Hurricane Information

The term *hurricane* is derived from the Spanish word *huracan*. The word *huracan* probably came from Hunraken, the Mayan storm god. The word was originally used to describe any localized tropical storm in the West Indies. It now classifies the powerful tropical cyclones that develop in the North Atlantic Ocean, the Gulf of Mexico, the Caribbean Sea, or the eastern North Pacific Ocean, east of the International Dateline and north of the equator.

Saffir-Simpson Scale

Hurricanes have sustained winds of at least 74 miles per hour. The winds in some hurricanes can become much stronger. Hurricanes are categorized on a scale of one to five based on the wind speed, barometric pressure, and their destructive potential. This is known as the Saffir-Simpson Scale, named after its originators, Herbert Saffir and Dr. Robert Simpson. Hurricanes occur in other parts of the world but are referred to by other names. In the western North Pacific Ocean, for example, they are known as typhoons.

Saffir-Simpson Hurricane Intensity Scale

Category	Central Pressure (mb)	Central Pressure (in)	Wind Speed (mph)	Storm Surge (ft)	Damage
1	>980	>28.94	74-95	4-5	minimal
2	965-979	28.50-28.91	96-110	6-8	moderate
3	945-964	27.91-28.47	111-130	9-12	extensive
4	920-944	27.17-27.88	131-155	13-18	extreme
5	<920	<27.17	>155	>18	catastrophic

Saffir/Simpson Hurricane Damage Potential

Category One — **Winds 74-95 mph**

No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. No substantial damage to other structures; some damage to poorly constructed signs. Low-lying coastal roads flooded. Minor damage to piers. Small boats in open docks torn from moorings.

Category Two — **Winds 96-110 mph**

Considerable damage to shrubbery, tree foliage and some trees blown down. Mobile homes experience major damage. Extensive damage to poorly constructed signs with some damage to windows, doors, and roofing materials of buildings. No major destruction to buildings. Coastal roads and low-lying escape routes to inland areas cut off by rising water about two to four hours before landfall. Considerable damage to piers and marinas flooded. Small boats in protected docks torn from moorings. Evacuation of some coastline residences and low-lying areas required.

Category Three — **Winds 111-130 mph**

Leaves torn from trees and large trees blown down. Poorly constructed signs blown down. Some damage to roofing, windows, and doors. Small buildings experience damage. Mobile homes destroyed. The coast experiences major flooding. Many small structures near the coast destroyed. Battering waves and floating debris damage larger buildings near the beach. Major damage to piers. Low-lying inland roads cut off by rising water about three to five hours before landfall. Flat land, five feet or less above sea level, flooded eight or more miles inland. Evacuation of homes and people in low-lying areas within several blocks of the beach may be required.

Category Four — **Winds 131-155 mph**

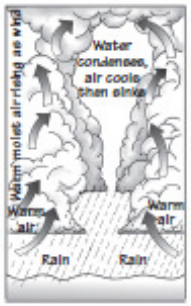
Shrubs and trees experience extensive damage. Almost all signs within five miles of the beach blown down. Roofs, windows, and doors of buildings receive extensive damage. Roofs on many smaller residences blow off. Mobile homes will be demolished. Flat land, ten feet or less above sea level, flooded inland as far as six miles. Buildings near the shore experience flooding and battering by waves and floating debris resulting in major damage to lower floors. Almost total destruction to piers. Low-lying evacuation routes inland cut off by rising water about three to five hours before landfall. Major erosion of beaches. Massive evacuation of all residences within 500 yards of the coast may be required. All single story residences in low ground with two miles of the coast under mandatory evacuation.

Category Five — **Winds greater than 155 mph**

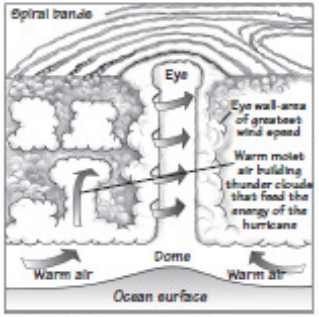
Almost all trees and shrubs totally destroyed within ten miles of the beach. All signs blown down within ten miles. Roofs experience considerable damage on all types of buildings. Roofs of many residences and industrial buildings blown off. Buildings experience extensive damage to windows and doors within ten miles of the coast. Siding torn from the sides of buildings. Glass in windows and doors experience shattering. Many buildings destroyed. Small buildings overturned or blown away. Mobile homes demolished. Major damage and destruction to all structures less than 15 feet above sea level within 1500 feet of the beach. All piers totally destroyed and washed away. Low-lying evacuation routes inland cut off by rising water about three to five hours before landfall. Major erosion of beaches. Massive evacuation of residential areas on low ground five to ten miles of the beach required.

Life Cycle of Hurricanes

Meteorologists do not know exactly why a hurricane forms. They know that warm moist air is set in motion and begins to rise rapidly over an area of low pressure over warm ocean waters. A low-pressure area begins to move to an area of high pressure. As the low-pressure area begins to move the air, it picks up moisture. This warm moist air is lifted upward. As the air rises it cools then begins to sink. The cooling causes moisture to condense into tiny droplets of water that form clouds.



As the moist air condenses, it gives off heat. This heat energy powers the growing hurricane. The low-pressure system acts like a chimney, the warm air is drawn in at the base and it rises in a spiral as it moves up the eye. It moves in a spiral as a result of the Earth's rotation. The eye is the central part of the storm and it is where the air pressure is the lowest. An eye can be up to 20 miles in diameter. It is one of the most unique features of a hurricane. It is best described as a column that reaches from the base of the storm up to the very top. The winds in the eye are relatively calm and the air is often clear and the sky is blue with sunshine. When the air reaches the top of the column, it cools and spreads out. When air moves up in the eye, more warm moist air is drawn in at the base and the storm strengthens. When high winds begin to develop as a result of this air movement, the pressure falls within the eye and the storm intensifies.



