HURRICANE
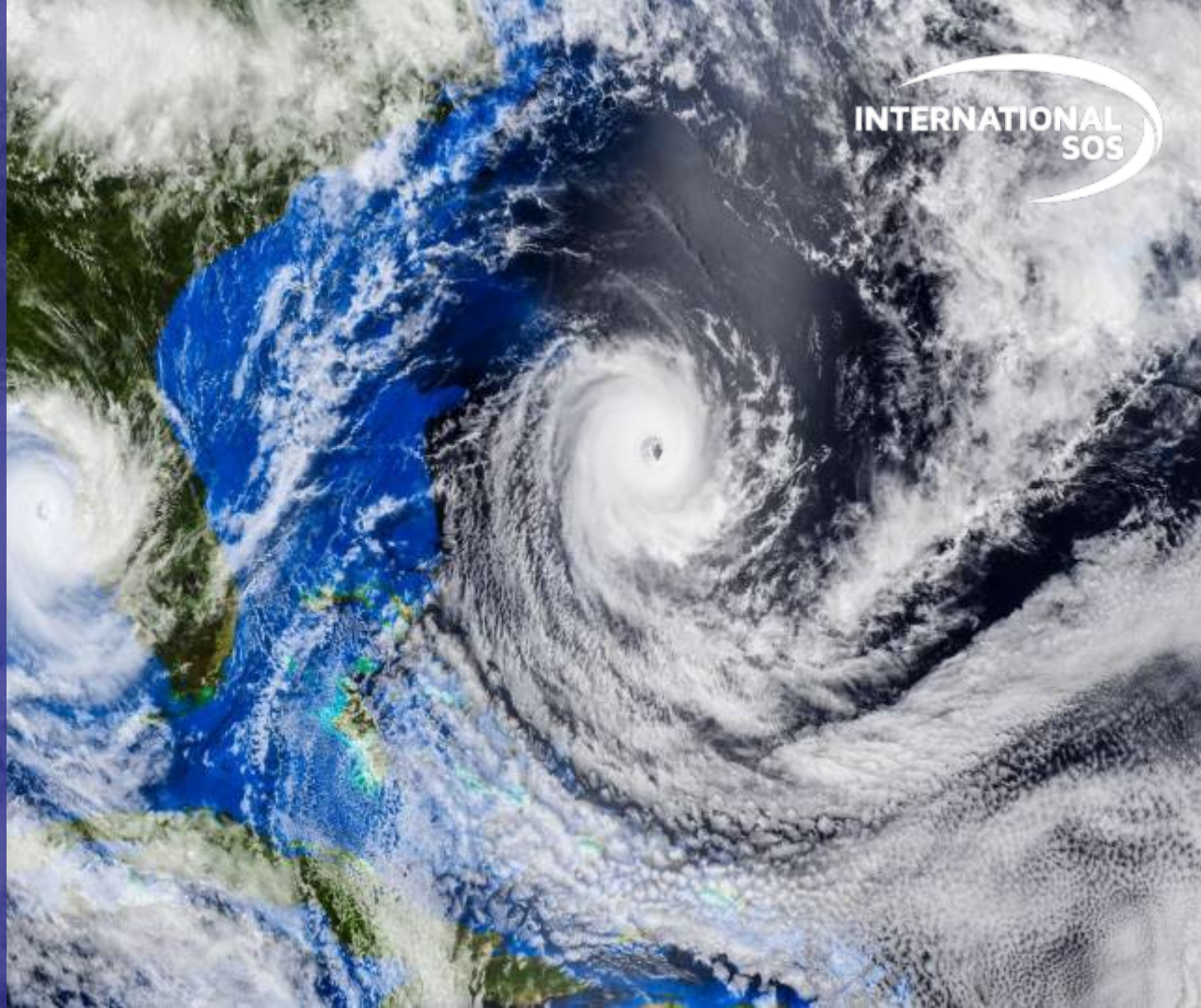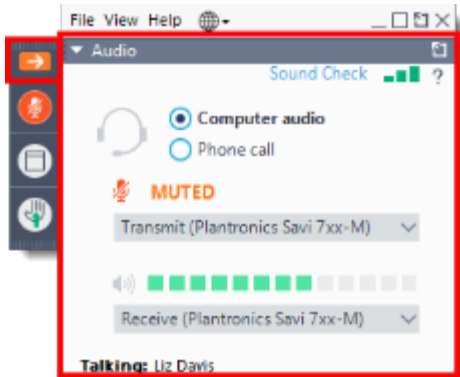# Readiness
2023

May 30, 2023

INTERNATIONAL SOS

GOTOWEBINAR HOUSEKEEPING: ATTENDEE PARTICIPATION

Your Participation

Submit your questions using the **questions** panel, we will answer as time allows.

Note: Today's presentation is being recorded and will be provided via email.

INTERNATIONAL SOS

SPEAKERS

AGENTA

JOSH DOZOR
General Manager, Assistance
Operations, Americas
International SOS

PAUL DOUCET
Security Director, Assistance
International SOS

INTERNATIONAL
SOS

- 2023 Hurricane Season Storms & Forecast

- Lessons Learned
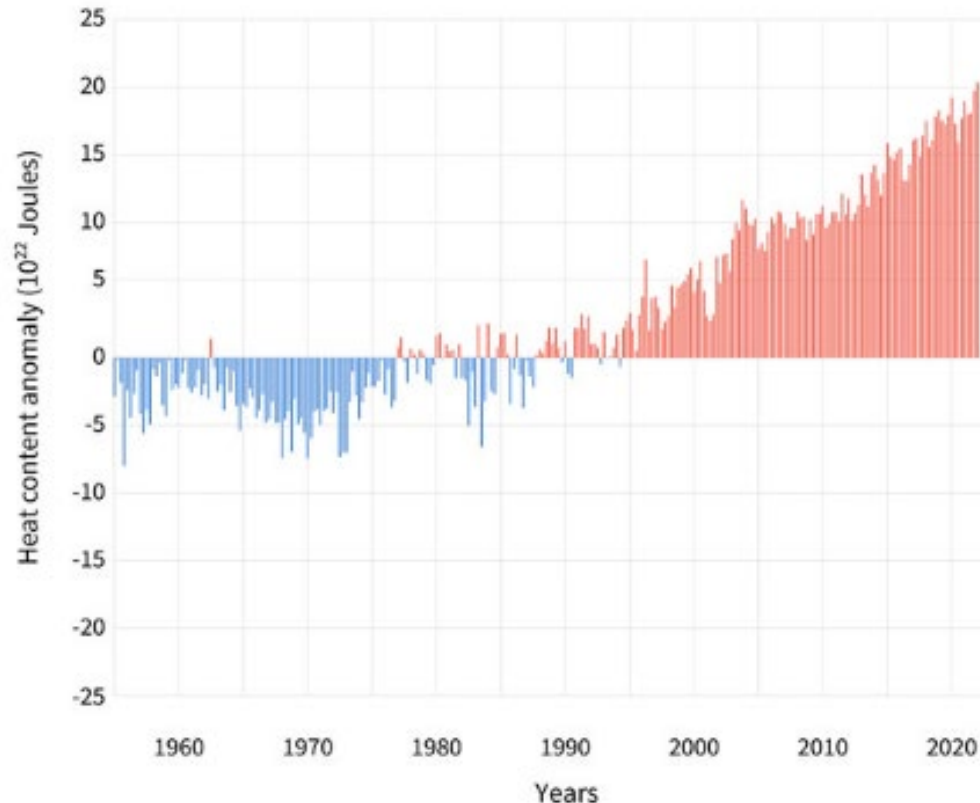
- Support from International SOS

