eo kids

earth observatory for kids

Keeping a Close Eye on the Storm

In September 1900, a severe hurricane surprised the residents of Galveston, Texas. Telephones were scarce. There were no satellites. Weather forecasting was relatively new. It was hard to see such storms coming and even harder to predict their paths. The result was the deadliest hurricane in U.S. history.

Today, NASA watches hurricanes from the moment they form. Scientists track them as they grow, move across the ocean, and make landfall. Specialized sensors on satellites have allowed them to look inside storms to see how they work. This information helps forecasters better predict future hurricanes. Other data help governments assess the damage after storms pass.

Hurricane Dorian
September 2, 2019

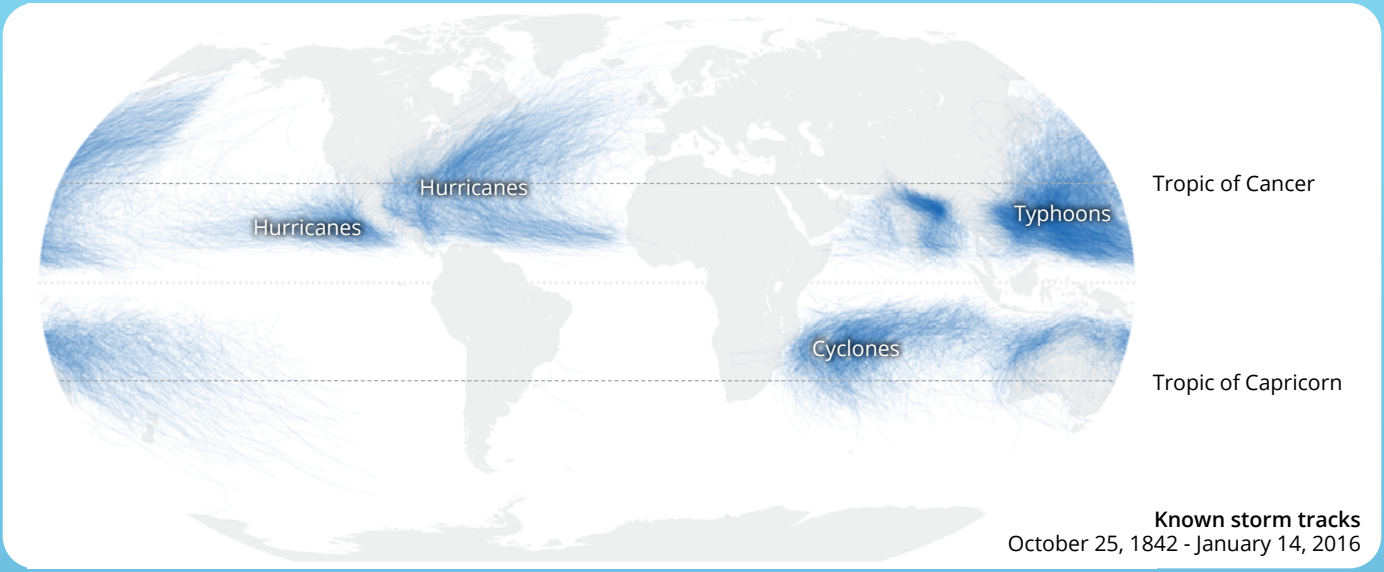
Astronauts onboard the International Space Station (ISS) have a unique view of storms. With sustained winds of 300 kilometers (185 miles) per hour, Dorian was one of the strongest hurricanes to ever strike the Bahamas.

Why do hurricanes have names?

Since 1953, every hurricane has been given a name. Naming hurricanes makes them easier to remember. It also makes it easier for people to keep track of multiple storms that are happening at the same time. Every six years the list of names repeats, unless a hurricane is very deadly or costly. Then the name is retired.

