



Blowin' in the wind - Tropical cyclones

Szende Sándor

Agenda

Basic
concepts



TOP 5 of all
time



Categorization



Hurricane
Hunters





Basic concepts



Hurricane 101

- hurricane, typhoone, cyclone depending on location
 - "Hurricane Season" : June 1 - November 30
 - giving women's names before the end of the 19th century
- Meaning: evil spirit of the wind



Hurricane Florence, seen from the International Space Station, in the Atlantic in September 2018

Hurricane 101

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Hurricane formation

Several factors are required:

- High sea surface temperature
- Low vertical wind shear
- Atmospheric instability
- High humidity
- Coriolis force

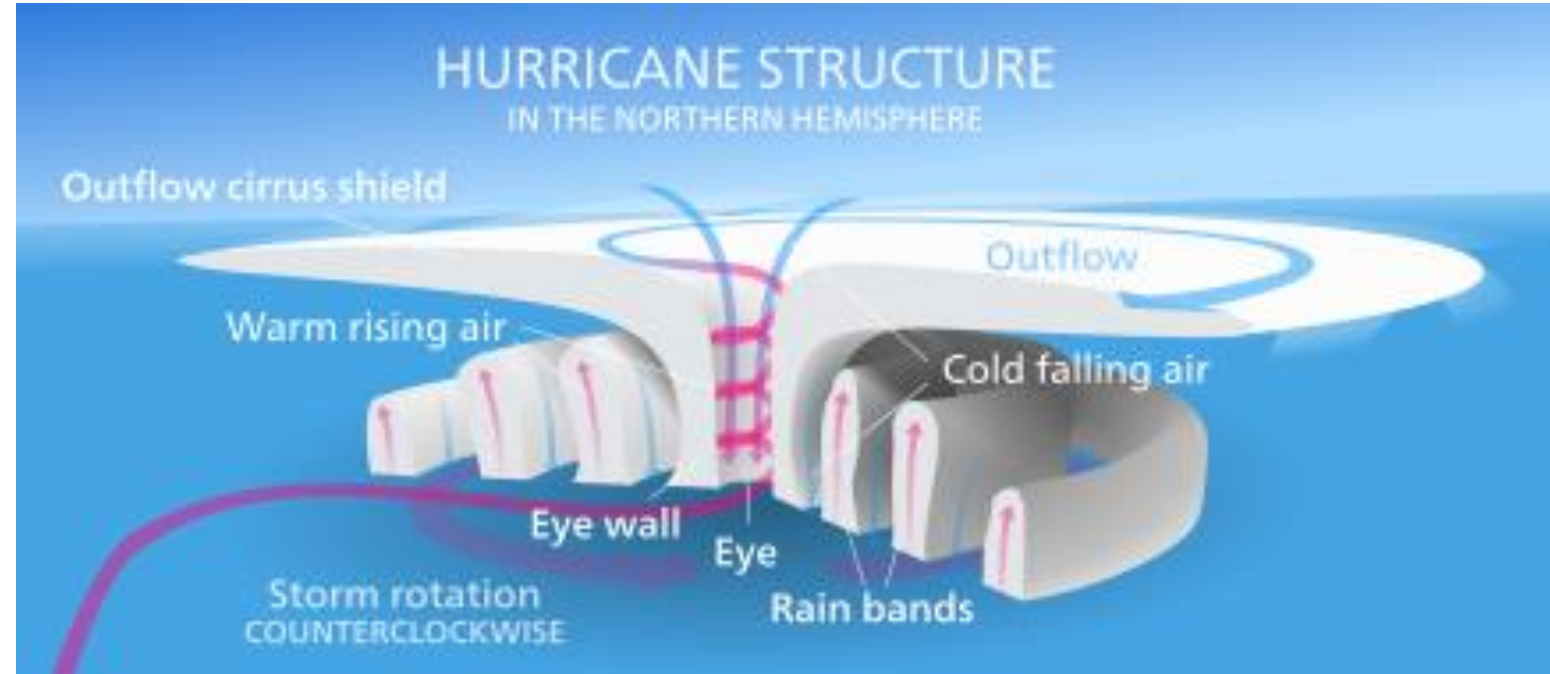
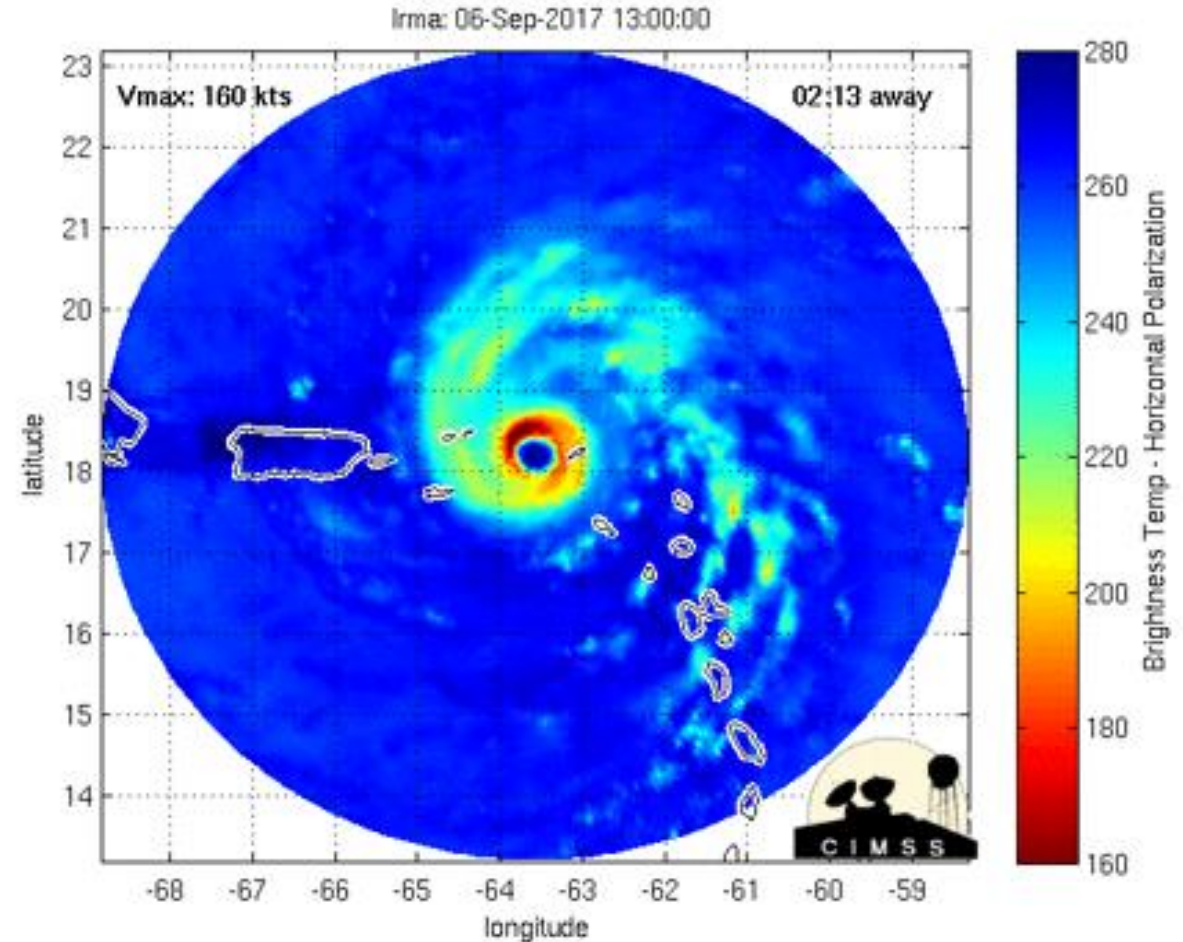