HURRICANE FORECASTS

tcome

2022 Revised

3 Hurricanes)

11 Hurricanes)

Hurricane)

2022 Began Slow
- Persistent wi

oast of Africa

2023 12-17 S
1-4 Ma

This Season

l storm formed

phoon

nes (Freddy & Mocha)

2023 Characteri
- El Nino and r
- Favorable W

yphoon Mawar

ic

OCEAN HEAT COMPARED TO AVERAGE

Heat content anomaly (10^{22} Joules) vs. Years (1960–2020)

2023 SEASON ..... WHAT'S IN STORE

INTERNATIONAL SOS

Central North Pacific

Akoni	Aka
Ema	Ekeka
Hone	Hene
Lona	Iolana
Keli	Keoni
Lala	Lino
Moke	Mele
Nolo	Nona
Olana	Oliwa
Pena	Pama
Ulana	Upana
Wale	Wene

Eastern Pacific

Adrian	Max
Beatriz	Norma
Calvin	Otis
Dora	Pilar
Eugene	Ramon
Fernanda	Selma
Greg	Todd
Hilary	Veronica
Irwin	Wiley
Jova	Xina
Kenneth	York
Lidia	Zelda

Atlantic

Arlene	Margot
Bret	Nigel
Cindy	Ophelia
Don	Philippe
Emily	Rina
Franklin	Sean
Gert	Tammy
Harold	Vince
Idalia	Whitney
Jose	
Katia	
Lee	

*IT ONLY TAKES ONE HURRICANE LANDFALL
TO DEFINE A REMARKABLE SEASON*

Tropical Cyclone Basins

INTERNATIONAL SOS

Equator
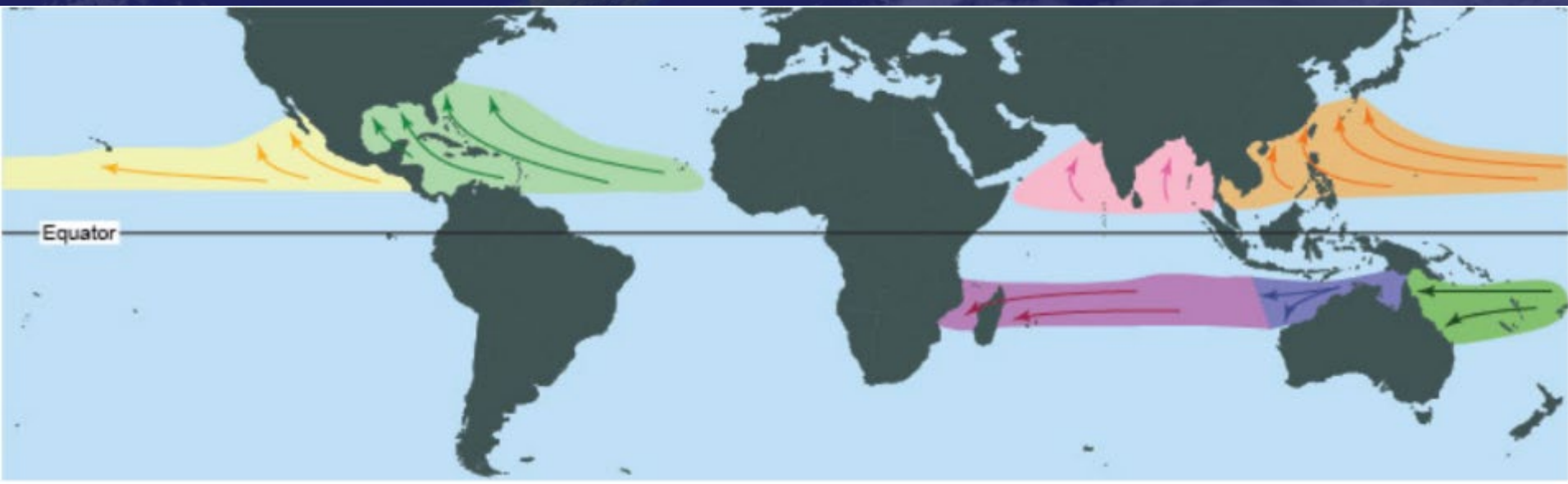
Favorable Conditions for monitoring include:
- Warm ocean waters
- Low vertical wind shear (ie change in wind speed with height)
- Pre-Existing surface disturbance (ie tropical waves)
- Model consistency

