



**Scientist in Every
Florida School**
Thompson Earth Systems Institute



HURRICANES 101

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Who am I?



Dr. Sim Aberson



I'm a research meteorologist who studies hurricanes at the National Oceanic and Atmospheric Administration in Miami.

What is a hurricane ?

What is a hurricane ?



A large storm that forms over warm ocean made up of thunderstorms, with winds of at least 74 miles per hour. In addition to the wind, hurricanes have heavy rainfall, flooding, and storm surges.

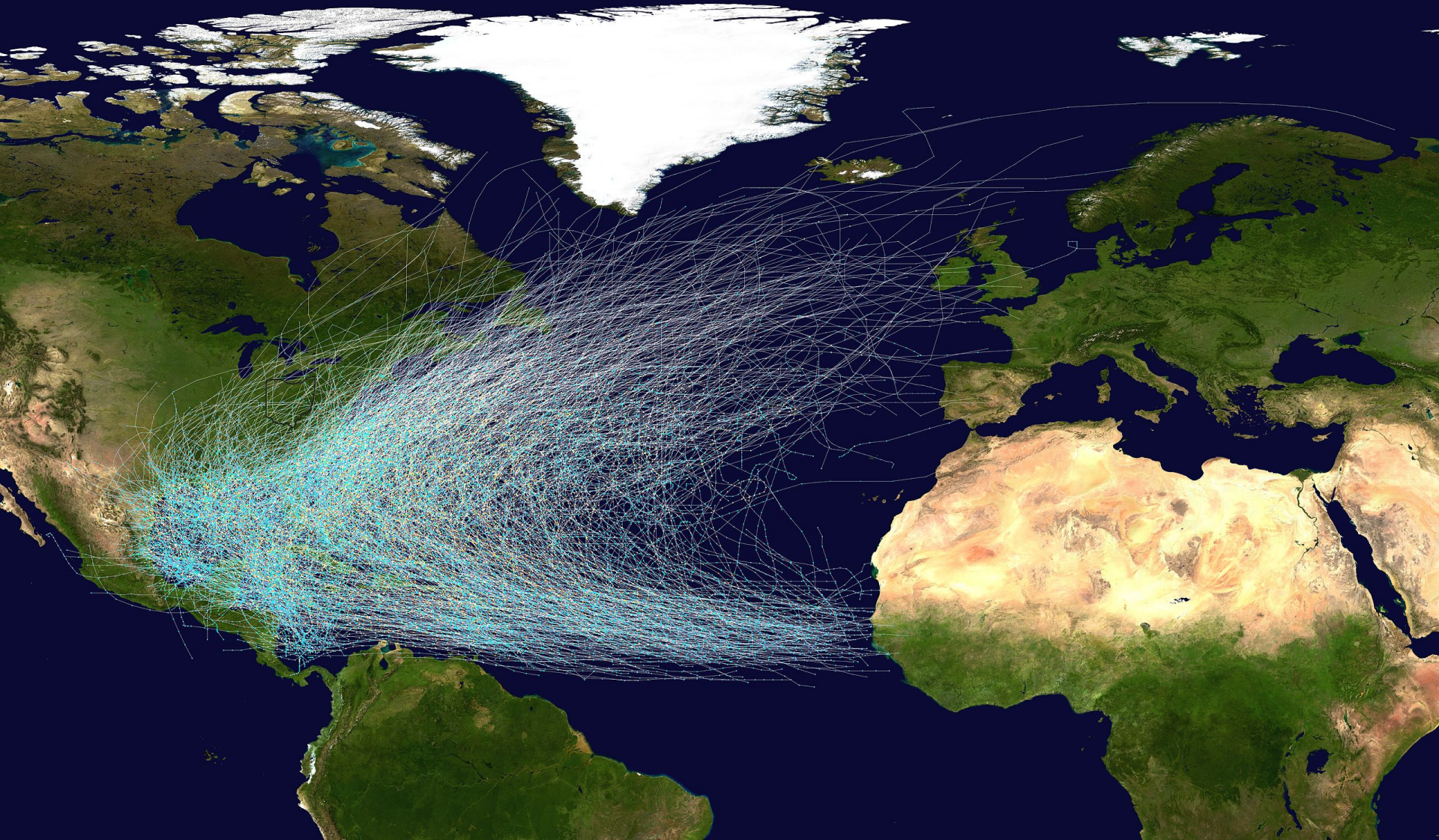


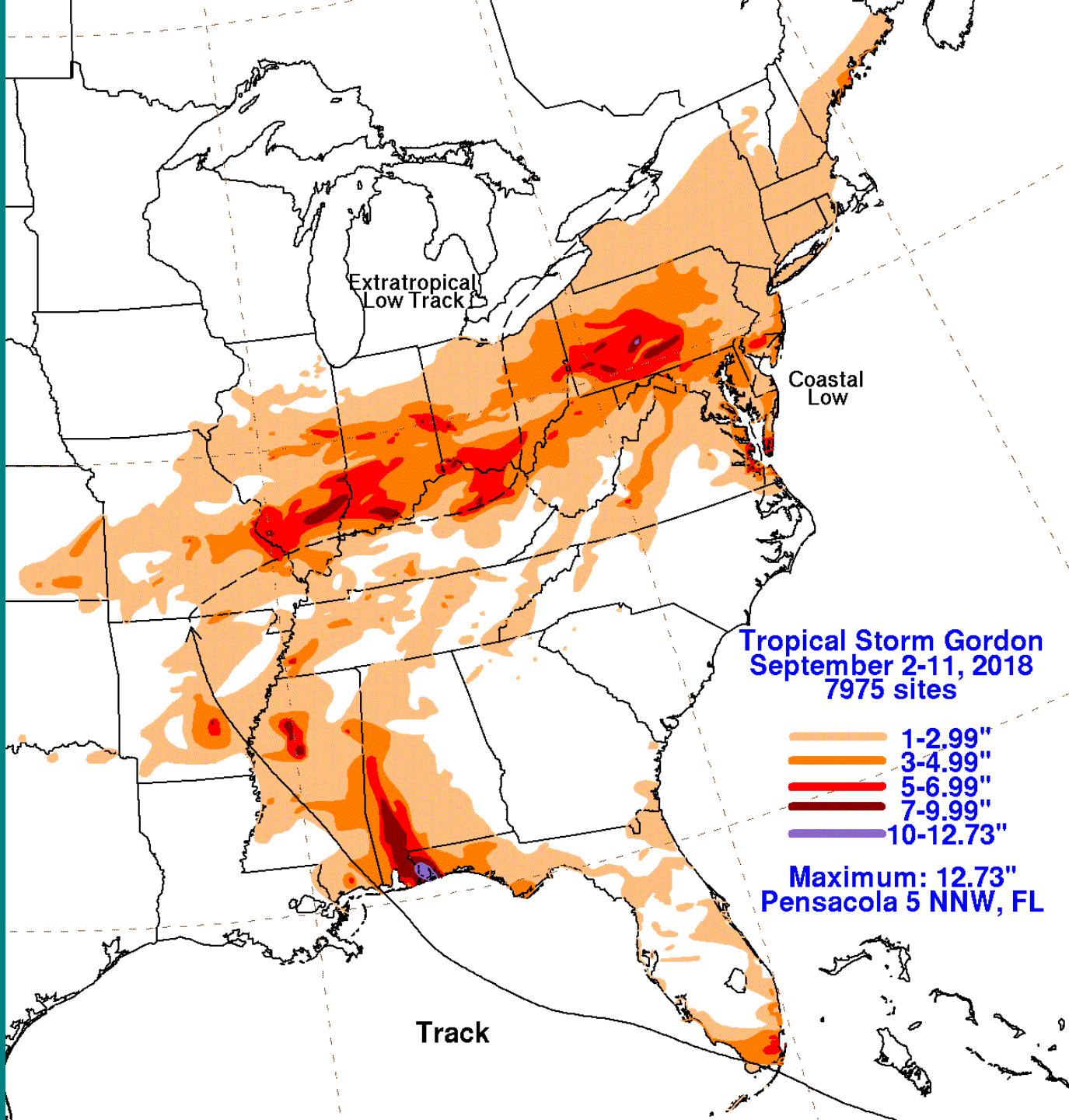
Before Katrina...