Diagram of a tropical cyclone in the Northern hemisphere

Hurricane formation

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Hurricane Irma eyewall formation [source: <https://gifer.com/en/g29r>]

Build your own hurricane



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TOPICS



Storms



Tides and Oceans



Atmosphere



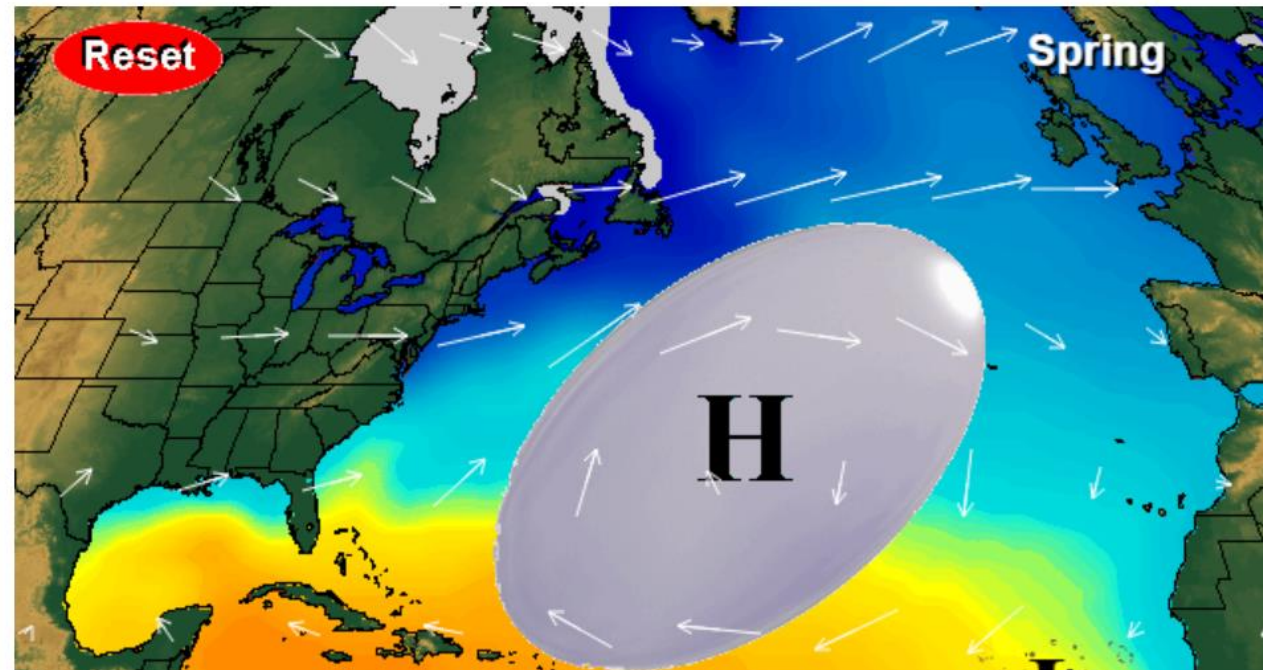
Water and Ice



Satellites and Technology

Storms

Hurricane Simulation



Top 5 deadliest hurricanes



Top 5 Hurricanes

5. Katrina (2005)

- Rapidly strengthening to Category 5 levels over warm water in the Gulf of Mexico
- At one point 80 percent of New Orleans was underwater
- Damage: \$161 billion is considered the costliest hurricane in U.S. history



This dog rode out Hurricane Katrina on a piece of wood

Top 5 Hurricanes

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New Orleans under water

Top 5 Hurricanes

5. Katrina (2005)

4. **Maria (2017)**

- Coming just two weeks after a brutal Irma particularly on the same area
- At one point 90 percent of Puerto Rico was without electricity
- Thousands of residents have moved to the U.S.



People wait in line for gas as they deal with the aftermath of Hurricane Maria

Top 5 Hurricanes

5. Katrina (2005)

4. Maria (2017)

3. Galveston Hurricane (1900)

- Killed an estimated 6,000 to 12,000 people, mostly in Texas
- After the hurricane Galveston 5 kilometer seawall and raised the level of the entire city



Top 5 Hurricanes

5. Katrina (2005)
4. Maria (2017)
3. Galveston Hurricane (1900)
- 2. Mitch (1998)**

- Killing 11 000 people, mainly in Honduras and Nicaragua
- Total damage amounting to over \$5 billion



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The residents of Tegucigalpa, Honduras clean the streets of the capital after Hurricane Mitch unleashed deadly mudslides

Top 5 Hurricanes

5. Katrina (2005)
4. Maria (2017)
3. Galveston Hurricane (1900)
2. Mitch (1998)

1. **Great Hurricane (1780)**

- Killing approximately 22 000 people
- Destroys warships in Revolutionary War.
- The deadliest Atlantic hurricane on record



Categorization of the storms



Saffire-Simpson scale

Classifies into five categories distinguished by the intensities of their sustained winds.