Seeing Storms from Space

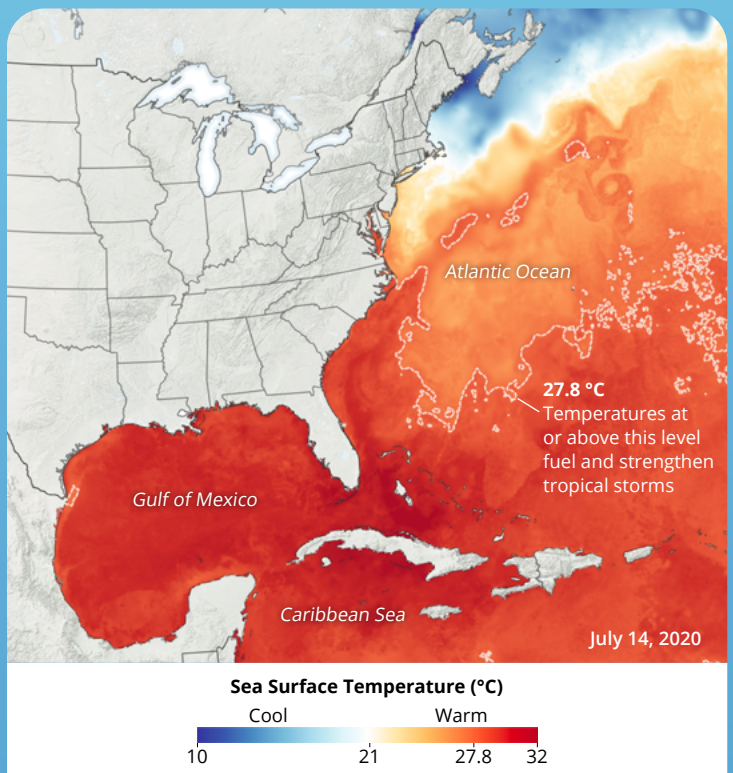
Tropical storms can intensify to become hurricanes, typhoons, or cyclones. All are large storms, but their names tell us where on Earth they form. Hurricanes form over the Atlantic and Eastern Pacific Oceans. Typhoons form over the Western Pacific. Cyclones form over the Indian Ocean and South Pacific.



Nearly one third of the world's tropical storms form in the Western Pacific each year. This is because the surface waters are among the warmest in the world and there are fewer land barriers to slow down a storm. The **tropopause** is very high and cold here, which means that the moist ocean air can rise higher into the atmosphere and grow into taller, stronger storms.

Warming Water

No matter which ocean, these storms all form in the **tropics**. But why there? The Sun's rays shine most directly on the tropics throughout the year, so the water is warmer than most other places on Earth. In the Atlantic and eastern Pacific, ocean temperatures are warmest between June and November. This is when most hurricanes form. Scientists have found that hurricanes need ocean temperatures to be at least 27.8°C (82°F). Satellites measure sea surface temperatures, which helps meteorologists know where there is enough energy to fuel a hurricane.



In July 2020, the Atlantic Ocean had a lot of fuel for hurricanes to form.

Vocabulary

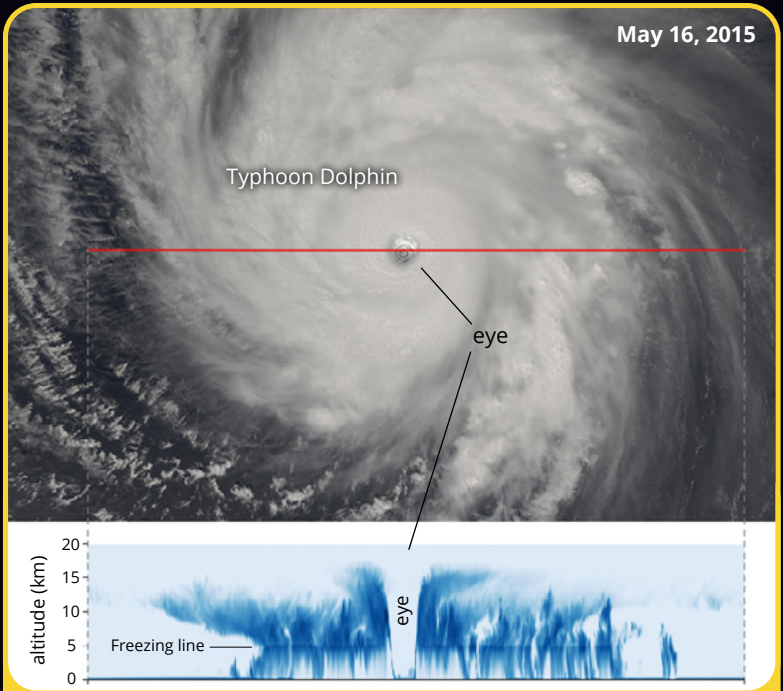
tropics — The region between the geographic Tropic of Cancer (23°26" north latitude) and Tropic of Capricorn (23°26" south latitude).

tropopause — The boundary between the lower atmosphere and the stratosphere.