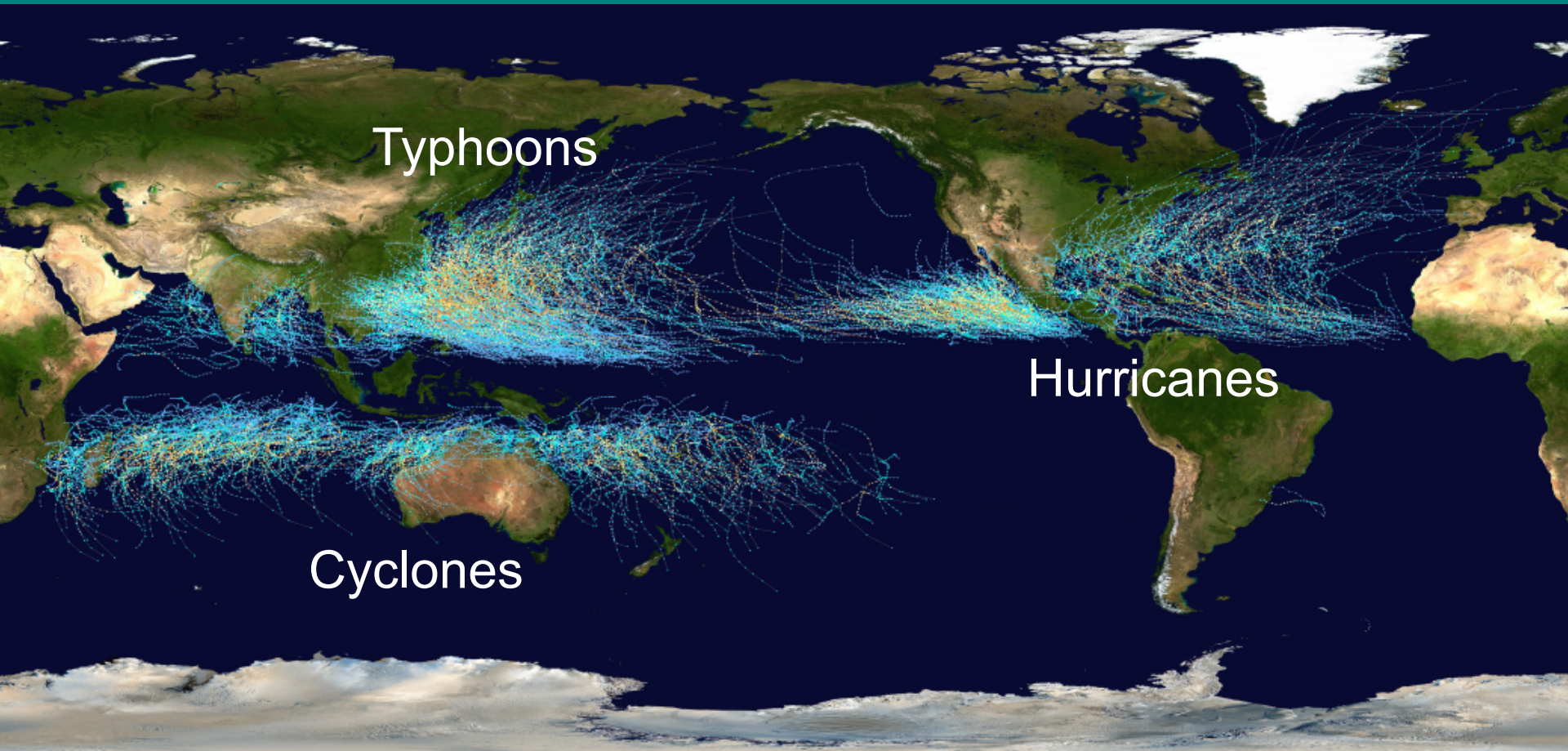
...After Katrina

Where do they happen?