Category 1	Category 2	Category 3	Category 4	Category 5
- 119–153 km/h - no significant structural damage	- 154–177 km/h	- 178–208 km/h	- 209–251 km/h	- ≥ 252 km/h



Pamela (2021)



Saffire-Simpson scale

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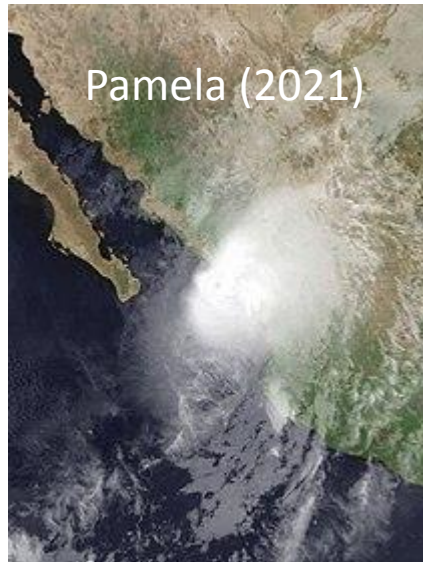
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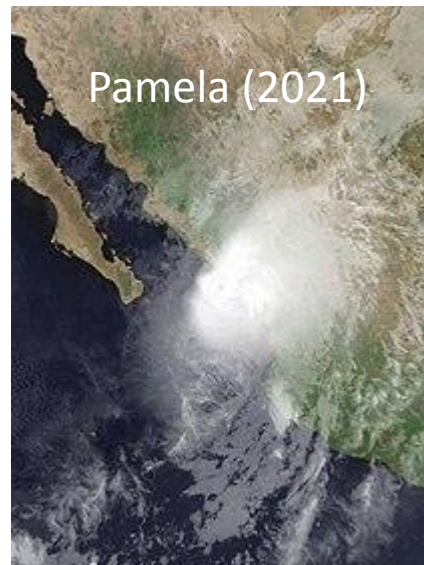
