

Hurricane alert

Warming Oceans Are Fueling Stronger Hurricanes

What is a Hurricane?

A hurricane is an intense, rotating storm weather system that forms over the North Atlantic Ocean or over the North-eastern Pacific Ocean. If wind speeds exceed 63 km/h, the system is deemed a tropical storm and assigned a name (generally speaking a given name, alternately male and female, taken from a predetermined alphabetical list). When the **wind speed exceeds 119 km/h it is called a hurricane**. In other parts of the world such a storm is known as "**typhoon**" or "**tropical cyclone**".

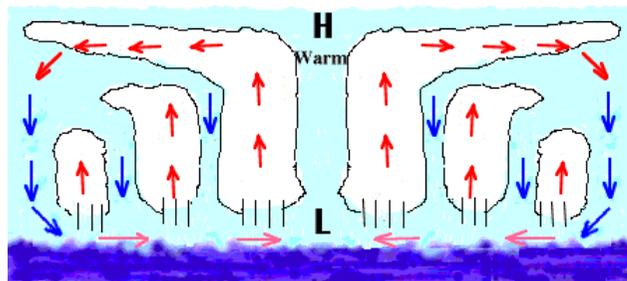
The winds of a hurricane swirl around a calm central zone called the eye surrounded by a band of tall, dark clouds called the eyewall. The **eye is usually 16 to 64 km** in diameter and is free of rain and large clouds. In the eyewall, large changes in pressure create the hurricane's strongest winds. These **winds can reach nearly 320 km/h**. Hurricanes are typically **about 500 km in diameter and can reach to height of 15 km** into the sky.



Source: [BBC News](#)

Hurricane conditions

A tropical storm cannot spontaneously generate, but a weak low-pressure system is needed. In addition, the sea surface temperature must be **greater than 26.5 °C**.



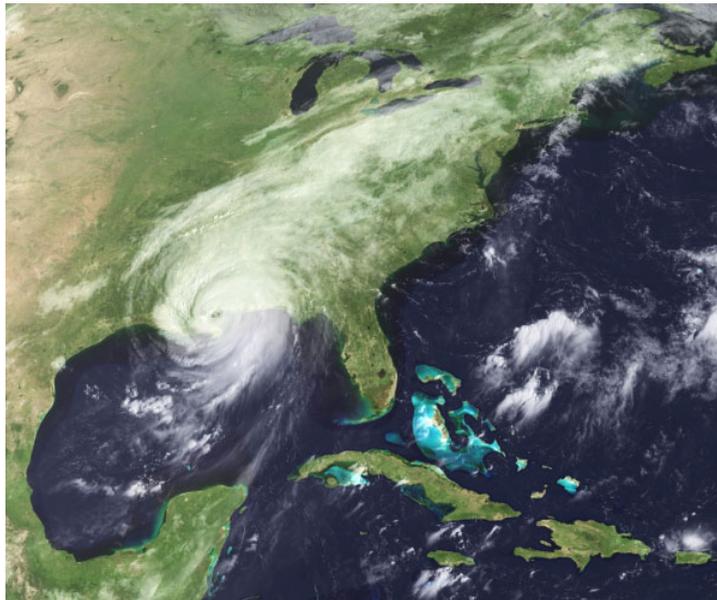
Source

The warm water heats the air above it. By taking up the moisture supplied by evaporation from the ocean, the air starts rising rapidly. This movement of air creates a vacuum near the surface. Higher up the air cools and vapour condenses, forming large rain-generating clouds and releasing energy used for the formation of the storm.

The heavier cooled air descends toward the ocean where it is heated, becomes lighter and takes up moisture again, thus perpetuating the cycle. The winds start moving in a spiral pattern around the depression, and form that way the eye of the cyclone. The higher the initial water temperature, the more the air is driven upwards, and the more the atmospheric pressure will decrease and the wind speed increase. As long as the tropical storm is moving over warm ocean waters, the hurricane can gain size and strength.

In the Northern Hemisphere, the Earth's rotation causes the wind to swirl into a low-pressure area in a counter-clockwise direction. In the Southern Hemisphere, the winds rotate clockwise around a low. This effect of the rotating Earth on wind flow is called the **Coriolis effect**. The Coriolis effect increases in intensity farther from the equator. To produce a hurricane, **a low-pressure area** must be more than 5 degrees of latitude North or South of the equator. Hurricanes seldom occur closer to the equator. The **main development region for hurricanes is within the 10° -20° North latitude belt** that stretches from West Africa to Central America.