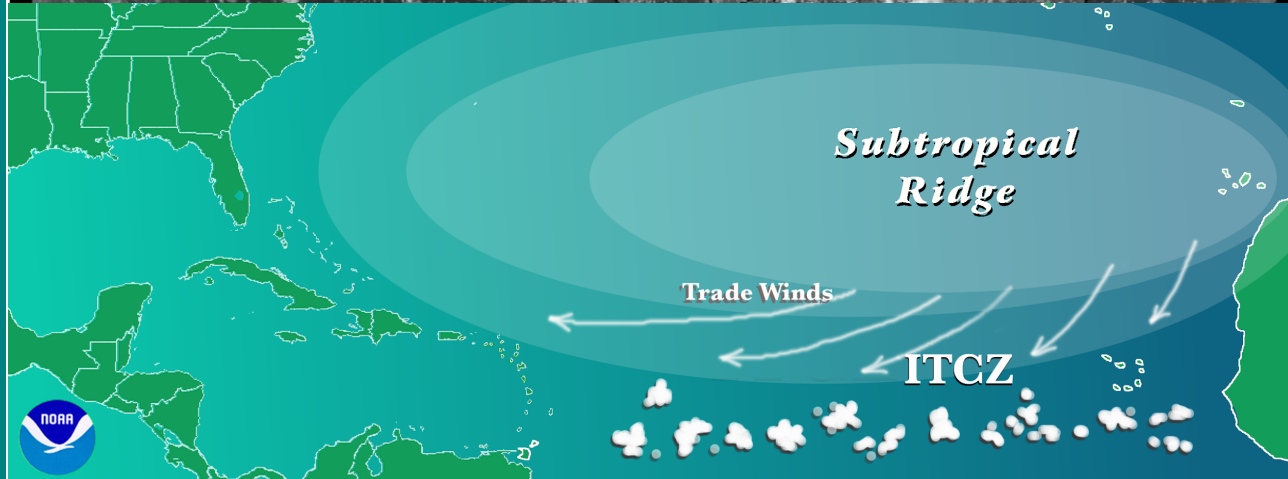
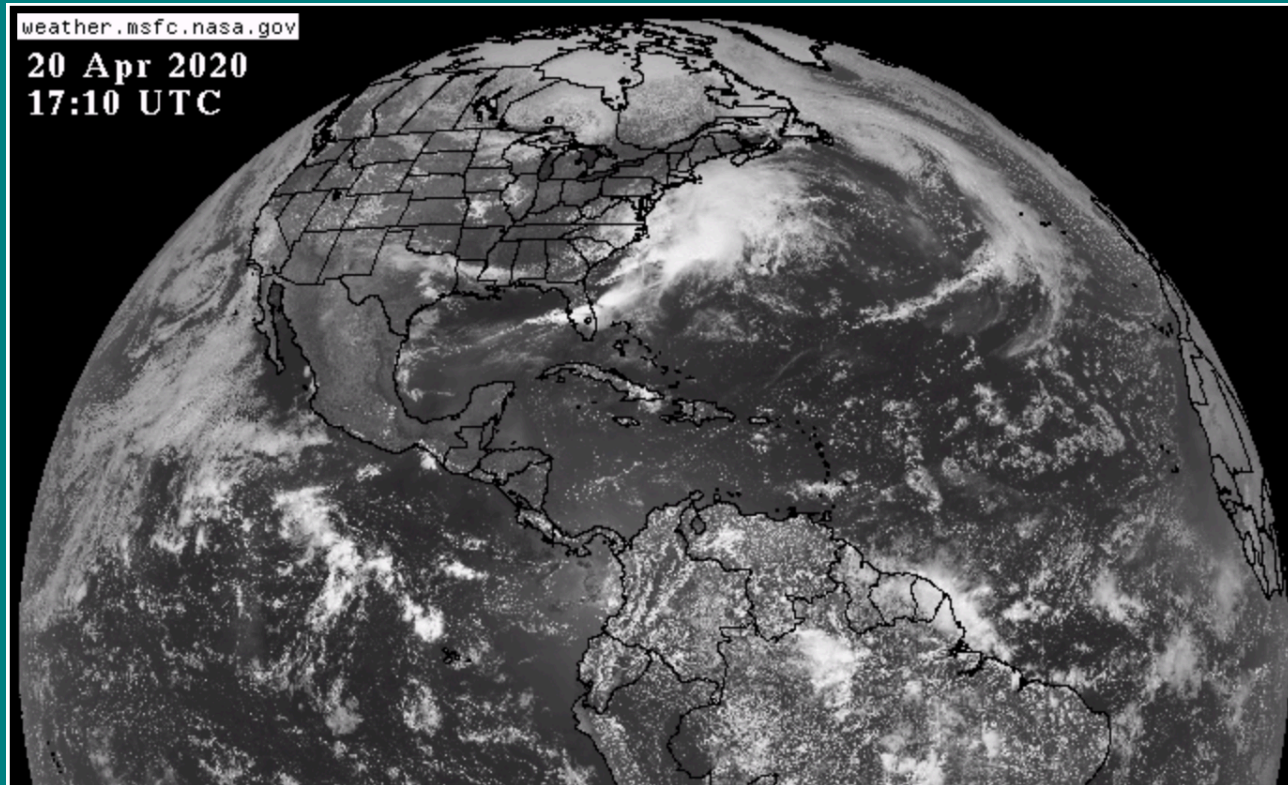