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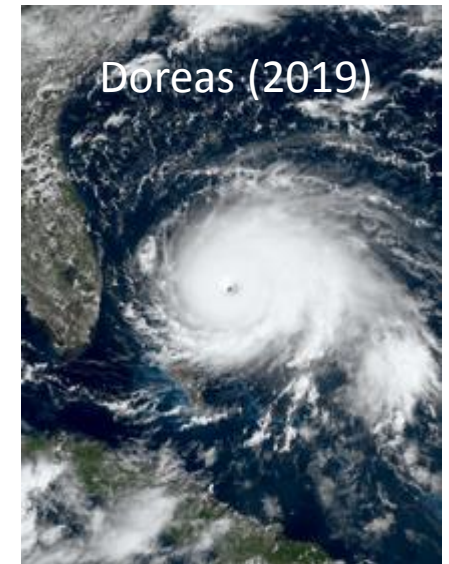
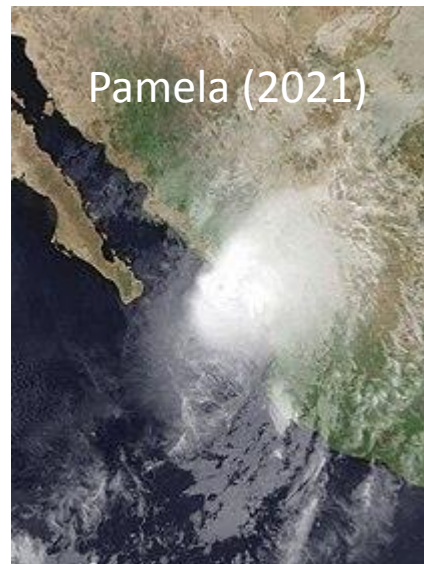
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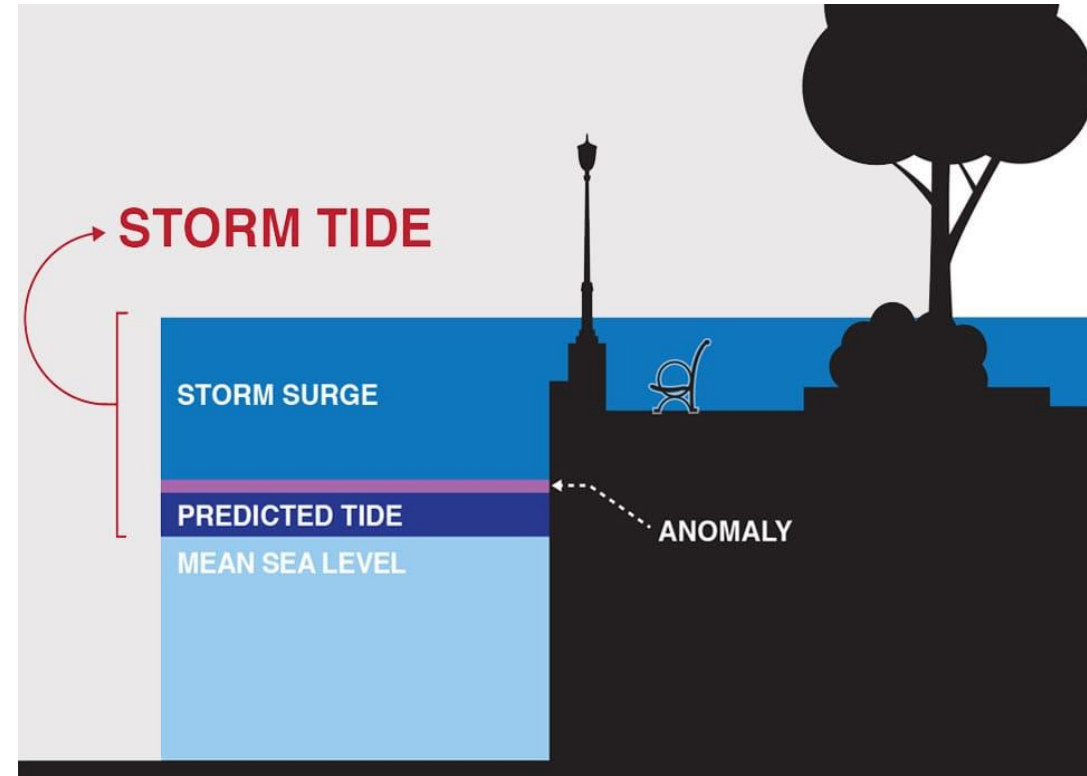
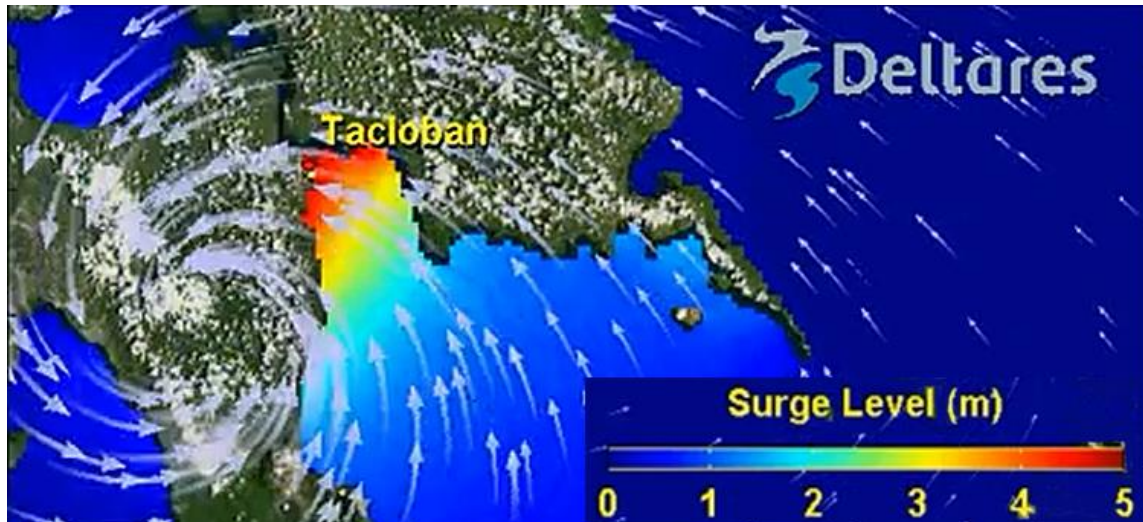
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Storm Surge

