

Hurricane Glossary

Southeast Coastal Ocean Observing Regional Association

Definitions selected & adapted from weather.com

Atmospheric Pressure: The pressure exerted by the atmosphere at a given point. Its measurement can be expressed in several ways, including millibars and inches of mercury (Hg). Average sea level pressure is 1013.25 millibars or 29.92 inches of mercury. *A drop in atmospheric pressure usually indicates the approach of a storm, such as a hurricane.*

Barometric Pressure: The pressure exerted by the atmosphere at a given point (as measured by a barometer). It can be measured in millibars or inches of mercury, among others. *Watching a barometer for a drop in atmospheric pressure helps forecasters determine when a hurricane is approaching.*

Beaufort Wind Scale: A system for estimating and reporting wind speeds. It is based on the visible effects of wind upon land objects (such as vegetation) and/or sea surface conditions such as white caps and foam. The scale was devised by Sir Francis Beaufort (1777-1857), hydrographer to the British Royal Navy.

Blocking High: A high pressure system that is warm aloft and cold at the surface. Such a high will move very slowly, tending to move westward during intensification and eastward during dissipation. It prevents the movement of cyclones across its latitudes by causing a split in westerly winds. *A hurricane may be steered toward or away from land by a blocking high.*

Calm: Atmospheric conditions without significant wind or rain. In oceanic terms, it includes the apparent absence of motion of the water surface when there is no wind or swell. *Conditions are calm in the eye of a hurricane.*

Central Pressure: The atmospheric pressure at the center of a high or low. It is the highest pressure in a high and the lowest pressure in a low, referring to the sea level pressure of the system. *In a hurricane, a lower central pressure create a stronger gradient from outside to inside the*

system. The stronger this pressure gradient is, the greater the maximum wind speeds around the eye wall.

Convection: In weather processes, there is circulation of fluid (air) that serves to equalize temperatures. An example is air flow between ocean and land during day and during night. *Hurricanes use warm ocean waters for convection, often allowing for an increase in strength. Warmer water allows for an increase in storm strength.*

Convergence: The net flow of a fluid into a given region. In a cyclone, it refers to wind movement resulting in horizontal inflow of air toward a low pressure center. Wind movement that results in a horizontal inflow of air into a particular region, such as toward the low pressure center of a hurricane. Convergent winds at lower levels are cause upward motion. *In a hurricane, convergent air rises and fuels storm strength by carrying warm air upward through the storm.*

Coriolis effect: A force per unit mass that arises solely from the earth's rotation, acting to deflect fluid parcels that are in motion. The Coriolis Effect is dependent on the latitude and the speed of the moving object. The Coriolis effect is stronger at higher latitudes and is equal to zero at the equator. Hurricanes can't cross the equator because a steadily decreasing Coriolis effect will stop the storm from spinning. In the Northern Hemisphere, Coriolis' deflecting force causes air and water to deflect to the right of its path, while in the Southern Hemisphere they are deflected to the left of their path. *This is the effect that causes a hurricane to rotate counter-clockwise (or have cyclonic motion.) Ocean currents in the Northern Hemisphere such as the Gulf Stream are deflected to the right as well.*

Cyclogenesis: The process that creates a new low pressure system or cyclone, or intensifies a pre-existing one. It is also the first appearance of a trough. *Hurricanes undergo this as they develop from a disturbance to a hurricane (as they "become" a cyclone).*

Data Buoys: Instrumented buoys placed throughout the Gulf of Mexico and along the Atlantic and Pacific coasts of the United States that collect and relay data or information on air and water temperature, wind speed, air

pressure, and wave conditions through several media. *For hurricanes, these buoys are used to gather information to help predict hurricane strengthening or weakening and direction of movement.*

Disturbance: An area in the atmosphere exhibiting signs of potential cyclone development.