Inside the Hurricane

Air temperatures inside a storm are also important. As moist air rises, it grows cooler as it moves higher into the atmosphere. This affects the type of precipitation that forms within the storm. Cold temperatures in the clouds create ice crystals, but the warmer air at lower altitudes melts the ice, creating rain.

Satellites can use radar (microwave radiation) to collect data on how much precipitation there is within different parts of a storm. It can also detect the eye of the storm – the center where there are very few clouds. Information like this helps scientists better understand storm structures and why they produce more or less rain.

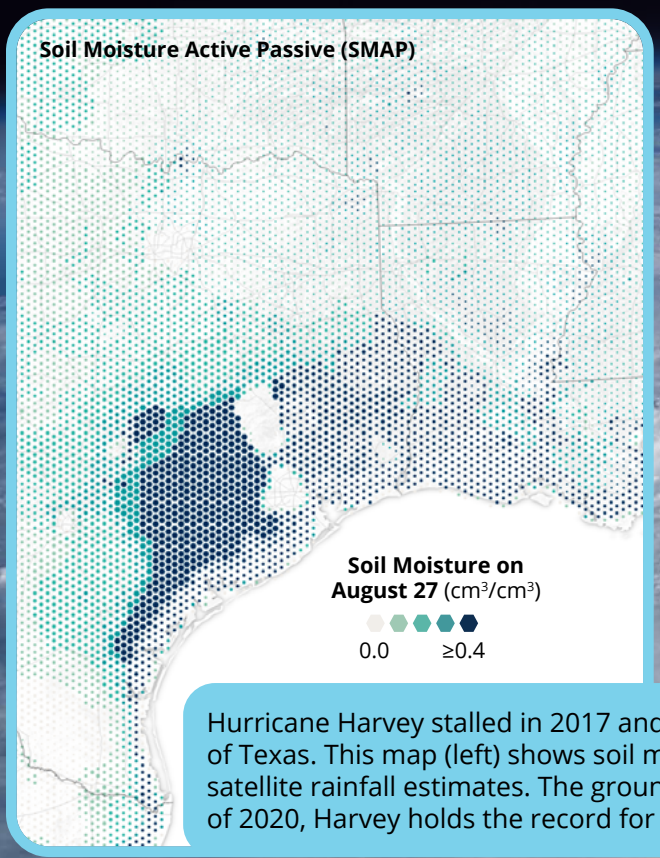


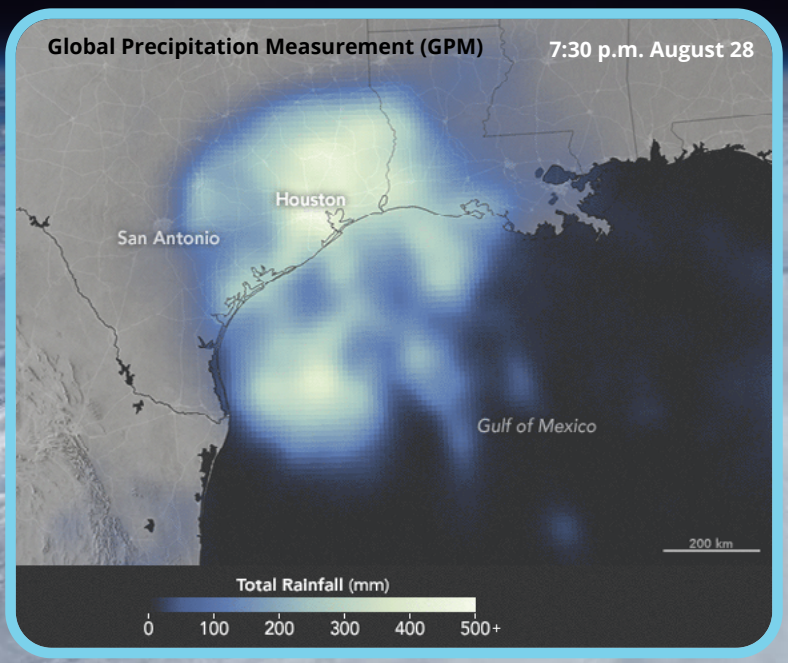
CloudSat makes a cross-section of the inside of storms.