Tropical Depression: Max sustained winds of 38 mph or less

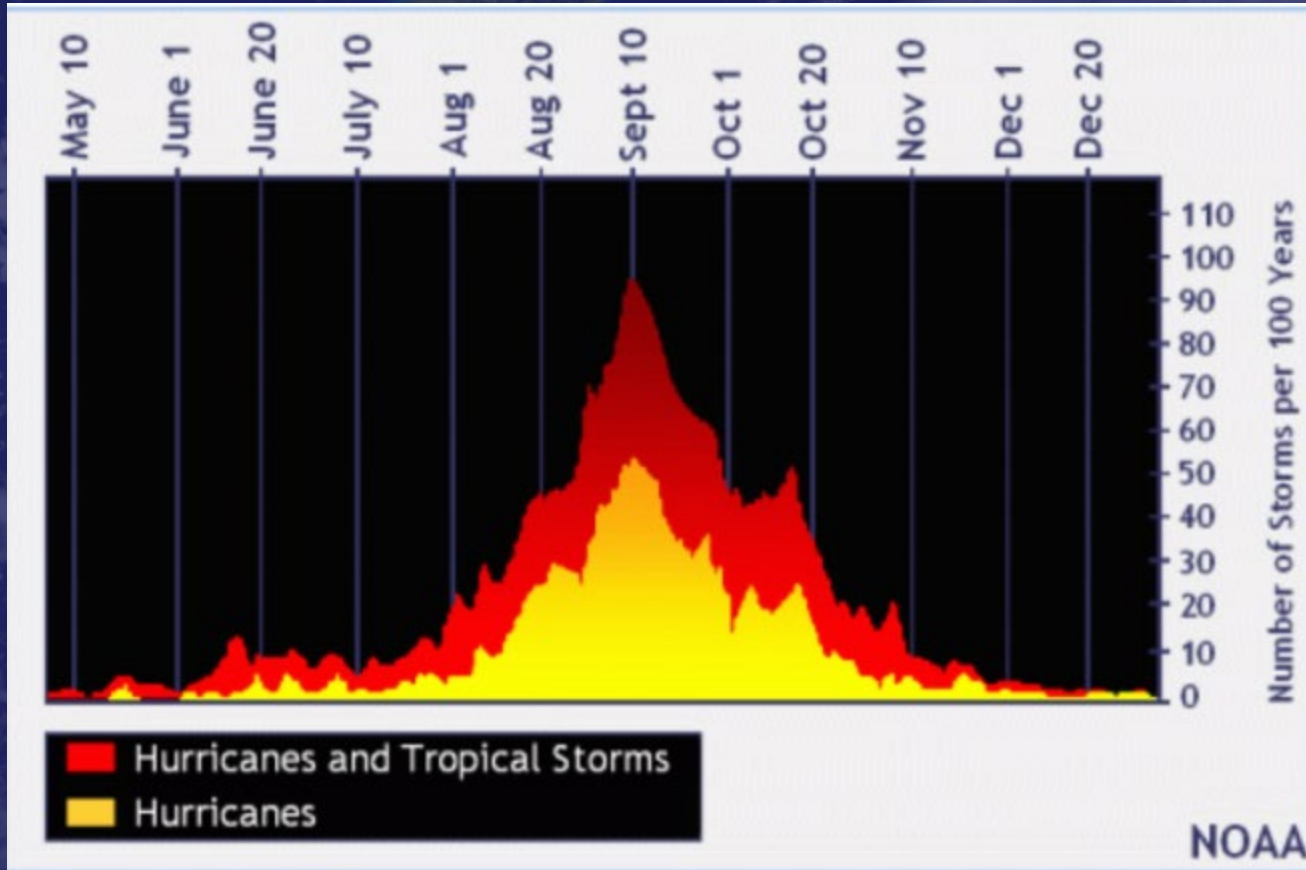**Tropical Storm:** max sustained winds of 39-73 mph

Hurricane/Typhoon: Max sustained winds of 74 mph (Cat 1-2)

Major Hurricane/Typhoon: Max sustained winds of 111 mph (Cat 3-5)

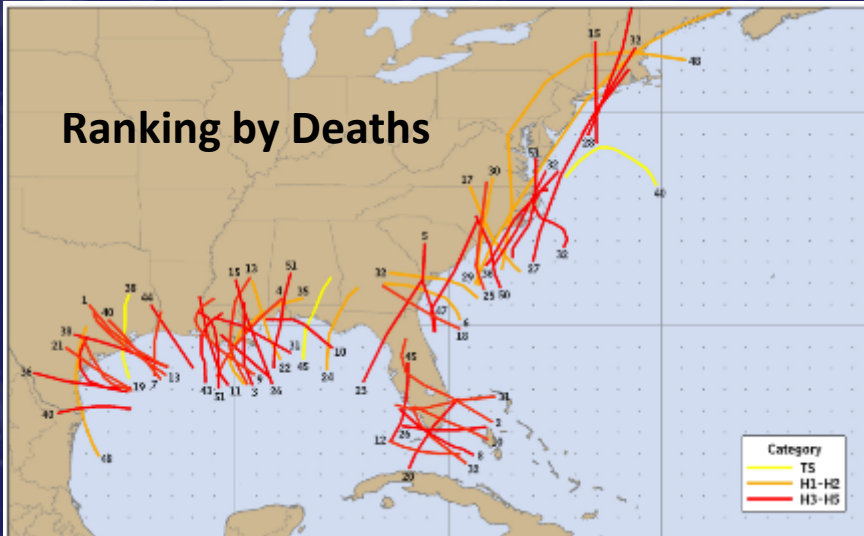# The Life Cycle of a Cyclone

TROPICAL CYCLONES PAST 100 YEARS

Hurricanes and Tropical Storms
Hurricanes

NOAA

https://www.nhc.noaa.gov/climo/images/peakofseason.gif
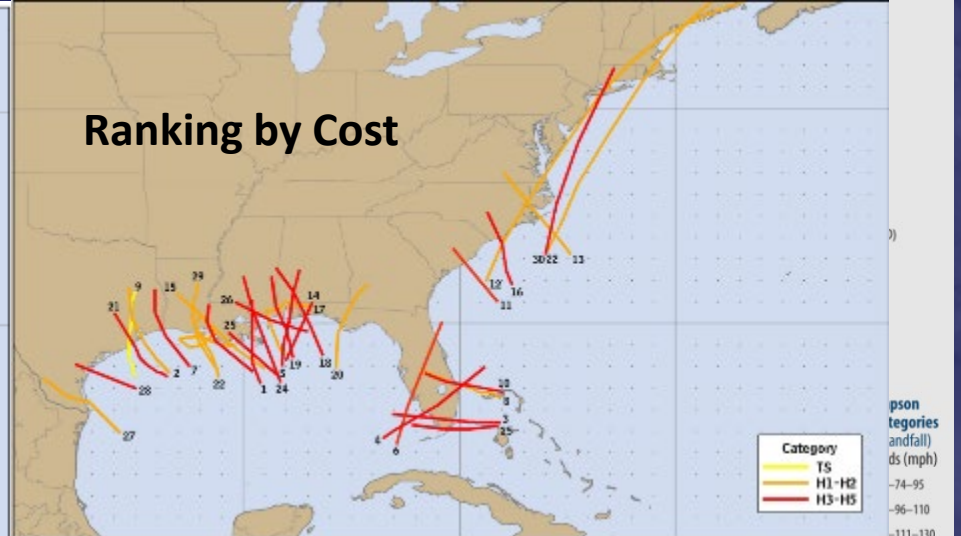
OK, BUT WHERE ARE THE WORST STORMS?