Dropsonde: A weather reconnaissance device designed to be dropped from an airplane. The dropsonde includes meteorological instruments and a parachute. A vertical profile of the atmosphere is returned to meteorologist's computers as the dropsonde collects the data. *These are used by hurricane hunter aircrafts to obtain the minimum central pressure in the eye of the hurricane, and conditions throughout the storm.*

Easterly wave: A wave-like disturbance (trough) in the tropical region that moves from east to west, affecting patterns of wind and rain. The presence of a disturbance like this indicates atmospheric instability. *It is often associated with tropical cyclone development.*

Eye: The center of a tropical storm or hurricane, with a roughly circular area of light winds and rain-free skies. An eye will usually develop when the maximum sustained wind speeds exceed 78 mph. It can range in size from 5 miles to 60 miles in diameter, but the average size is 20 miles. *When the eye begins to shrink in size, the storm is usually intensifying. Highly organized storms have a smaller eye which indicates greater intensity. Inside the eye of a hurricane, there is no rain and winds are light.*

Eyewall: An organized band of storms surrounding the eye, or center, of a tropical cyclone. An eyewall contains cumulonimbus clouds, intense rainfall and very strong winds. *This is the most intense part of the hurricane, containing maximum wind speeds, heavy hail, and the heaviest rainfall.*

Fetch: The area over which the wind blows steadily. The greater the fetch, the greater the wave height. *In a hurricane, fetch, wind speed, and wind direction associated with the storm will determine the storm surge as the storm moves landward.*

Forward velocity: The speed at which a hurricane moves along its path. *Slow-moving hurricanes (those with a low forward velocity) provide more opportunity for people to prepare.*

Gale: On the Beaufort Wind Scale, defined as winds with speeds from 28 to 55 knots (32 to 63 miles per hour). *"Gale force winds" are often associated with the outer portion hurricanes.*

Gulf Stream: The warm, swift, relatively narrow ocean current that flows from south to north off the southeast Atlantic coast of the United States. *The warm waters of the Gulf Stream often feed hurricanes by providing warm water that might be patchy elsewhere.*

Gust: A sudden significant increase in or rapid fluctuations of wind speed. Peak wind speed must reach at least 16 knots (18 miles per hour); the duration is usually less than twenty seconds. *Hurricane gusts have speeds 10mph or greater faster than a hurricane's sustained wind speed.*

Hurricane: The name for a tropical cyclone with sustained winds of 74 miles per hour (65 knots) or greater in the North Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and in the eastern North Pacific Ocean. *Tropical cyclones are known as typhoons in the western Pacific and cyclones in the Indian Ocean.*

Hurricane Warning : A formal advisory issued by forecasters at the National Hurricane Center when they have determined that hurricane conditions are expected in a coastal area or group of islands within a 24 hour period. A warning is used to inform the public and marine interests of the storm's location, intensity, and movement.

Hurricane Watch: A formal advisory issued by forecasters at the National Hurricane Center when they have determined that hurricane conditions are a potential threat to a coastal area or group of islands within a 24 to 36 hour period. A watch is used to inform the public and marine interests of the storm's location, intensity, and movement.

Isobars: A line drawn on a weather map connecting points of equal pressure. *Isobars take the shape of concentric circles around a hurricane or any "closed" low pressure system.*

Knot: A nautical unit of speed equal to the velocity at which one nautical mile is traveled in one hour. Used primarily by marine interests and in weather observations. A knot is equivalent to 1.151 statute miles per hour or 1.852 kilometers per hour.

Latent heat: The energy released or absorbed during a change of state, for example, in changing from a liquid to a gas. *In a hurricane, latent heat comes from warm ocean water that is turned to steam providing energy to the storm. This is one ingredient needed to form & strengthen a hurricane.*

Latitude: The location north or south in reference to the equator, which is designated at 0 degrees. Lines of latitude on a map or globe are parallel lines that circle the globe both north and south of the equator. The poles are at 90 degrees North and South latitude.

Low Latitudes: Latitudes between 30 and 0 degrees North and South of the equator. Also referred to as the tropical or torrid region. *Most hurricanes develop at low latitudes (where waters are warmest).*

Low Pressure System: An area of a relative pressure minimum that has converging winds and rotates in the same direction as the earth. This is counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. Also known as a cyclone, it is the opposite of an area of high pressure (anticyclone).