The water which evaporates from the ocean surface condenses as it rises. Soon, clouds and rain become caught up in the circular motion of a storm. As long as the tropical storm remains over the warm water of the ocean, the hurricane can get stronger and larger



Hurricane Katrina, 29 August 2005, GOES-12 visible channel over a MODIS true-color background - Source: [GOES Project NASA-GSFC](#)

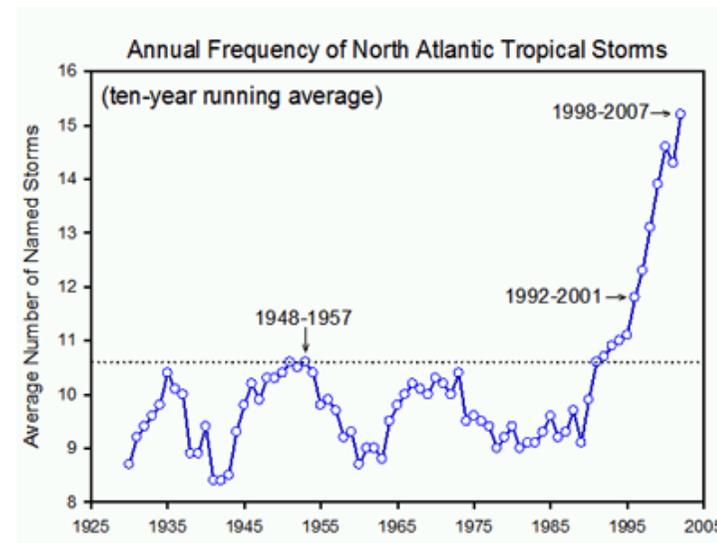
For a hurricane to develop, there must be little vertical wind shear (difference in speed or direction between winds at upper and lower elevations). Uniform winds enable the warm inner core of the storm to stay intact. Wind shear would disrupt the budding hurricane by tipping it over or by blowing the top of the storm in one direction while the bottom moved in another direction.

Potential for damage

Hurricanes produce damaging surface winds and storm surges. **Storm surges** are often the most devastating element of a hurricane, especially along a shallow-water coastline such as the Gulf Coast. A storm surge is a rise in sea level along a coastline caused by the combination surface winds and the geography of a coastline. Surface winds above the ocean's surface push water toward the hurricane's eye, creating a mound of water. The mound of water is then influenced by the slope of the coastline as the hurricane approaches land. As the depth decreases, the waves are slowed and they are contracted, which results in a sharp increase in their amplitude.

The Saffir-Simpson Hurricane Intensity Scale is used to categorize hurricane strength and potential damage.

Category	Wind Speed (km/h)	Storm surge (m)	Expected Damage
1	119-154	1-2	Minimal
2	155-178	2-3	Moderate
3	179-210	3-4	Extensive
4	211-250	4-6	Extreme
5	>250	>6	Catastrophic

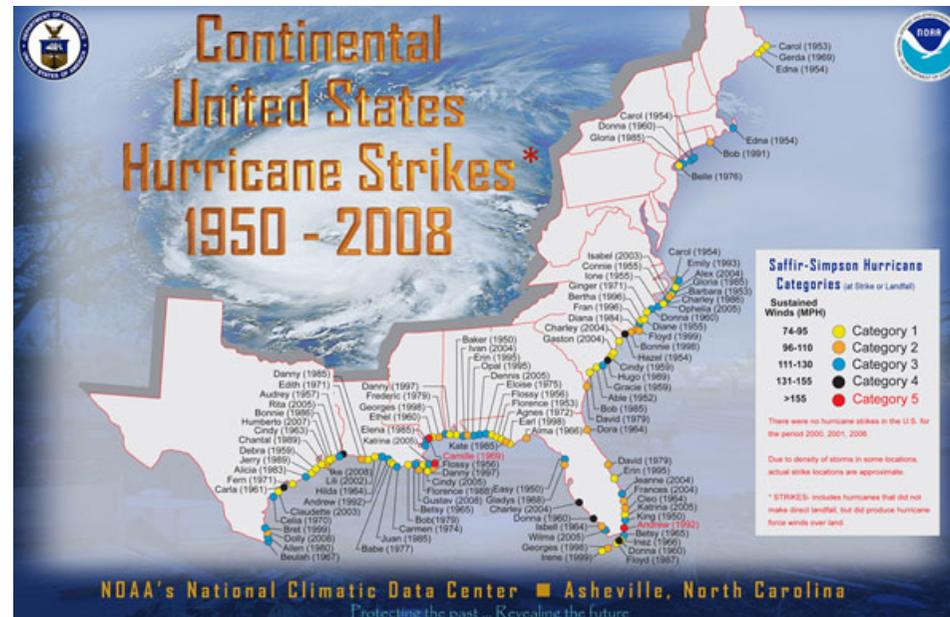


[Source](#)

Increased hurricane activity

In the North Atlantic there has been **a clear increase in the frequency of tropical storms and hurricanes**. From 1850-1990, the long-term average number of tropical storms was about 10, including about 5 hurricanes.