Ranking by Deaths

Ranking by Cost
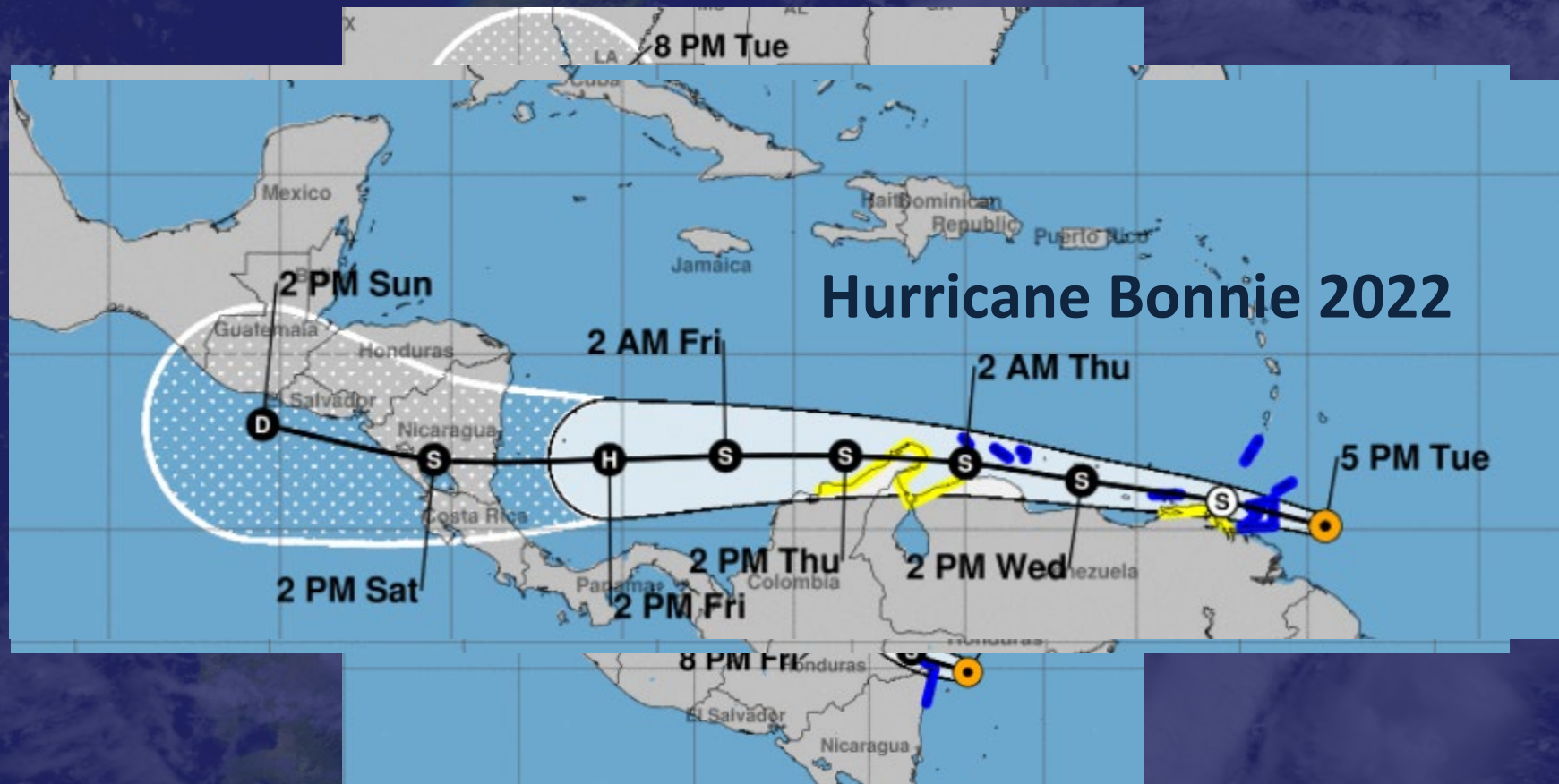
1. TX Galveston – 8000 (1900)
2. FL Lake Okeechobee – 2500 (1928)
3. Katrina – 1200 (2005)

1. Katrina - $108 billion (2005)
2. Ian - $100 billion (2022)
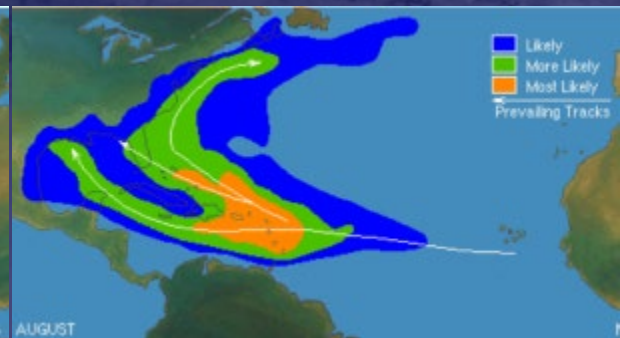3. Ike - $29.5 billion (2008)
4. Andrew - $26.5 billion (1992)

