are still far out in the ocean, indirect measurements using satellites are the main tool, although ships and buoys also provide observations. Once the storms come closer to land, more direct measurements (reconnaissance aircraft, radiosondes, and Automated Surface Observing Stations) are also used. Within about 200 miles of the coast, radar provide important indirect measurements of the storm.

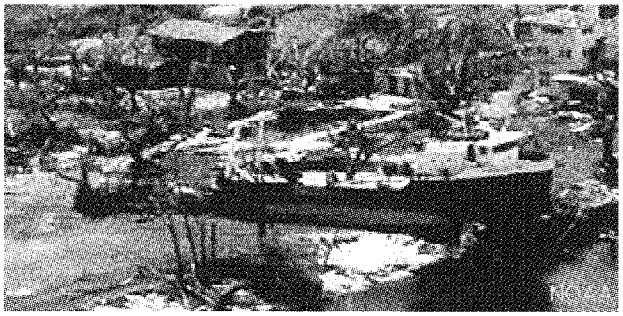


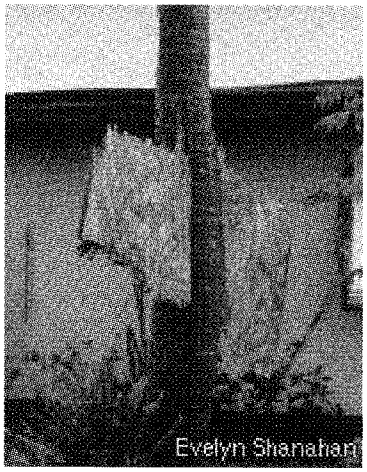
Computer models used to forecast storm intensity and movement require a great deal of data about the atmosphere. Lack of observations (especially over the ocean) and errors and inconsistencies in the data are major sources of forecast errors.

Hurricane Hazards

The main hazards associated with tropical cyclones and especially hurricanes are storm surge, high winds, heavy rain, and flooding, as well as tornadoes. The intensity of a hurricane is an indicator of damage potential. However, impacts are a function of where and when the storm strikes. Hurricane Diane (1955) hit the northeastern U.S. and caused 184 deaths. It was only a Category 1 hurricane but the thirteenth deadliest since 1900. Hurricane Agnes (1972), also a Category 1 hurricane, ranks fifth with damages estimated at 6.9 billion when adjusted for inflation[1].

A storm surge is a large dome of water, 50 to 100 miles wide, that sweeps across the coastline near where a hurricane makes landfall. It can be more than 15 feet deep at its peak. The surge of high water topped by waves is devastating. Along the coast, **storm surge is the greatest threat to life and property.**





Hurricane winds not only damage structures, but the barrage of debris they carry is quite dangerous to anyone unfortunate enough (or unwise enough!) to be caught out in them. **Damaging winds begin well before the hurricane eye makes landfall**.

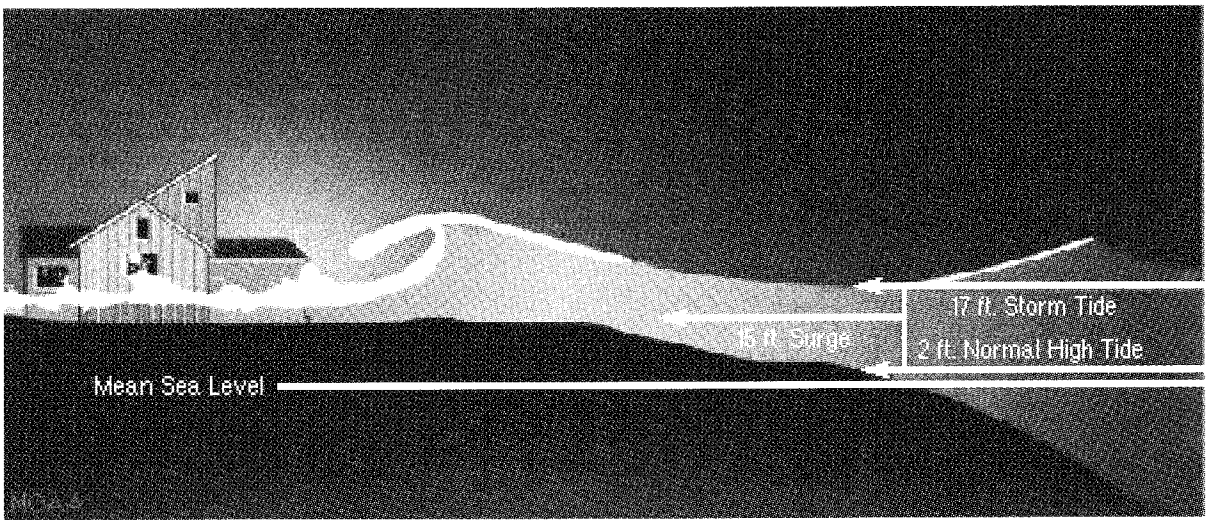
Tropical cyclones frequently produce huge amounts of rain, and flooding can be a significant problem, particularly for inland communities. **A typical hurricane brings at least 6 to 12 inches of rainfall** to the area it crosses. The resulting floods cause considerable damage and loss of life, especially in mountainous areas where heavy rains mean flash floods and can also result in devastating mudslides.