Maximum sustained winds: This describes the hurricanes' steady winds. Unlike hurricane gusts, maximum sustained winds must last over twenty seconds continuously. *This determines the category of the hurricane on the Saffir-Simpson Scale.*

Millibar (MB): The standard unit of measurement for atmospheric pressure used by the National Weather Service. One millibar is equivalent to 100 newtons per square meter or .029 inches of Mercury. Standard surface pressure is 1013.2 millibars.

Nautical Mile: A unit of length used in marine navigation that is equal to one minute of arc of a great circle on a sphere. One international nautical mile is equivalent to 1,852 meters or 1.151 statute miles.

Saffir-Simpson Scale: *This scale classifies hurricanes based on their intensity, and is used to predict how damaging the hurricane will be to property. Saffir-Simpson classifies hurricanes from a scale of 1 (minimal) to 5 (catastrophic.)*

This scale was developed in the early 1970s by Herbert Saffir, a consulting engineer in Coral Gables, Florida, and Dr. Robert Simpson, then Director of the National Hurricane Center. The scale is based primarily on wind speeds and includes estimates of barometric pressure and storm surge associated with each of the five categories.

| Category | Central Pressure | Winds | Surge |
|-------------------|------------------------------------|----------------------------------|----------------------|
| 1 -- Minimal | greater than 980 mb or 28.94 in | 74 to 95 mph or 64 to 83 kts | 4 to 5 feet |
| 2 -- Moderate | 965 to 979 mb or 28.50 to 28.91 in | 96 to 110 mph or 65 to 96 kts | 6 to 8 feet |
| 3 -- Extensive | 945 to 964 mb or 27.91 to 28.47 in | 111 to 130 mph or 97 to 113 kts | 9 to 12 feet |
| 4 -- Extreme | 920 to 944 mb or 27.17 to 27.88 in | 131 to 155 mph or 114 to 135 kts | 13 to 18 feet |
| 5 -- Catastrophic | less than 920 mb or 27.17 in | greater than 155 mph or 135 kts | greater than 18 feet |

Category 1 [Minimal]

- Damage primarily restricted to shrubbery, trees, and unanchored mobile homes; no substantial damage to other structures; some damage to poorly constructed signs
- Low lying roads inundated; minor damage to piers; small craft in exposed anchorages torn from moorings

Category 2 [Moderate]

- Considerable damage to shrubbery and tree foliage, some trees blown down; major damage to exposed mobile homes; extensive damage to poorly constructed signs and some damage to windows, doors and roofing materials of buildings, but no major destruction to buildings
- Coastal roads and low lying escape routes inland cut off by rising water about 2 to 4 hours before landfall; considerable damage to piers and marinas flooded; small craft in protected anchorage torn from moorings
- Evacuation of some shoreline residences and low lying areas required

Category 3 [Extensive]

- Foliage torn from trees; large trees blown down; poorly constructed signs blown down; some damage to roofing, windows, and doors; some structural damage to small buildings; mobile homes destroyed.
- Serious flooding along the coast; many small structures near the coast destroyed; larger coastal structures damaged by battering waves and floating debris
- Low lying escape routes inland cut off by rising water about 3 to 5 hours before landfall; flat terrain 5 feet or less above sea level flooded up to 8 or more miles inland
- Evacuation of low lying residences within several blocks of shoreline may be required

Category 4 [Extreme]

- Shrubs, trees, and all signs blown down; extensive damage to roofs, windows, and doors, with complete failure of roofs on many smaller residences; mobile homes demolished

- Flat terrain 10 feet or less above sea level flooded inland as far as 6 miles; flooding and battering by waves and floating debris cause major damage to lower floors of structures near the shore; low lying escape routes inland cut off by rising water about 3 to 5 hours before landfall; major erosion of beaches
- Massive evacuation of all residences within 500 yards of the shore may be required, as well as of single story residences in low ground with 2 miles of the shore

Category 5 [Catastrophic]

- Trees, shrub, and all signs blown down; considerable damage to roofs of buildings, with very severe and extensive damage to winds and doors; complete failure on many roofs of residences and industrial buildings; extensive shattering of glass in windows and doors; complete buildings destroyed; small building overturned or blown away; mobile homes demolished
- Major damage to lower floors of all structures less than 15 feet above sea level within 1500 feet of the shore
- Low lying escape routes inland cut off by rising water about 3 to 5 hours before landfall; major erosion of beaches
- Massive evacuation of residential areas on low ground within 5 to 10 miles of the shore may be required