A typical hurricane's life cycle passes through four distinct stages: tropical disturbance, tropical depression, tropical storm, and finally, a hurricane. All are classified as *tropical cyclones*.

Tropical Disturbance

A tropical disturbance is a system of clouds, showers, and thunderstorms that originates in the tropics and maintains its identity for 24 hours or more. Tropical waves are a type of tropical disturbance. They are areas of low pressure that move generally from east to west, imbedded in the tropical easterlies. They are also called easterly waves.

Tropical Depression

When a tropical disturbance develops a closed circulation (counterclockwise winds) blowing around a center of low pressure in the Northern Hemisphere, it is called a tropical depression. Tropical depressions contain maximum sustained winds of 38 miles per hour or less on the surface.

Tropical Storm

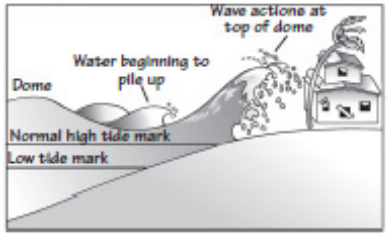
A system is given a name by the National Hurricane Center once it reaches tropical storm status. Tropical storms contain maximum sustained winds of 39 to 73 miles per hour.

Hurricanes

A storm is classified as a hurricane once its wind field has sustained winds of greater than 73 miles per hour. One of the unique features of a hurricane is its eye. The eye wall surrounds the relatively calm eye. It is in the eye wall region where you find the most violent wind and rain. The central pressure of a hurricane is measured in the eye.

The Storm Surge

The storm surge is the most devastating part of a hurricane. It is the cause of the most damage and 90 percent of all hurricane-related deaths. A surge is a bulge 40 to 50 miles long in the ocean that builds under the hurricane. The low air pressure causes the ocean water to rise and form a dome. When the surge reaches the shallower water near the shore, it is slowed down. It rises higher because the water behind pushes it and it piles up. The normal wave action of the ocean is transferred to the top of the storm surge. This wall of water is pushed on shore. One of the most devastating losses of life as a direct result of a storm surge was in the delta region of Bangladesh on November 13, 1970. The storm made landfall near the time of high tide. The official death toll was 200,000 people. Unofficial estimates ran as high as 500,000. Obviously the time of landfall of a hurricane is watched closely. If a hurricane arrives at the time of low tide, the surge will be less. If it arrives at the time of high tide, the damage from the surge is often greatly magnified.



WHERE'S THE HURRICANE? — A TRACKING ACTIVITY

Task

Your job as the head meteorologist is to plot the progress of a hurricane, predict the storm's path, and issue watches and warnings as necessary.

Materials

Hurricane Tracking Map, pencil, ruler, compass

Background

A hurricane has been spotted in the Atlantic Ocean. Every 12 hours, between 7:00 AM and 7:00 PM, you will receive information on the location of the eye of the hurricane and be asked to give the proper warnings to the areas that may be affected.

You must issue a hurricane warning at least 12 hours before the hurricane hits so that people have time to evacuate the area. Remember, however, that it is dangerous to evacuate an area at night; too many accidents can occur, and people might panic. It is also important to know that evacuations and damage prevention costs money so you don't want to give it too early.

Each time you get a location of the hurricane eye, plot its position on the map using the appropriate symbol. The hurricane, however, is much larger than the eye. Therefore, use the compass to draw a circle around the eye with a radius of 75 km. (Hint: use the scale.) All areas encompassed by the circle will experience strong winds and heavy precipitation.

Tracking Information

A. 7:00 PM, May 1–hurricane centered at 25°N latitude and 62°W longitude:
   1. Map the location/position on the tracking map. Be sure to add the "hurricane circle".
   2. Add a compass rose in the upper right-hand corner in the clear space.
   3. Give the new hurricane a name:
   4. Will you issue any warnings? Why?

B. 7:00 AM, May 2–hurricane centered at 23°N and 67°W:
   5. In which compass direction is the hurricane heading?
   6. How far has it traveled in the last 12 hours?
   7. You can assume it will continue traveling at the same speed. Where will it be in 12 hours?
   8. Will you issue any warnings, and if so, for what areas?

C. 7:00 PM, May 2–hurricane now centered at 26°N and 71°W:
   9. In which compass direction is the hurricane moving now?
   10. Should you give any warnings to any area?…if so, what areas?
   11. Has the hurricane speed remained fairly constant?

D. 7:00 AM, May 3–hurricane centered at 27°N and 76°W:
   12. What areas will be affected?
   13. Should you give any warnings now?
   14. Can you wait until the next reading to give out the warnings? Why?

E. 7:00 PM, May 3–hurricane centered at 28°N and 80°W:
   15. In what compass direction do you think the hurricane will continue?
   16. Will the hurricane continue as it has been or turn and follow the coastline?
   17. How can you make an intelligent guess as to where it may go?
   18. Should you issue any new warnings? Where?

F. 7:00 AM, May 4–hurricane centered at 32°N and 81°W:
   19. Which compass direction did the hurricane take?
   20. Were the people in the affected areas warned in time to get out?
   21. Who will receive your next warning?

G. 7:00 PM, May 4–hurricane centered at 35°N and 77°W:
   22. Was your last warning correct? Explain.

What additional information would you like to have to make it possible to predict the hurricane's <u>path</u> more accurately?

Hurricane Tracking Map