Tornadoes spawned by landfalling hurricanes can cause enormous destruction. As a hurricane moves shoreward, **tornadoes** often develop on the fringes of the storm.

These hazards can bring other consequences not directly related to the storm. For example, hurricane-related deaths and injuries are often the result of fires started by candles used when the electricity fails. Heart attacks and accidents frequently occur during the clean-up phase. And depending on the industrial facilities in your area, hurricane damage might cause chemical spills that could make the disaster even worse.

[1] *Hurricanes: Their Nature and Impact on Society* , (Pielke and Pielke, 1997, p. 125)

Hurricane Hazards Summary



Storm Surge

- Storm surge is the greatest potential threat to life and property associated with hurricanes.
- A storm surge is a large dome of water, 50 to 100 miles wide, that sweeps across the coastline near where a hurricane makes landfall. It can be more than 15 feet deep at its peak.
- The level of surge in a particular area is primarily related to the intensity of the hurricane and slope of the continental shelf.
- The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model is used by communities to evaluate storm surge threat from different categories of hurricanes striking from various directions.
- Because storm surge has the greatest potential to kill more people than any of the other hurricane hazards, it is wise to err on the conservative side by planning for a storm that is one category more intense than is forecast.

High Winds

- Typically, the more intense the storm (in terms of the Saffir-Simpson Hurricane Scale), the more wind damage a community will sustain, particularly if it does not have an effective mitigation program and has not prepared in advance for the storm.
- Tropical storm-force winds (39-73 mph) can also be dangerous, and it is wise to have evacuations completed before they reach your area.

Heavy Rains

- Hurricanes (and some tropical storms) typically produce widespread rainfall of 6 to 12 inches or more, often resulting in severe flooding.
- Inland flooding has been the primary cause of tropical cyclone-related fatalities over the past 30 years.
- Rains are generally heaviest with slower moving storms (less than 10 mph).
- The heaviest rain usually occurs to the right of the cyclone track in the period 6 hours before and 6 hours after landfall. However, storms can last for days, depending on what inland weather features they interact with.
- Large amounts of rain can occur more than 100 miles inland where flash floods and mudslides are typically the major threats.

Hurricane Hazards Summary (cont.)

Tornadoes

- Tornadoes are most likely to occur in the right-front quadrant of the hurricane. However, they are also often found elsewhere in the rainbands.
- Typically, the more intense a hurricane is, the greater the tornado threat.
- Tornado production can occur for days after landfall.
- Most tornadoes occur within 150 miles of the coast.
- The National Weather Service's Doppler radar systems can provide indications of tornados from a few minutes to about 30 minutes in advance. Consequently, preparedness is critical.

Saffir-Simpson Hurricane Scale*

Category	Definition—Likely Effects
ONE:	**Winds 74-95 mph:** No real damage to building structures, Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal road flooding and minor pier damage.
TWO:	**Winds 96-110 mph:** Some roofing material, door, and window damage to buildings. Considerable damage to vegetation, mobile homes, and piers. Small craft in unprotected anchorages break moorings.
THREE:	**Winds 111-130 mph:** Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures, Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
FOUR:	**Winds 131-155 mph:** More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Major damage to lower floors of structures near the shore Terrain may be flooded well inland.
FIVE:	**Winds greater than 155 mph:** Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Major damage to lower floors of all structures located near the shoreline. Massive evacuation of residential areas may be required.

*In operational use, the scale corresponds to the 1-minute average sustained wind speed as opposed to gusts which could be 20 percent higher or more.

Hurricane Forecasting

Over the past 20 years, improvements in hurricane computer modeling, observational instrumentation, and better training for forecasters have greatly increased forecast accuracy. New data systems give forecasters a greater understanding of tropical cyclones and provide better and more timely input for computer models used to predict hurricane behavior.