Rainfall Rates & Stalling Storms

Though most people talk about the strength of hurricane winds, flooding is the leading cause of death from these storms. Specialized NASA satellites measure the amount of rain dropped by a storm.

As global air and water temperatures rise, our atmosphere can hold more moisture. This means some storms bring more precipitation today than in the past. If a storm stalls and hovers over the same area longer, even more rain can fall in one place and the strong winds can cause damage for a longer time. Those data can be turned into maps of where rainfall was heaviest.

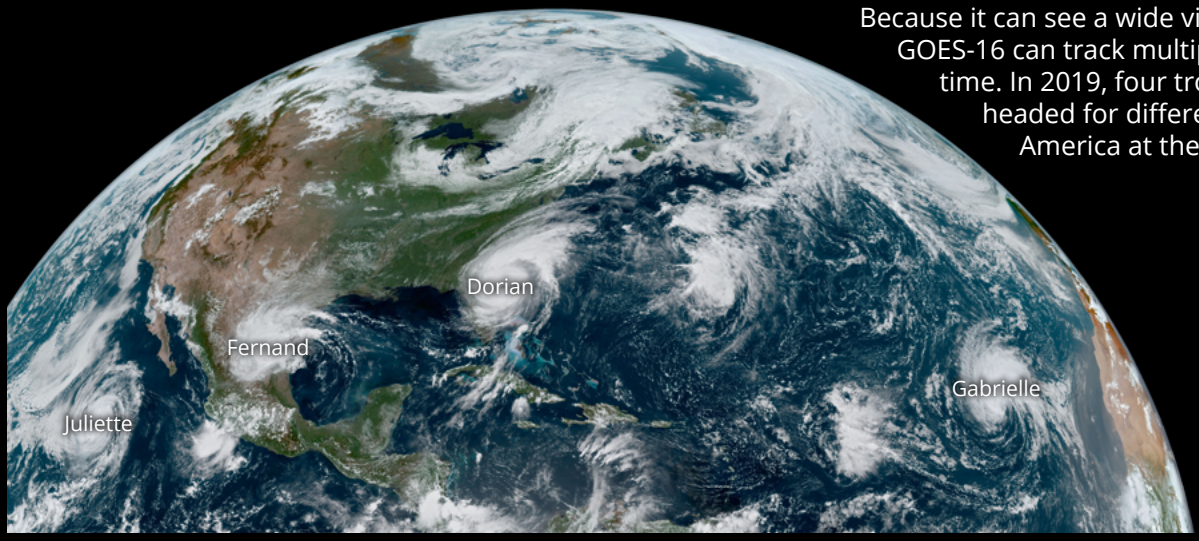




Hurricane Harvey stalled in 2017 and dropped more than 1500 mm (60 inches) of rain on parts of Texas. This map (left) shows soil moisture data after the storm; the map on the right shows satellite rainfall estimates. The ground became so saturated that it led to widespread flooding. As of 2020, Harvey holds the record for most rainfall from a single hurricane in the U.S.

Tracking Storms

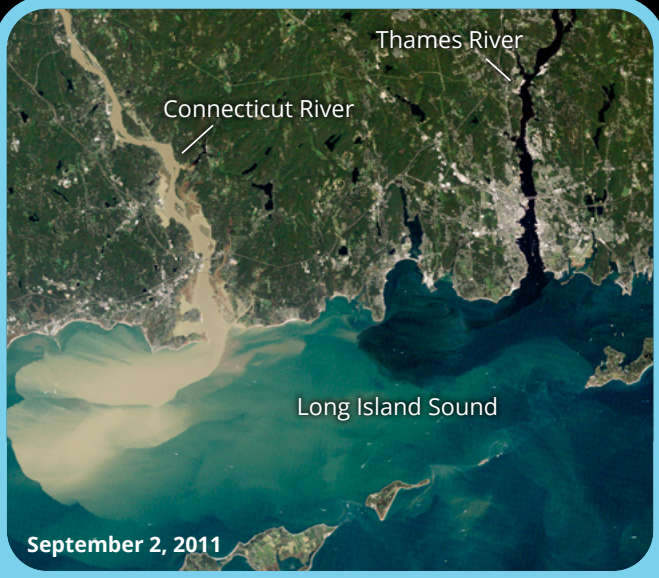
Geostationary weather satellites like GOES-16 (built by NASA and operated by NOAA) track the movement of storms every few minutes, day and night. This helps the National Weather Service predict when and where severe storms may strike.