Where do they happen?



The Atlantic Basin

The Atlantic Basin is usually dominated by a big area of high pressure and good weather. An area of storms, the Inter-Tropical Convergence Zone is to the south.

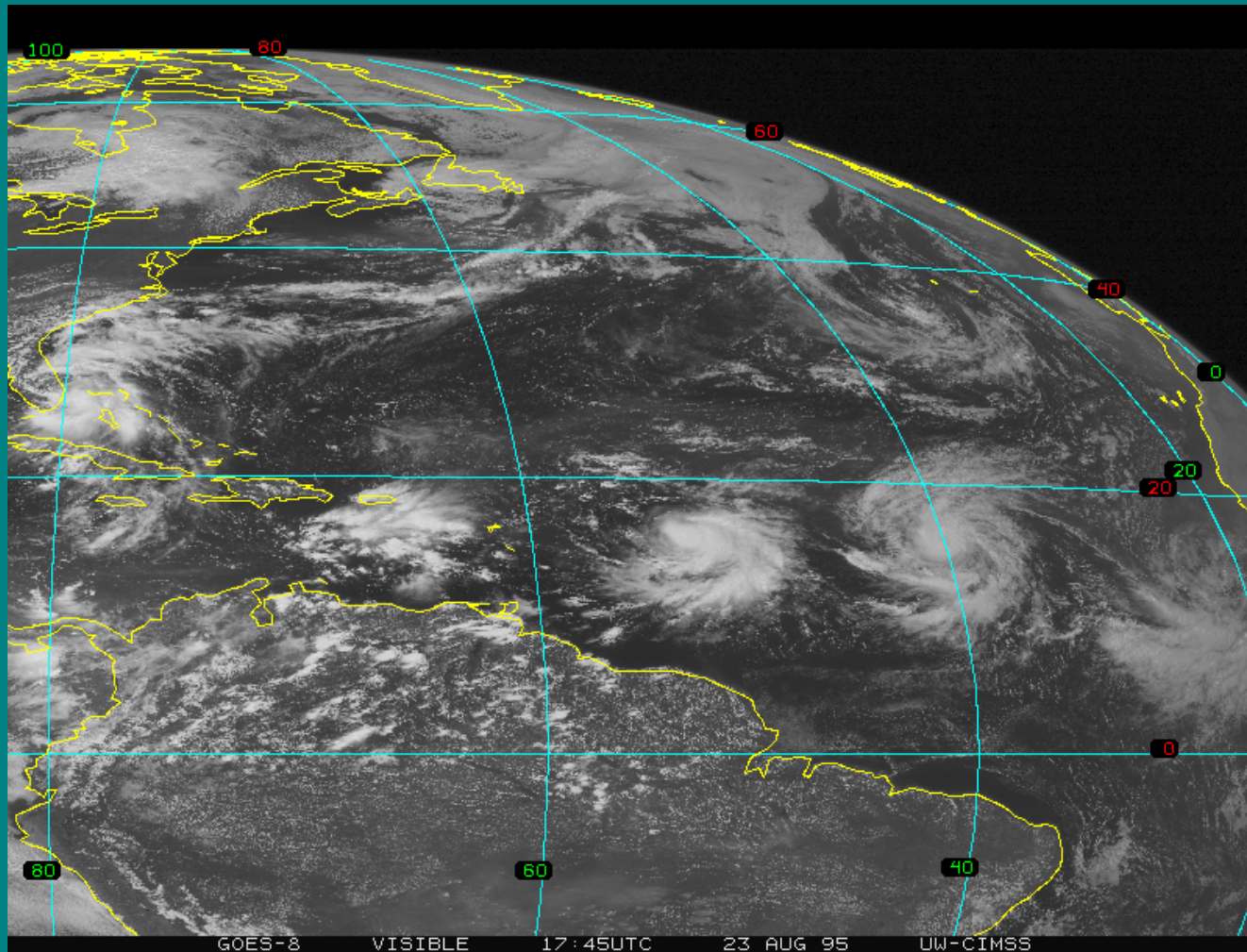


The Atlantic Basin



Disturbed areas of weather form over Africa and are pushed out into the Atlantic. These are known as African Easterly Waves.