SOUTHERN RISKS ARE INCREASING
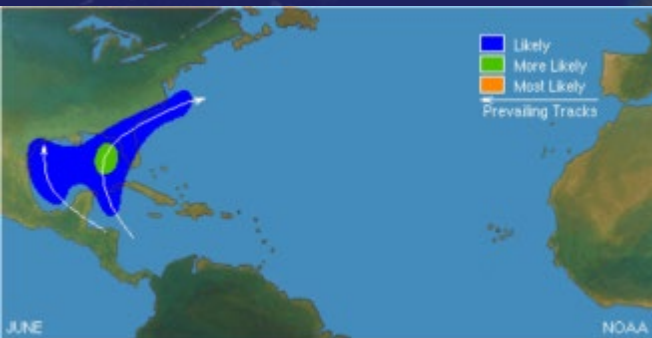
Hurricane Bonnie 2022
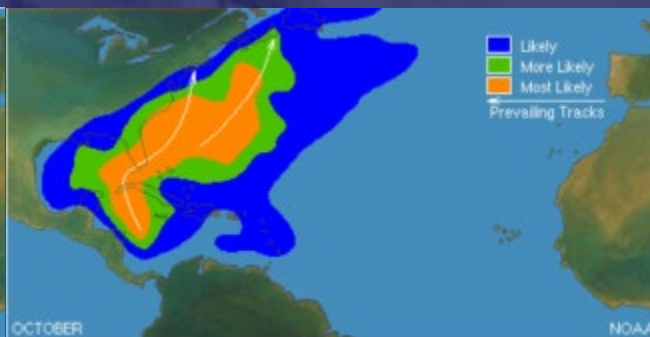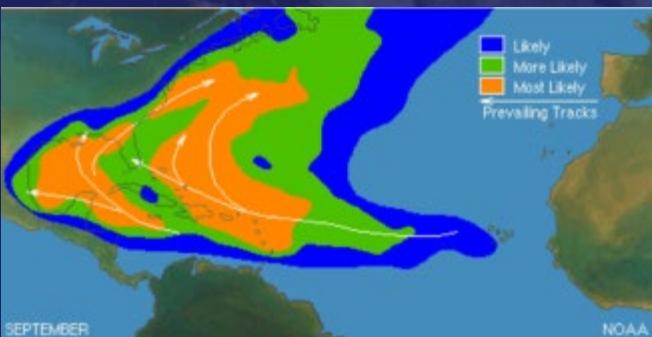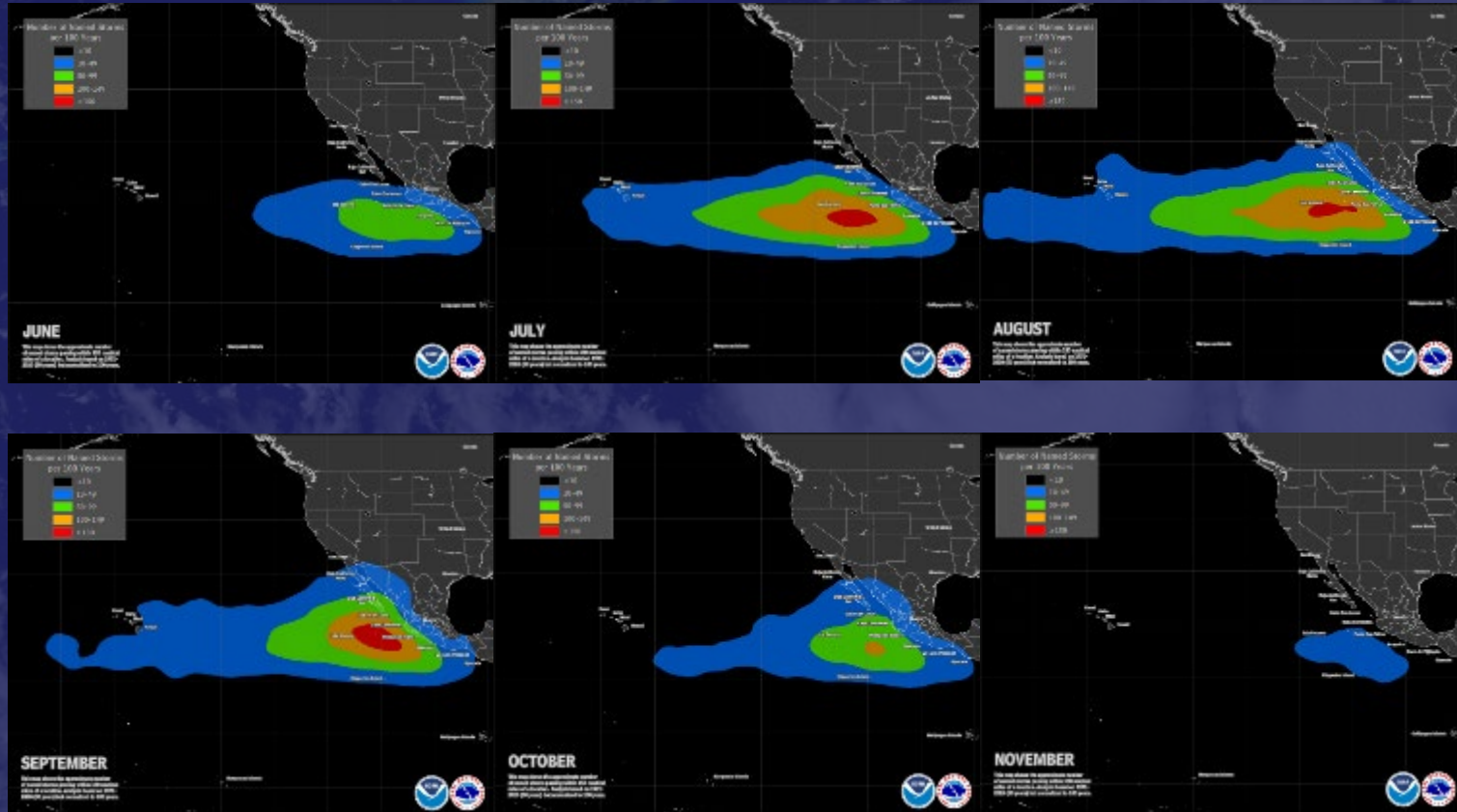
CYCLONE AREAS OF ORIGIN BY MONTH

Andrew, Charley, Gustav, Harvey, Ike, Irene, Isaac
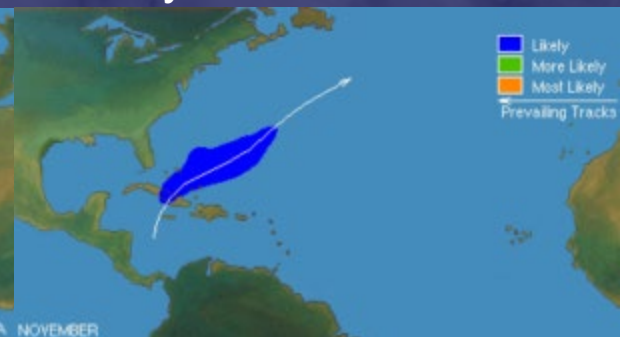
Ian, Irma, Hugo, Isabel, Maria, Katrina, Rita

Michael, Sandy, Wilma

https://www.nhc.noaa.gov/climo/

PACIFIC CYCLONE ORIGIN BY MONTH
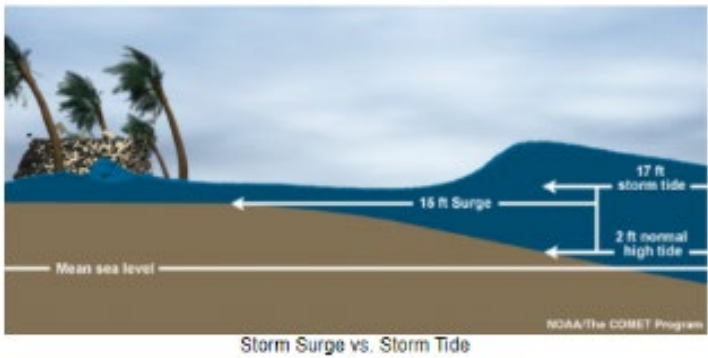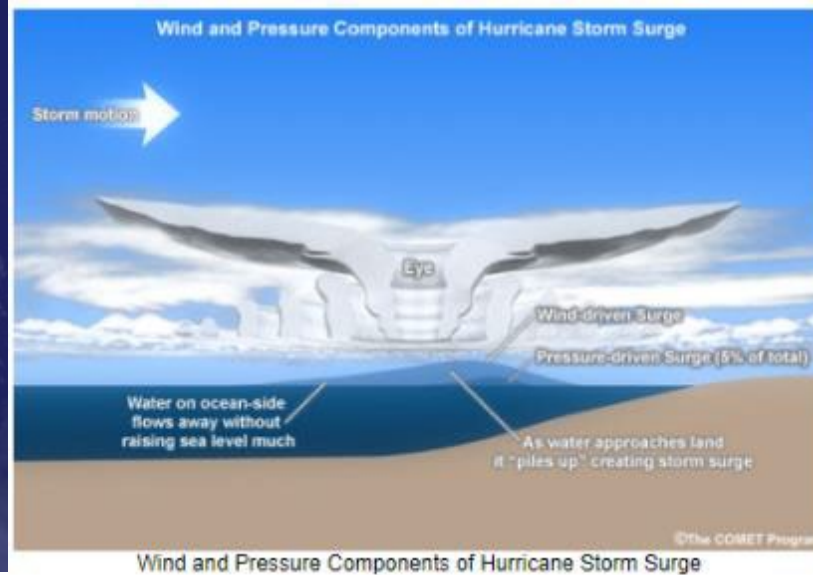