Despite these advances, the many complex interactions that occur within the atmosphere are not fully understood or adequately modeled, limiting the accuracy of forecasts. When all is said and done, hurricane forecasting is still a very difficult job.

The forecasting process that is the joint responsibility of NOAA's Tropical Prediction Center's National Hurricane Center (NHC) and the local Weather Forecast Offices (WFOs). The forecasting process contributes to a significant reduction in the number of deaths attributed to tropical cyclones and their related hazards.

Part of the mission of the National Weather Service (NWS) Tropical Prediction Center (TPC) is to save lives and protect property by issuing watches, warnings, forecasts, and analyses of hazardous weather conditions in the tropics.

The TPC is comprised of the National Hurricane Center (NHC), the Tropical Analysis and Forecast Branch (TAFB), and the Technical Support Branch (TSB). During hurricane season, the latter two provide support to the NHC.

A **Hurricane Liaison Team (HLT) is** activiated during hurricanes to provide a link between the NHC and emergency managers and decision makers.

The local NWS Weather Forecast Offices (WFOs) in hurricane-prone areas are also important participants in the forecast process.

The NHC and your local WFO have various roles in the forecast process that are closely coordinated.

In general, the NHC provides products that have a broad view of the hurricane and its potential impacts, while the local forecast office (the WFO) takes the information from NHC and tailors it to their specific locale, providing local emergency managers with additional information about the hazards expected in their area. The NHC issues hurricane advisories, watches and warinings. Information includes strike probability and wind speeds.

Observation
Observations are the basis for all forecast and warning products issued by the NHC. Quality, timeliness, and quantity of remote sensing observations are critical for accurate and timely forecasts and warnings.

Analysis
The various observations are checked for quality, analyzed, and put into a suite of computer models

Central Model Guidance/Interpretation
The computer models take in the observations and perform millions of calculations to generate predictions of hurricane behavior and the general conditions of the atmosphere in which the hurricane is embedded. The model results are packaged as guidance for the appropriate national centers and local offices and for evaluation and use in the NWS's forecast and warning process.

Coordination within the NWS
Model results are coordinated between the national centers and local forecast offices to provide consistency, which is critical during severe weather episodes.

Product Dissemination
Once the coordination and collaboration process reaches group consensus, the issuing offices generate forecast and warning products for release to the public.

Product Dissemination
Timely and reliable dissemination of forecasts and warnings is critical to the protection of life and property.

Coordination with Customers
The NHC and the local WFO work with customers to determine the level of satisfaction with the service provided and, in particular, whether the forecast and warning products issued were useful.

Local Level: The Weather Forecast Office (WFO)

All of the National Weather Service Forecast Offices are staffed 24 hours a day and produce:

- Watches and warnings for severe local storms, floods, flash floods, as well as local and zone public forecasts
- Local aviation forecasts, watches, and warnings
- Marine warnings and forecasts for coastal areas
- Hydrologic services such as support for flood and run-off forecasts

Offices affected by hurricanes analyze the products created by the NHC and fine tune them for their own locale in order to provide local officials with the necessary information to make timely and efficient decisions. The WFOs produce local weather statements to inform the public about current and anticipated storm effects in their area and to augment NHC advisories and releases. The local statements are highly specific and are designed to keep the media, local decision makers, and the public current on present and anticipated storm effects.

Local forecasters initiate or participate in inter-site coordination between NHC and other local WFOs to ensure forecast and warning consistency. Following product delivery, the local office coordinates with local officials, the media, and the emergency management community. These coordination calls focus on the pending weather threat and what implications the forecast or warning has for the local area. Following the storm, the local Warning Coordination Meteorologist evaluates the service with the forecast users.