The Atlantic Basin

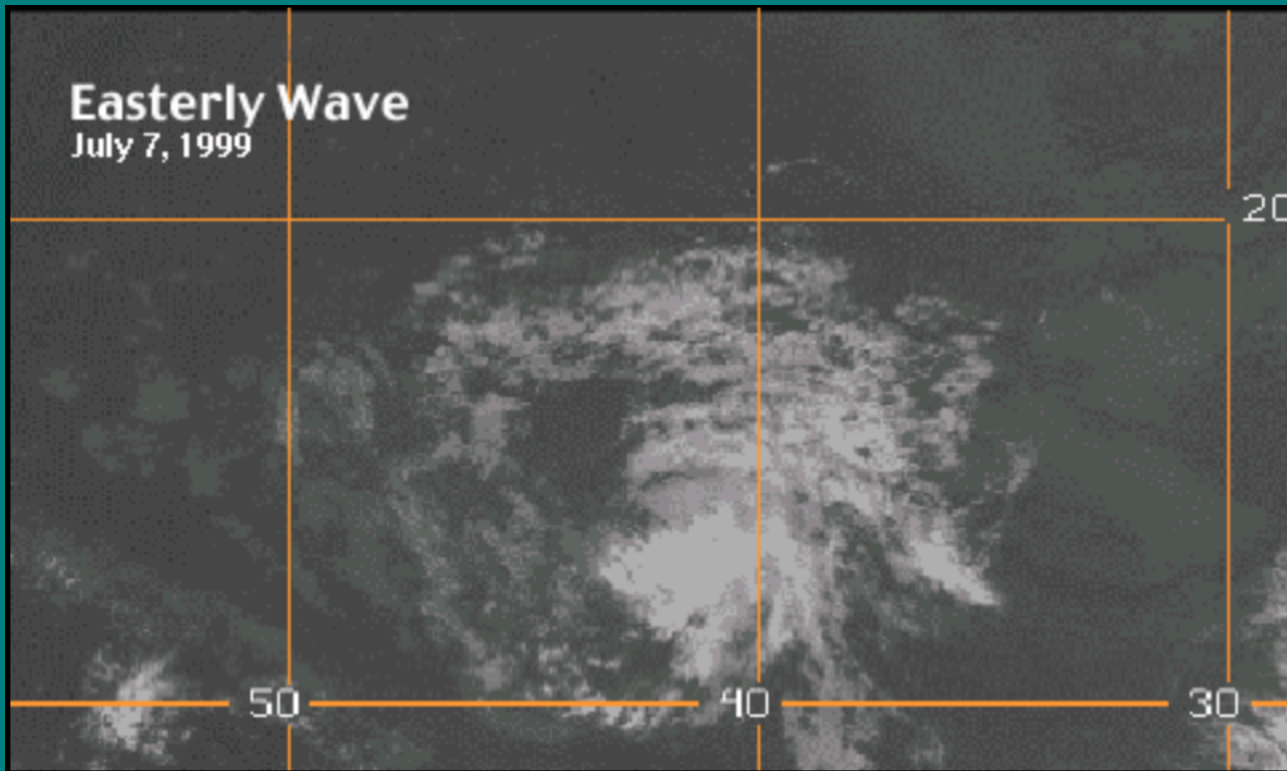


These Waves will sometimes intensify into Tropical Depressions, Tropical Storms, and even Hurricanes.

What is necessary for a hurricane to form ?

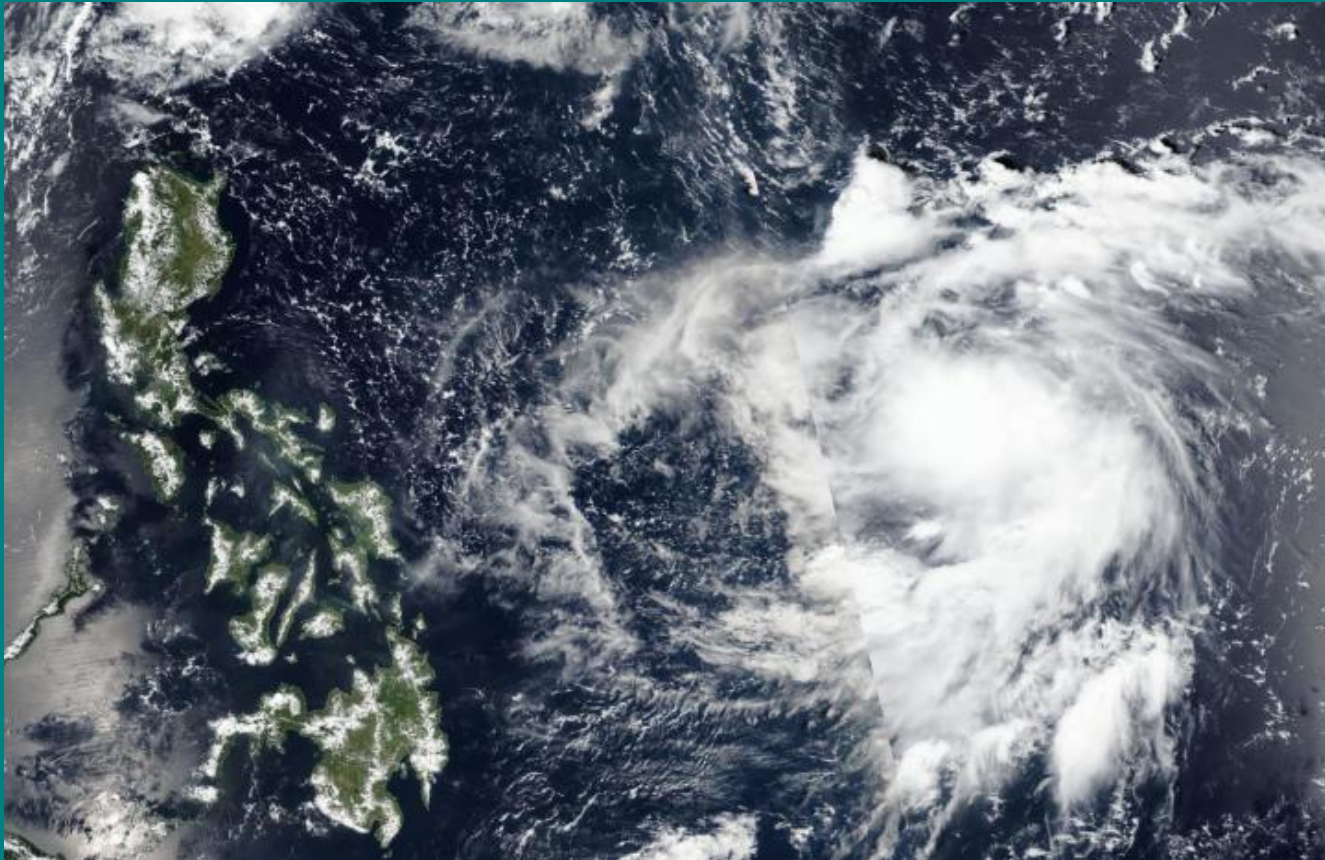
- Warm ocean water at least 80°F [26.5°C] at least 100 feet [40 m] deep.
- An atmosphere where thunderstorms can form, what we call unstable.
- A lot of humidity from the ocean surface to about 3 miles (5 km) up.
- A weather disturbance, like a tropical wave.
- Wind blowing in the same direction near the bottom and the top of the atmosphere (low wind shear).