https://www.nhc.noaa.gov/climo/

KEY HAZARDS & STORM SURGE

- Storm surge and storm tide
- Heavy rainfall and inland flooding
- High winds
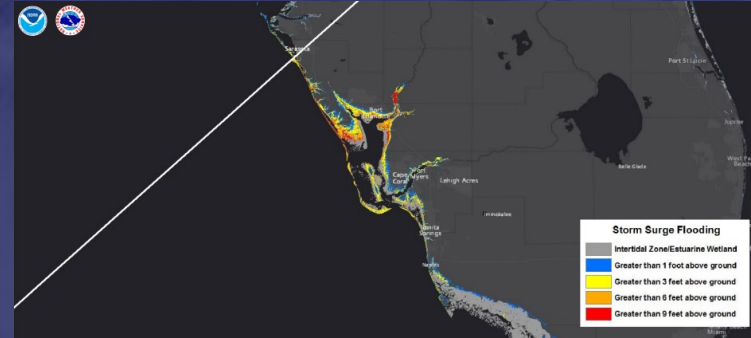- Rip currents
- Tornadoes

Surge Key Factors:
- Width and slope of the shelf
- Size
- Storm intensity
- Forward speed
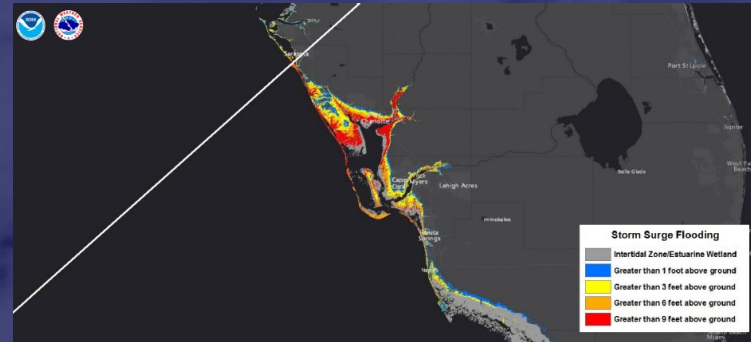- Angle of approach
- Central pressure

Wind and Pressure Components of Hurricane Storm Surge

Eye

Wind-driven Surge

Pressure-driven Surge (5% of total)

Water on ocean-side flows away without raising sea level much

As water approaches land it "piles up" creating storm surge

©The COMET Program

Wind and Pressure Components of Hurricane Storm Surge

17 ft storm tide

15 ft Surge

2 ft normal high tide

Mean sea level

Storm Surge vs. Storm Tide

NOAA/The COMET Program

Less than 3 feet above ground
Greater than 3 feet above ground
Greater than 6 feet above ground
Greater than 9 feet above ground
Leveed area
Consult local officials for flood risk

https://www.nhc.noaa.gov/

KEY HAZARDS (STORM SURGE)

Category 3

Category 4

Water goes where the wind pushes it

https://www.nhc.noaa.gov/

KEY HAZARDS (INLAND FLOODING)

MARKET STREET, HOUSTON

GOOGLE MAPS, 2016

AUG. 27, 2017

INTERSTATE 10, HOUSTON

GOOGLE MAPS, 2017

AUG. 27, 2017

Interstate 10 – West View

Interstate 10 – West View

Houston Chronicle
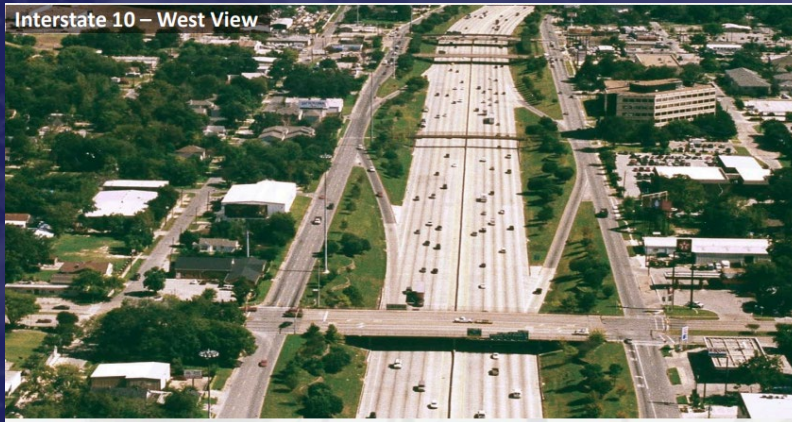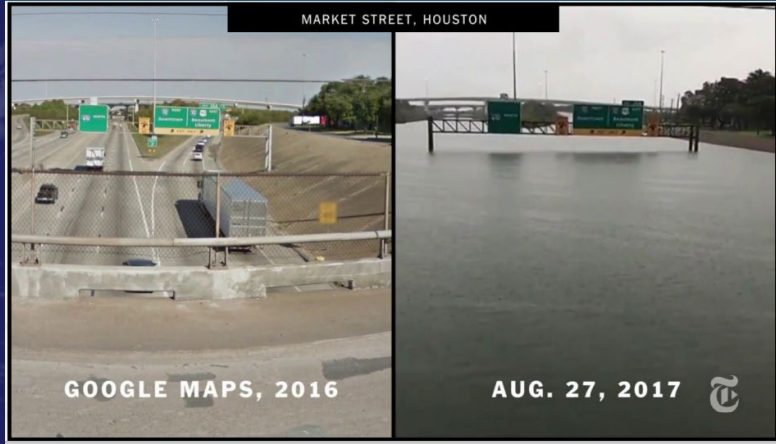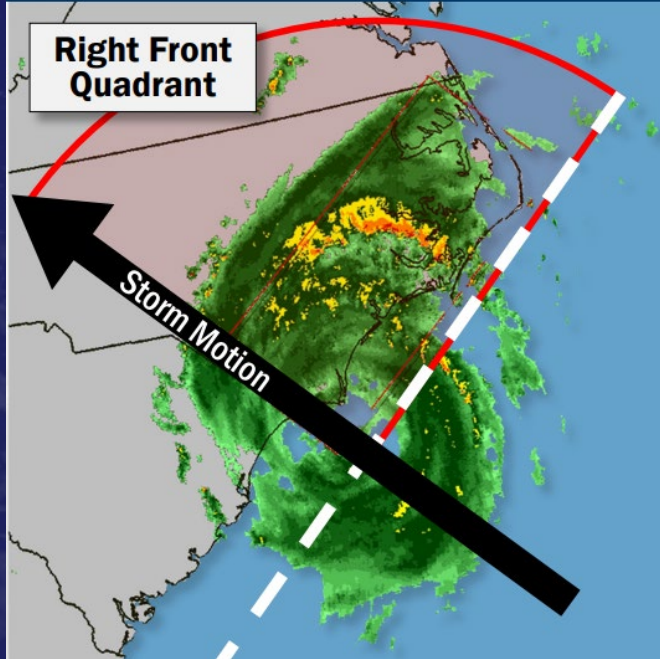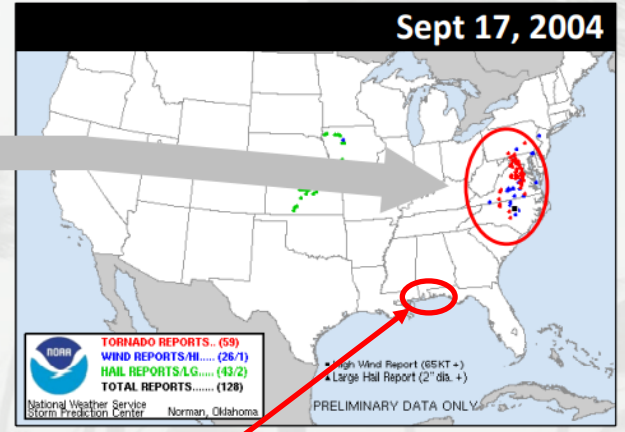
KEY HAZARDS (TORNADOS)