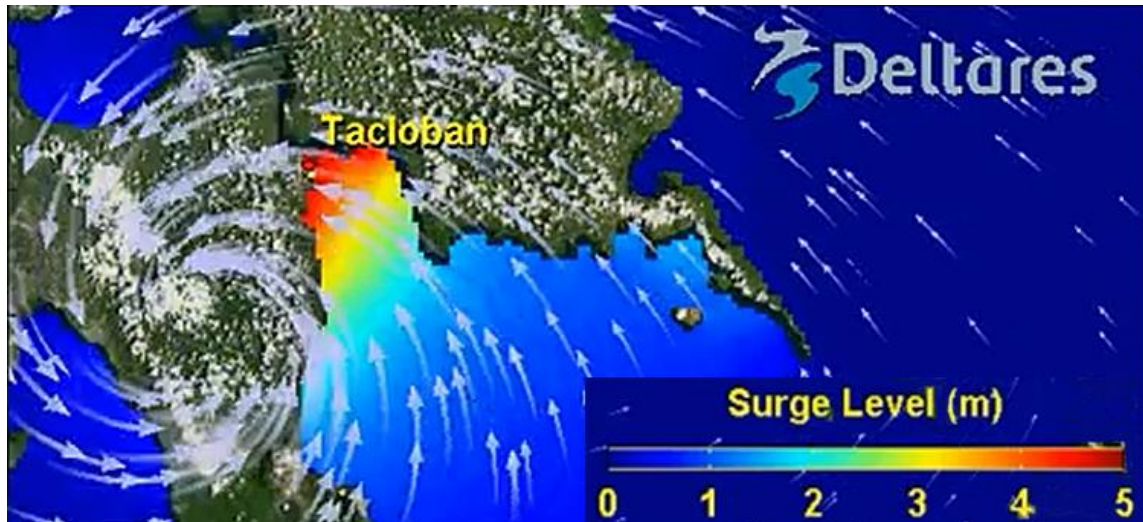
- abnormal rise in seawater level during a storm
- caused primarily by a storm's winds pushing water onshore
- greatest threat to life actually comes from the storm surge