Tropical Waves



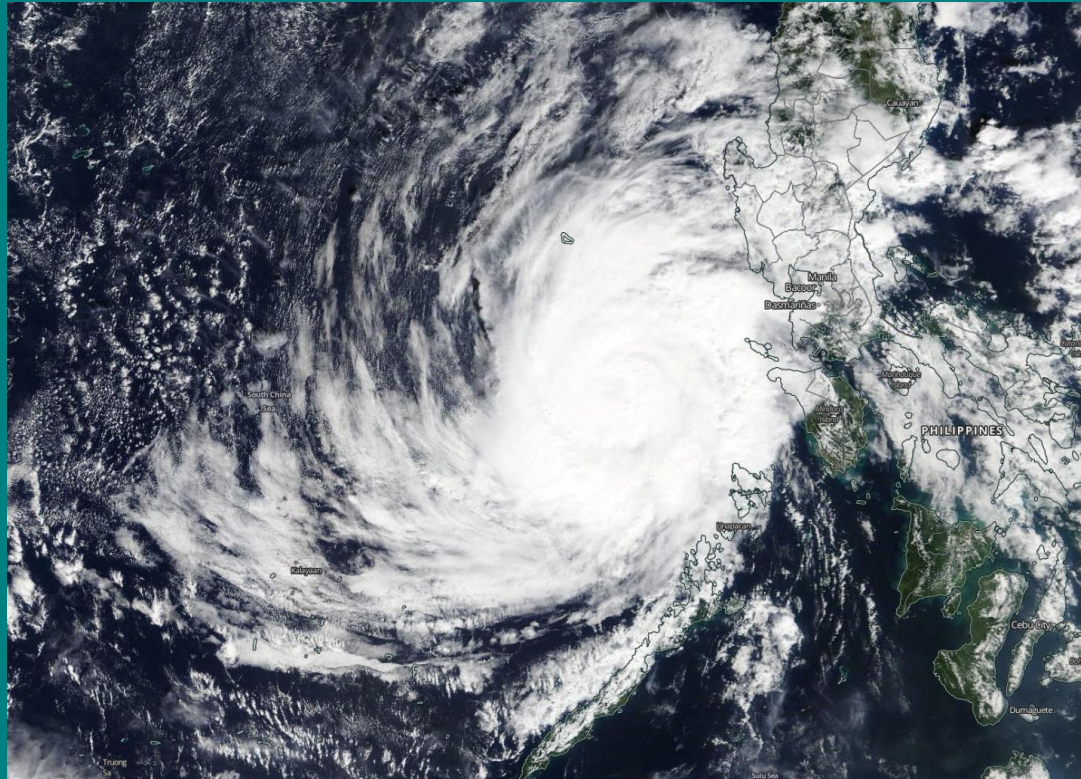
Tropical Waves have thunderstorms around a weak area of low pressure

Tropical Depressions



Tropical Depressions have storms clustered around a stronger area of low pressure at the surface. 15

Tropical Storms



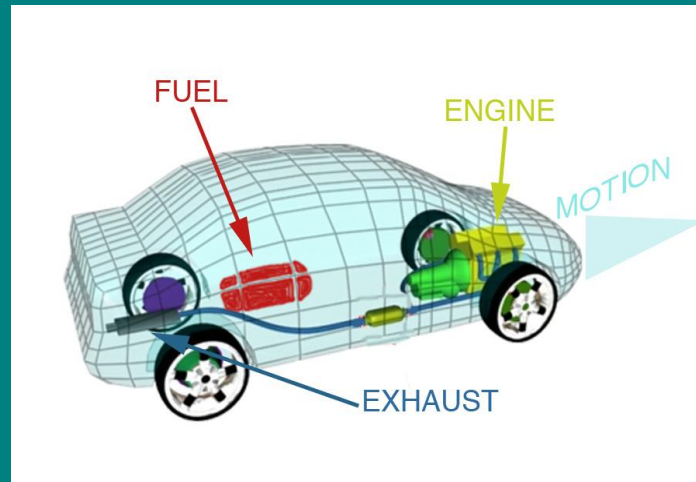
Tropical Storms are more organized with the thunderstorms spiraling inward toward the center in distinct rainbands.