For the period of 1998-2007, the annual average is about 15 tropical storms and about 8 hurricanes. This increase in frequency is **linked with the rise in North Atlantic sea surface temperature**. Recent scientific studies link this temperature increase to global warming. The [2007 report of the Intergovernmental Panel on Climate Change](#) states that it is likely that there is a human contribution to the observed trend of hurricane intensification. Greenhouse warming will likely cause hurricanes in the future to be more intense on average and have higher rainfall rates than present-day hurricanes and may lead to an increasing risk in the occurrence of highly destructive category-5 storms.



Landfall locations along the US coast - [Source](#)

Hurricane damage

The **USA suffers the world's greatest economic loss because of natural disasters** (mainly hurricanes): on average annually 18 billion USD between 1980 and 2008. Four major coastal urban areas are particularly vulnerable: Miami, New Orleans, Houston, and Tampa. With a unique confluence of geography, expansive lowlands (particularly in the New Orleans area), wetland loss, deforestation, rapid development, large populations of the poor, and a heavy concentration of industry, the Gulf Coast is extremely vulnerable to hurricanes. In addition to more than 1800 lives, **Katrina** cost the Gulf Coast area at least \$125 billion in economic damage and could cost the insurance industry up to \$60 billion in claims.

While absolute damage costs tends to be greatest in developed economies. However, when losses are considered as a percentage of GDP, developing nations are most at risk, particularly Small Island Developing States. In the top 10 of countries most at risk figure 3 small Caribbean counties: Haiti, Antigua and Honduras.



In the Caribbean, major population centres, agricultural areas, ports, and centres of industrial and commercial activity are mostly located in the coastal zone. And tourism—a mainstay of many economies—is also largely concentrated in coastal areas. Risk to infrastructure on the ground, and therefore overall attractiveness to investment, is **particularly high in Small Island Developing States (SIDS)**, which tend to combine high exposure to natural hazards, especially tropical storms, with high vulnerability, particularly in coastal regions where business activity (tourism, fishing, logistics etc.) is most concentrated. The biggest reason for increased loss of life and property in coastal regions is population growth and increasing development in coastal areas. As growth and development continue, the damages caused by severe weather will increase regardless of global warming. It stands to reason that **climate change**, namely sea level rise and increases in tropical storm activity, **would exacerbate the damage** as global warming continues. Many insurance companies have concluded that these economic losses will increase, due to the combined risks of climate change and the rapid expansion of urban areas.

Sources

- [Climate Change 2007: Synthesis report - Intergovernmental Panel on Climate Change](#)
- [Environmental Factors Affecting Tropical Cyclone Power Dissipation - Program in Atmospheres, Oceans, and Climate, Massachusetts Institute of Technology](#)
- [Global Warming and Hurricanes - NOAA Geophysical Fluid Dynamics Laboratory](#)
- [Hurricanes and Global Warming - American Meteorological Society](#)
- [Hurricanes and Global Warming - National Wildlife Federation](#)
- [Hurricanes and Global Warming FAQs - Pew Center on Global Climate Change](#)
- [Hurricane Features - Remote Sensing Using Satellite - COMET](#)
- [Hurricanes, Typhoons, Cyclones - In Depth - University Corporation for Atmospheric Research \(UCAR\)](#)
- [NOAA National Hurricane Center](#)
- [On Estimates of Historical North Atlantic Tropical Cyclone Activity - Journal of Climate - NOAA/Geophysical Fluid Dynamics Laboratory](#)
- [The Landmark 2007 IPCC Report on Climate Change - Weather Underground](#)
- [Tropical Twisters - For kids Only Earth Science - NASA](#)
- [USA and China top global risk ranking for economic loss due to natural disasters linked to climate change - Maplecroft](#)
- [Weather and Climate Extremes Weather and Climate Extremes - U.S. Climate Change Science Program](#)