Summary

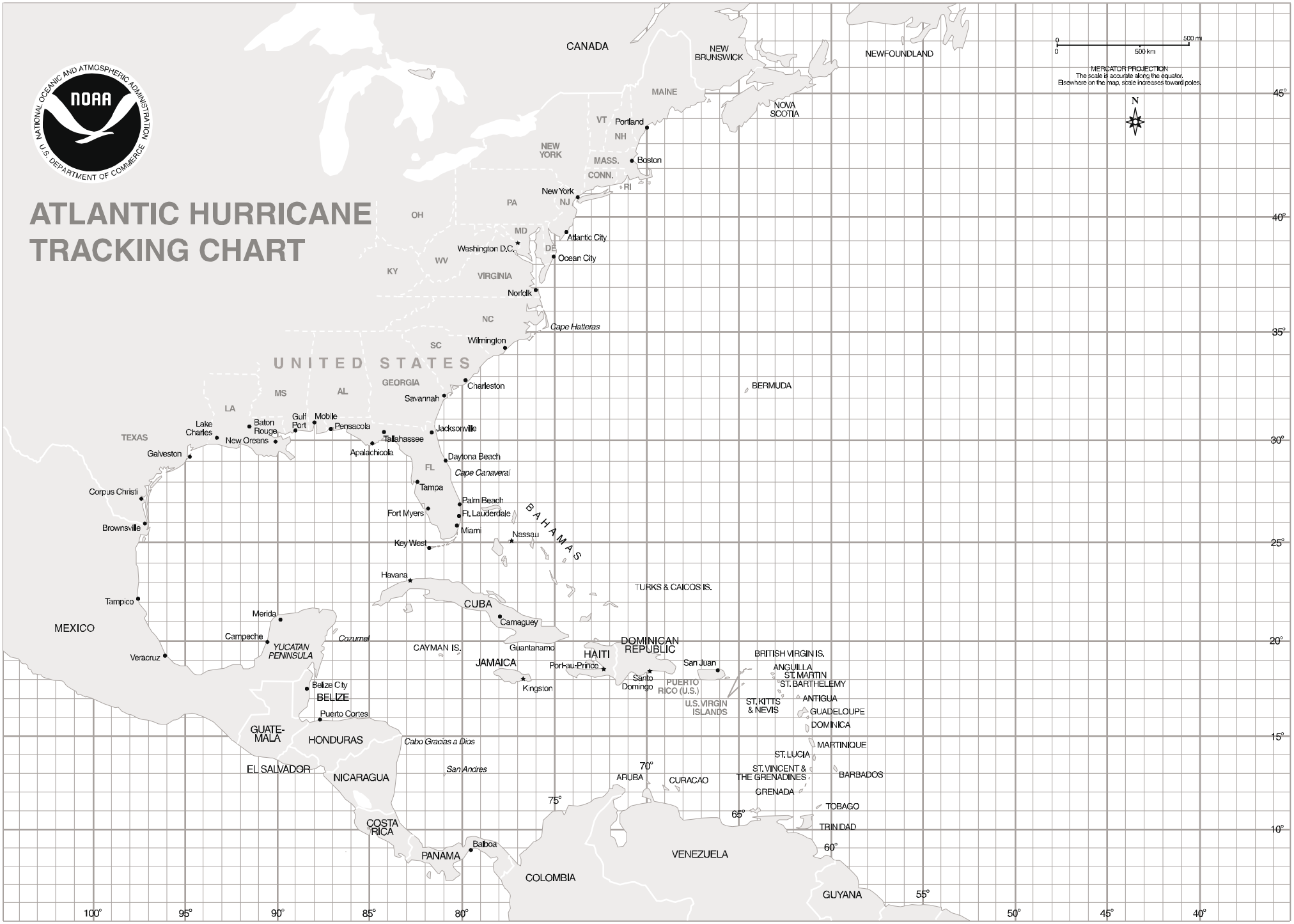
Who Produces Hurricane Forecasts

- NOAA's National Hurricane Center is responsible for providing information on the current status of the storm and future forecasts of its behavior.
- Local NOAA Weather Forecast Offices fine tune NHC status reports and forecasts for their particular area.

Forecast Information

- Tropical cyclone public advisories (issued every 6 hours) are intended for the general public in areas threatened by a tropical storm or hurricane.
- Intermediate public tropical cyclone advisories are issued every 3 hours once a watch or warning has been issued and every 2 hours once a reliable center appears on radar. Hourly radar position estimates are issued between the 2-hourly public advisories. They are similar to the 6-hour product.
- Tropical cyclone forecast/advisories (issued every 6 hours) are intended mainly for ships at sea and other marine interests, but also very useful to emergency managers because they contain wind field forecasts.
- Tropical cyclone discussions (issued every 6 hours) explain the rationale for the current forecast level of confidence.
- Tropical cyclone strike probability forecasts (issued every 6 hours) give the percentage chance that the center of a tropical cyclone will pass within 65 NM (75 mi) of specific locations within 72 hours.
- Hurricane local statements are issued by the local WFO to keep the media, local decision makers, and the public current on present and anticipated storm effects in their specific area. They include any actions declared by local emergency managers.
- Inland high wind watches and warnings are issued when hurricane-force winds are expected to occur beyond coastal areas.

ATLANTIC HURRICANE TRACKING CHART



Credits:

University Corporation for Atmospheric Research
National Oceanic and Atmospheric Administration (NOAA)
Federal Emergency Management Agency (FEMA)