Some famous hurricanes and their landfall Saffir-Simpson categories:

- Floyd, Category 2 (September 1999)
- Jeanne, Category 3 (September 2004)
- Opal, Category 3 (October 1995)
- Fran, Category 3 (August 1996)
- Katrina, Category 5 (September 2005)
- Hugo, Category 5 (September 1989)

Storm surge: The increase in sea water height from the level that would occur under calm conditions. It is estimated by subtracting the normal tide from the recorded water level of the storm. *Although the largest storm surges are associated with hurricanes, smaller low pressure systems and*

winds associated with fronts can cause an increase in the sea level if wind and fetch are cooperating. It is estimated by subtracting the normal astronomic tide from the observed storm tide.

Subtropical: The region between the tropical and temperate regions, an area between 35° and 40° North and South latitudes. This is generally an area of semi-permanent high pressure.

Subtropical waters: Also known as the semi-tropics, subtropical waters are in the region between the tropics (23.5 degrees north and south of the equator) and approximately 35 degrees latitude.

Swell: Ocean waves that have traveled out of the area where they were generated. Swell characteristically exhibits a more regular and longer period and has flatter wave crests than waves within their fetch. *The swell generated by hurricanes that are offshore can cause big waves at the coast and set up dangerous rip currents.*

Thunderstorm: Produced by a cumulonimbus cloud, it is a microscale event of relatively short duration characterized by thunder, lightning, gusty surface winds, turbulence, precipitation (including hail in larger systems), moderate to extreme up and downdrafts, and under the most severe conditions, tornadoes.

Tornado: A violently rotating column of air in contact with and extending between a convective cloud and the surface of the earth. It is the most destructive of all storm-scale atmospheric phenomena. They can occur anywhere in the world given the right conditions, but are most frequent in the United States in an area bounded by the Rockies on the west and the Appalachians in the east. *Waterspouts are tornadoes that form over water.*

Tropical Cyclone: A warm-core low pressure system which develops over tropical, and sometimes subtropical, waters and has an organized circulation. Depending on sustained surface winds, the system is classified as a (1) tropical disturbance, (2) a tropical depression, (3) a tropical storm, or (4) a hurricane or typhoon.

Tropical Depression: A tropical cyclone in which the maximum sustained surface winds are 38 miles per hour (33 knots) or less. Characteristically having one or more closed isobars, it may form slowly from a tropical disturbance or an easterly wave which has continued to organize. *This is two stages before hurricane.*

Tropical Storm: A tropical cyclone in which the maximum sustained surface winds are from 39 miles per hour (34 knots) to 73 miles per hour (63 knots). Once a tropical wave has become a tropical storm, it is given a name to identify and track it. *This is one stage before hurricane.*

Tropical waters: Ocean waters within 23 degrees latitude of the equator. In the western Atlantic, these waters are warm year-round. When a hurricane is moving through these waters, it is considered a tropical cyclone.

Wind Direction: The direction from which the wind is blowing. For example, an easterly wind blows from the east, not toward the east. It is reported with reference to true north, or 360 degrees on the compass, and expressed to the nearest 10 degrees, or to one of the 16 points of the compass (N, NE, WNW, etc.).

Wind Shear: The rate of change of wind speed or direction with distance. Vertical wind shear is rate of change of the wind with respect to altitude. Horizontal wind shear is the rate of change on a horizontal plane. *In a hurricane, vertical wind shear can cause significant weakening of the system.*

Wind Shift: The term applied to a change in wind direction of 45 degrees or more, which takes place in less than 15 minutes. It may the result of a frontal passage, sea breezes, or thunderstorms. And in some instances, the change may be gradual or abrupt.

Wind Speed: The rate of the motion of the air per unit of time. It can be measured with several types of instruments such as an anemometer, and may be reported using different units including knots (nautical miles per hour), miles per hour, or meters per second.