Hurricanes



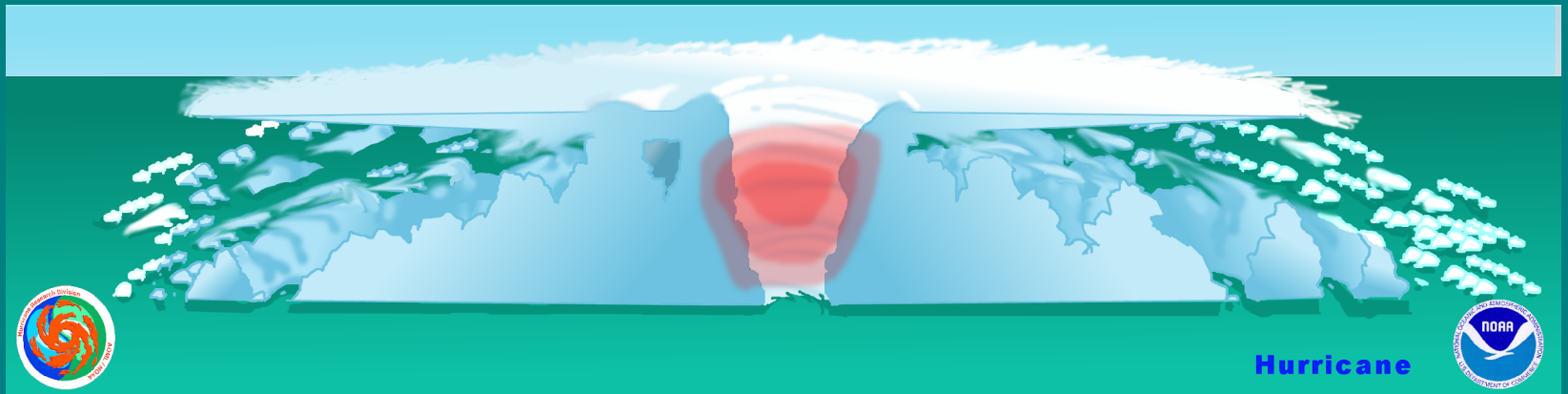
Hurricanes have thunderstorms organized into a ring around a clear, calm eye known as the eyewall. 17

Hurricane Heat Engine



An engine is something which converts one form of energy into another. An old-fashioned gasoline engine converts the chemical energy of gasoline into the mechanical energy of motion.

Hurricane Heat Engine



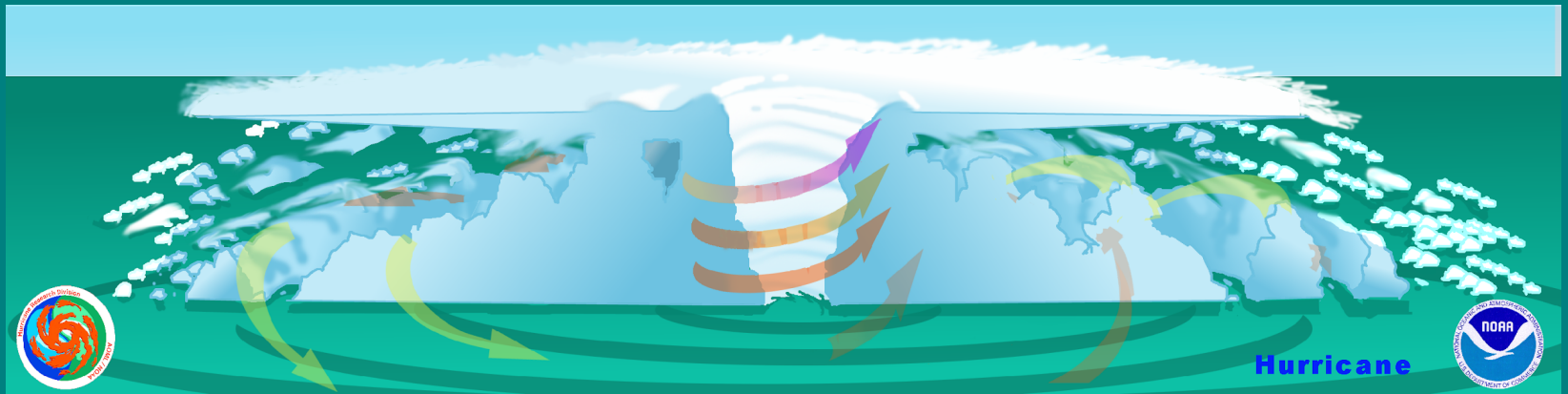
Hurricanes are heat engines which convert...