This example illustrates water level differences for storm surge, storm tide compared to sea level.

Storm Surge

- abnormal rise in seawater level during a storm
- caused primarily by a storm's winds pushing water onshore
- greatest threat to life actually comes from the storm surge



Storm surge of Haiyan (2013)

Storm forecast and data collection

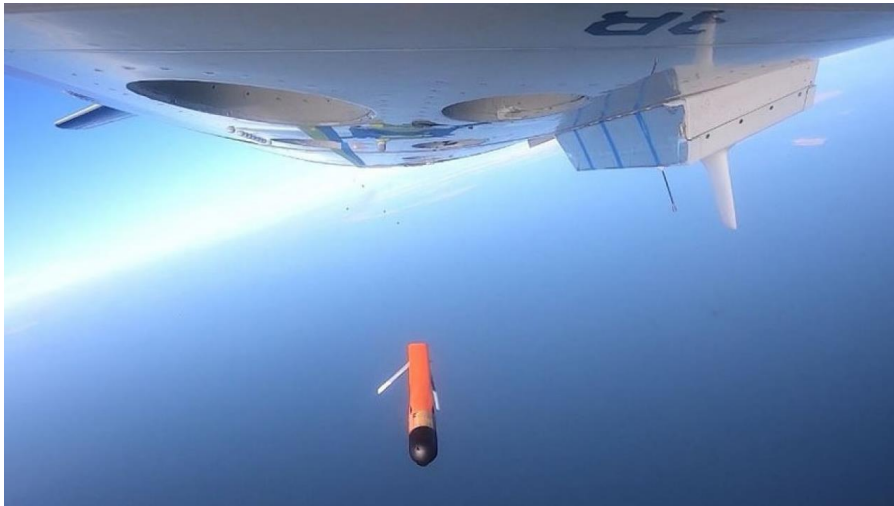


NOAA Hurricane Hunters

- integral role in hurricane forecasting
- Slicing through the eyewall of a hurricane
- continuously transmit measurements of pressure, humidity, temperature, and wind direction and speed
- New experiments with drone technology (2021)



Hurricane Hunter aircraft



Altius-600
uncrewed
aircraft
(research
drone)



NOAA Hurricane Hunters



Hurricane Hunters punched through Epsilon's eyewall in 2021 („stadium effect“)

Summary

Basic
concepts



TOP 5 of all
time



Categorization



Hurricane
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The image is a composite of two photographs. The left side shows a two-story house with significant structural damage, including missing roof sections and exposed interior walls. A white car is partially visible in the foreground, surrounded by a large pile of wooden debris and rubble. The right side shows a close-up view of a massive pile of debris, including wooden planks, beams, and other building materials, under a cloudy sky. The text "Thank you for your attention!" is overlaid in the center of the left image.

Thank you for your attention!