- ❑ Friction over land creates low-level wind conditions favorable for the development of tornados
- ❑ 70% of hurricanes produce at least 1 tornado and 40% produce at least 3 tornados
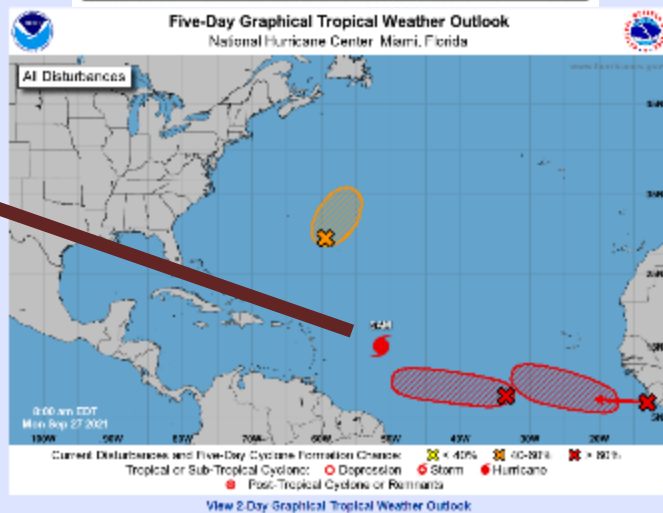- ❑ Formation may occur well after landfall

Right Front Quadrant

Storm Motion

Sept 17, 2004

Tornado "outbreak"

Hurricane Ivan (2004)
- 117 Tornadoes

TORNADO REPORTS.. (59)
WIND REPORTS/HI..... (26/1)
HAIL REPORTS/LG..... (43/2)
TOTAL REPORTS....... (128)

National Weather Service
Storm Prediction Center   Norman, Oklahoma

High Wind Report (65 KT +)
Large Hail Report (2" dia. +)

PRELIMINARY DATA ONLY

Where did Ivan make Landfall?

https://www.nhc.noaa.gov/

NHC FORECAST PRODUCTS

Actual storm position will be within the cone 67% of the time

https://www.nhc.noaa.gov/

FORECAST UNCERTAINTY

Forecast accuracy improves every year, but is still far from perfect

- ❑ Track error increases about 40 miles with each projected day
- ❑ The lesser-intense storms experience the greatest error
- ❑ Rapid intensification remains a forecast challenge
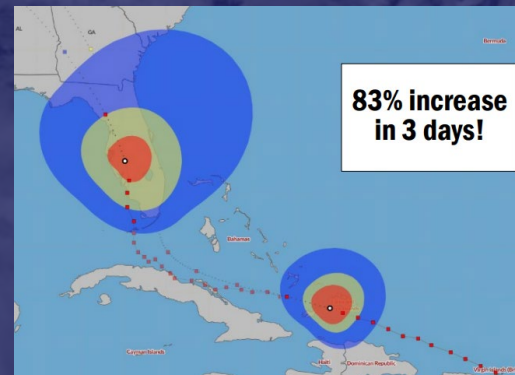
83% increase in 3 days!

Forecasted

Deterministic SLOSH
Limited surge threat to Pensacola area

Actual

Hurricane Ivan Storm Surge

https://www.nhc.noaa.gov/

PLANNING
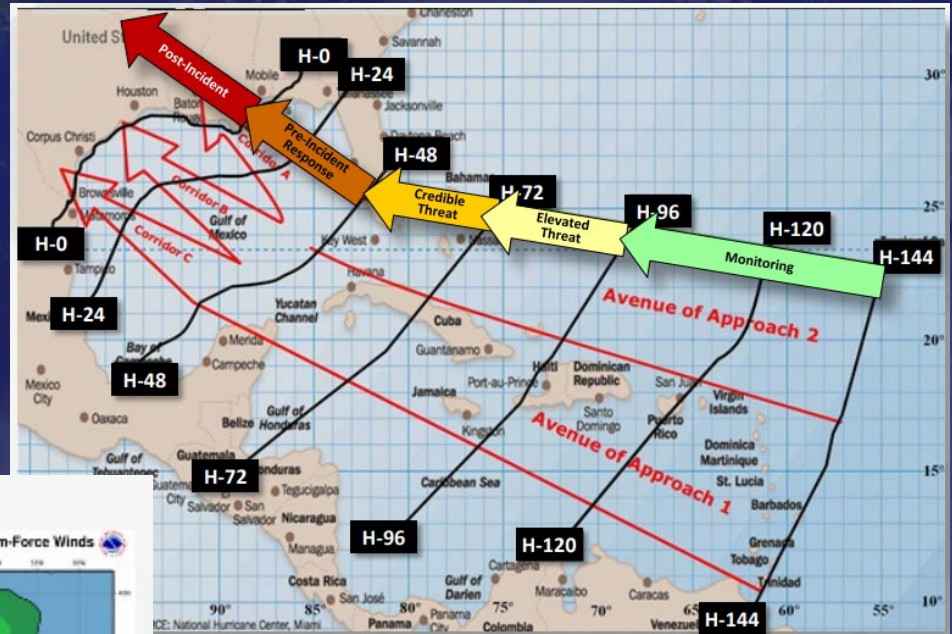
❑ How much time is needed to evacuate or take protective action BEFORE the onset of tropical storm-force winds?