Hurricane Heat Engine



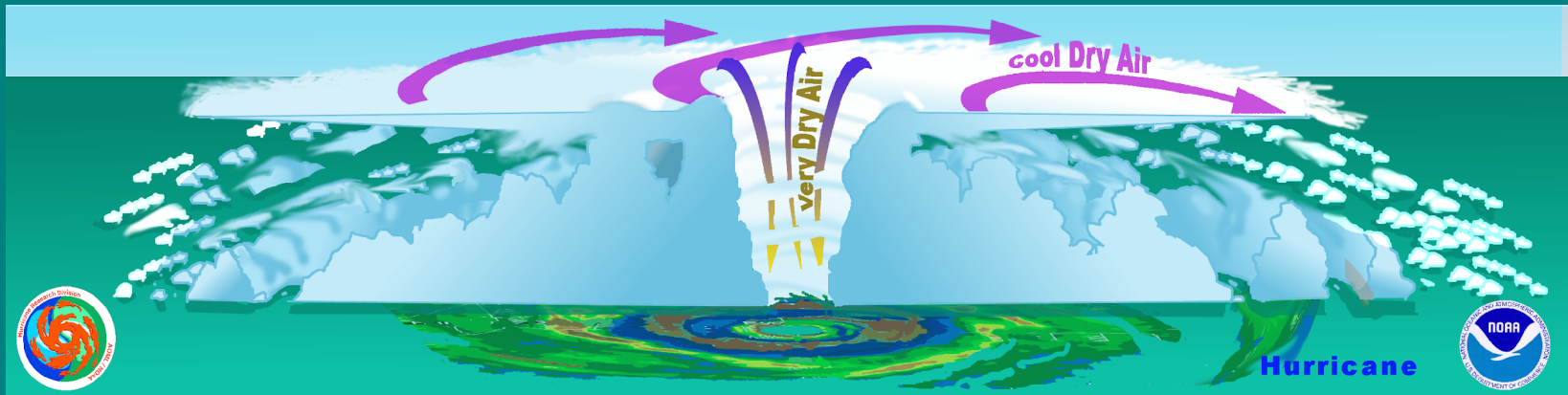
...heat, in the form of warm, moist air
and convert it into....

Hurricane Heat Engine



...wind (mechanical energy).

Hurricane Heat Engine



The exhaust products of the engine are the cool, drier air that produces cirrus clouds at the top, and the torrential rains that remove the water from the air.

Flying into hurricanes



Flying into hurricanes



- These missions can be fun and exciting...

Flying into hurricanes



... and sometimes not.

Flying into hurricanes



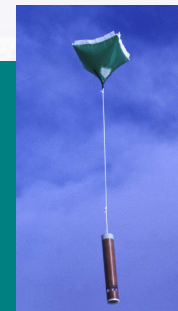
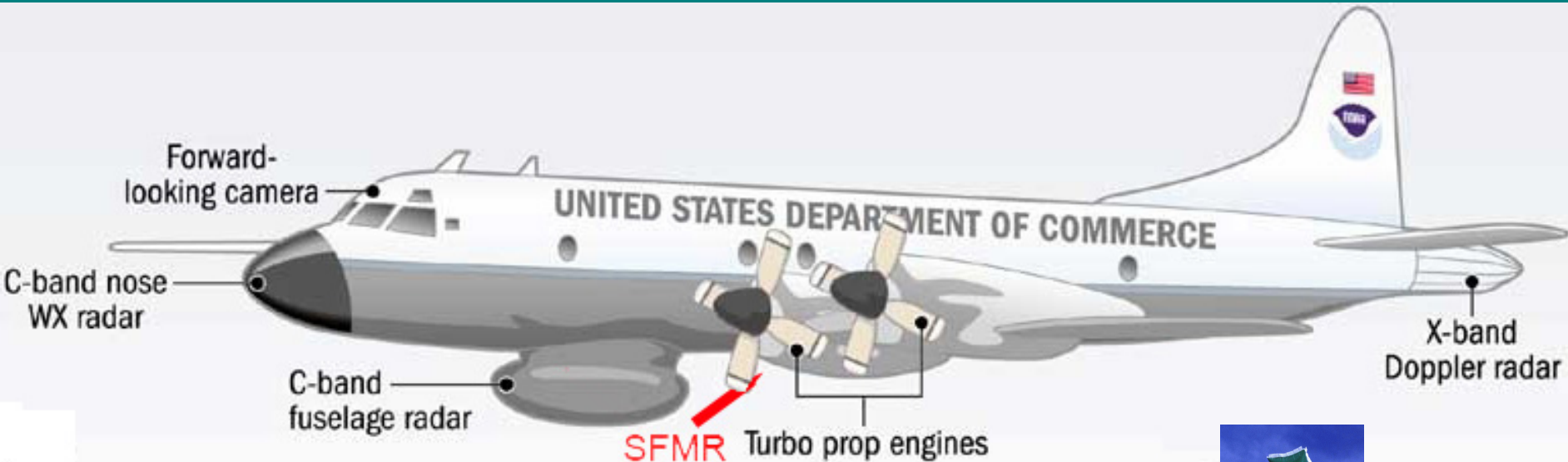
But we're very happy that we get to do this!

Aircraft



- NOAA (2) Orion P-3 “Kermit” & “Miss Piggy” and one Gulfstream-IV jet “Gonzo”
- USAF Reserves 53rd WRS (10) C-130J
- The crews are made up of pilots, navigators, scientists, and engineers
- Other countries also fly into hurricanes

Aircraft



Dropwindsondes measure wind, temperature, humidity, and pressure as they fall to the surface.

Radars tell us where rain is happening and how strong the wind is.

The Stepped Frequency Microwave Radiometer (SFMR) measures wind speed at the ocean surface.

Instruments on the plane measure wind, temperature, humidity, and pressure where the plane is.

Tools of the Future



- Drones
 - ⌘ Global Hawk
 - ⌘ Coyote