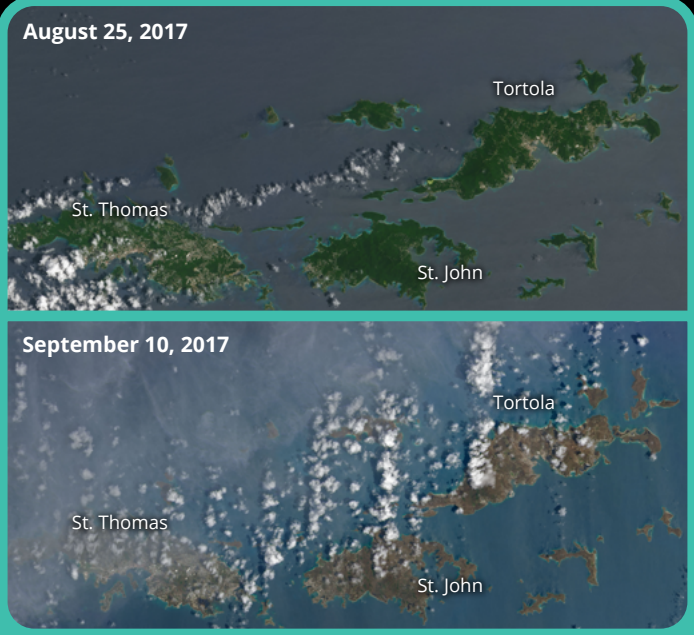
Because it can see a wide view of Earth, GOES-16 can track multiple storms at a time. In 2019, four tropical storms headed for different parts of North America at the same time.

Assessing the Aftermath

Storm surges and rainfall cause flooding. Strong winds and downed trees can knock out power. NASA satellites make it possible to compare images of our cities and lands before and after a hurricane. This can be useful to rescue and recovery efforts and for rebuilding later.



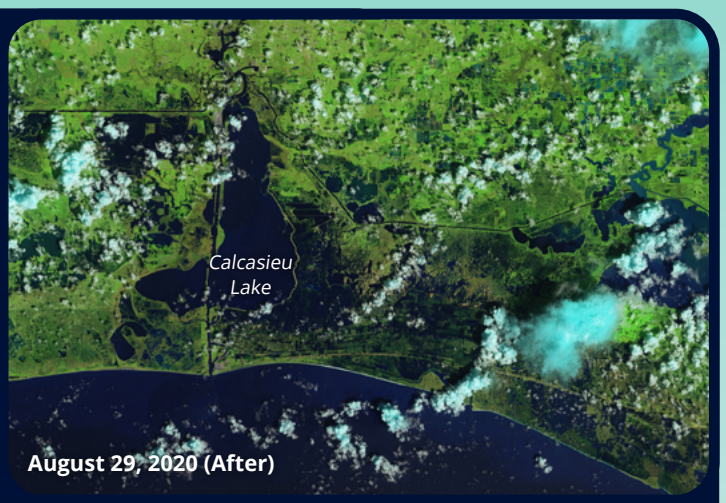
Nearly a week after Hurricane Irene drenched New England, the Connecticut River was spewing large amounts of muddy sediment into Long Island Sound.



Lush islands in the Caribbean turned from green to brown after being battered by Hurricane Irma.

Vocabulary

storm surge — When the winds and waves from a storm push more water up along the coast.