❑ What is your level of acceptable risk given forecast uncertainty?

EARLIEST REASONABLE

- **10% chance of onset**
  - Most conservative timing

- **Arrival time of TS winds**
  - Black contours

- **5-day cumulative TS probabilities**
 - Color fill

❑ In comparison, the 'Most Likely' arrival of TS-force winds presents a 50% chance of onset

https://www.nhc.noaa.gov/

BOTTOM LINE

- Major Hurricanes remain highly likely every year; *it's all about preparation.*

- Resilience = flexibility; *widen assumed parameters*

- Info is critical; *rely on trustworthy sources*

- Communication is key; *redundancy is a must*

- Ensure support; *good network partner make all the difference*
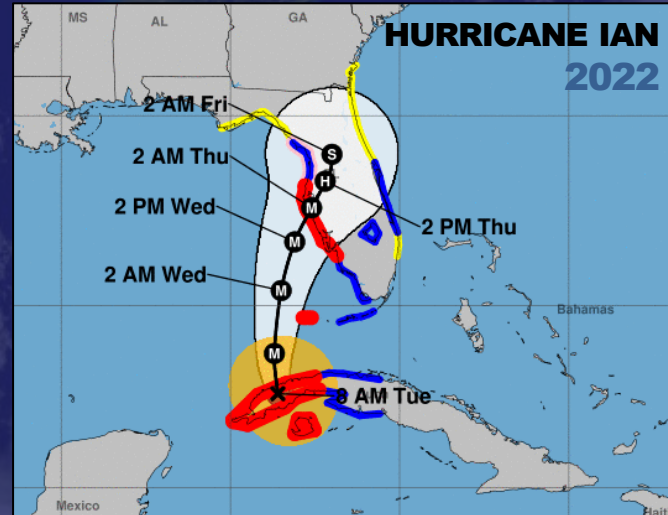
HURRICANE IAN 2022

Hurricane Ian was the storm of the 2022 season, peaking as a Category 5 storm on September 28 before striking Florida's Gulf Coast. The cyclone caused widespread destruction on Sanibel island and Fort Myers, in total causing 161 deaths and over $100 billion in damages.


HURRICANE SANDY 2012
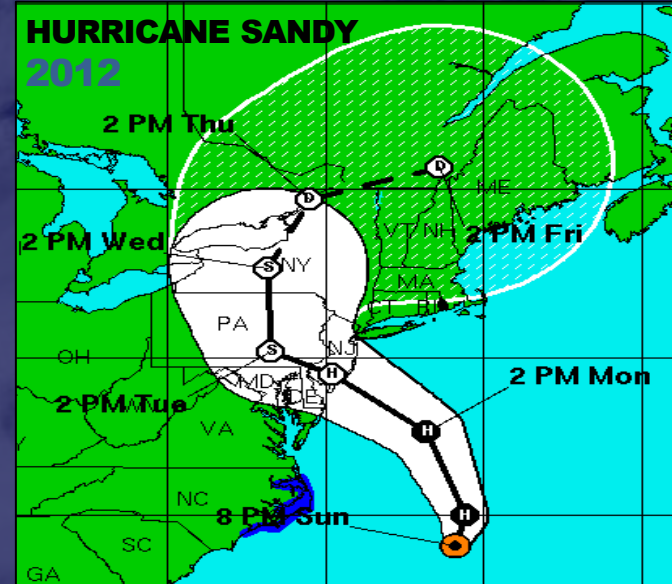
Hurricane Sandy struck the Mid-Atlantic/Northeast coast resulting in 23,000 people seeking temporary shelter and more than 8.5 million without power. The storm flooded numerous roads and tunnels, blocked transport corridors, and displaced hundreds of thousands of people.

BOTTOM LINE

- **Early preparation**: Assess vulnerability / exposure – *people and assets, sources of support*
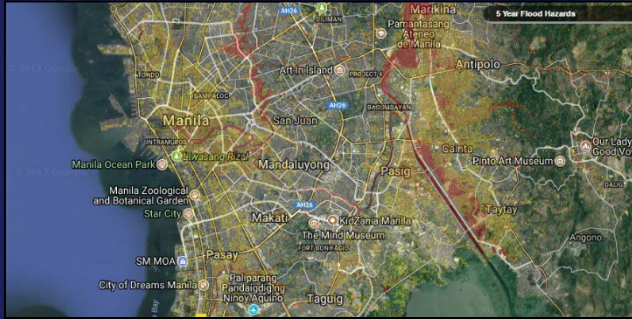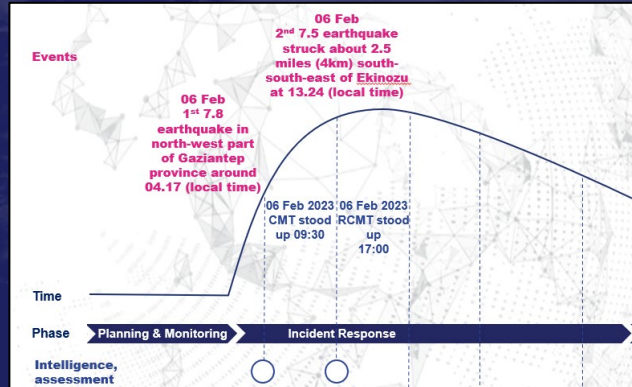

Metro Manila: Flood Hazard Map (5 yrs) http://noah.dost.gov.ph/
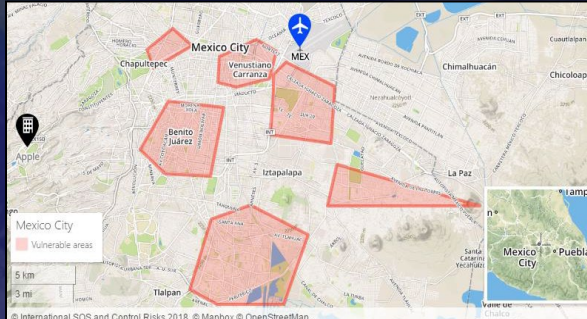
Mexico City: Earthquake vulnerability map

- **Response**: Stay flexible, time is a commodity, manage the 'mini-crises', leverage your network

Q&A

THANK YOU FOR ATTENDING

Webinar recording and materials will be emailed within the next few hours.

INTERNATIONAL SOS