Before and After Hurricane Laura

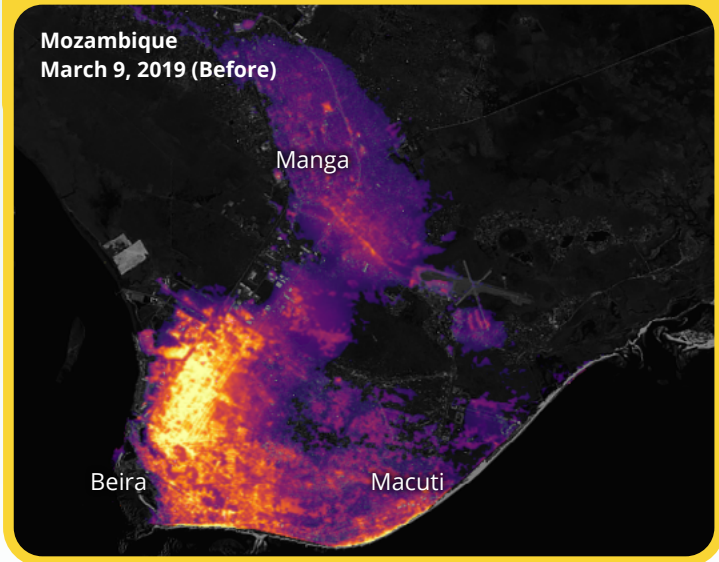
Hurricane Laura struck Louisiana and Texas in August 2020. Storm surges ranged from 3 to 5 meters (9 to 15 feet). The storm dropped 12 to 25 cm (5 to 10 inches) of rain in many places. Satellite images helped spot areas that were flooded.

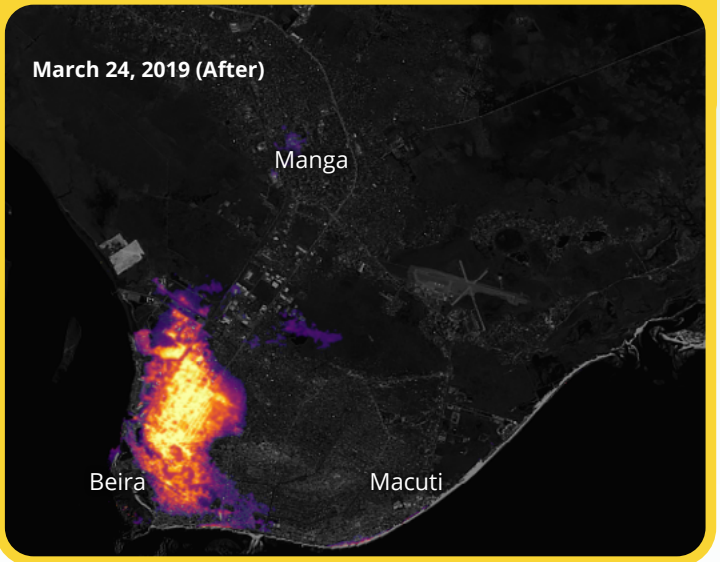
Hurricanes and Pets

People use to have to leave their pets behind during evacuations from natural hazards. After Hurricane Katrina in 2005, the U.S. Congress passed a law to keep pets with their owners in case of evacuation. The National Weather Service suggests that pet owners have a safety plan just like people.

Before and After Tropical Cyclone Idai

Comparing nighttime satellite images can make it easy to spot blackouts and areas in need of assistance.





DIY Science

Storm-Proof Structures

Can you design a structure that can sustain strong winds? Design and test your structure.

Materials:

- Index cards (4-8)
- Straws (~10)
- Craft sticks (4-8)
- String (~1 meter/~3 feet)
- Pipe cleaners (4-8)
- Tape
- Scissors
- Ruler
- Tennis ball
- Paper and pencil
- Fan with speed settings

Instructions:

Your challenge is to build, as tall as possible, a freestanding tower that can support a tennis ball while withstanding the wind from a fan.

1. Design your structure. What materials do you need? What shape will it be?

2. Collect your materials and build your tower.

3. Place the tennis ball on top of your completed tower.

4. Place the fan 25 centimeters away from your tower and turn it on low speed to simulate a tropical storm.

5. If your tower did not fall over, try increasing the fan's speed.

Did your tower survive your "tropical storm" or "hurricane" winds? Why or why not?

Saffir Simpson Scale

The Saffir-Simpson Scale is used to classify hurricanes by their wind speeds. The faster the wind speed, the greater the potential for destruction.