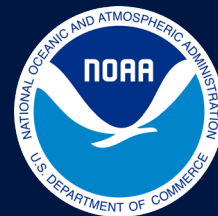


# From Uncertainty to Warnings: Making Watch and Warning Decisions

Robbie Berg  
Warning Coordination Meteorologist  
NOAA National Hurricane Center

**2026 National Hurricane Conference**  
Orlando, Florida  
April 1, 2026



U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Weather Service / National Hurricane Center

# What is the purpose of tropical watches and warnings?

- The National Weather Service (including the National Hurricane Center) issues hurricane, tropical storm, and storm surge watches and warnings to **alert the public, emergency managers, and decision makers** about the potential for hazardous wind and storm surge from tropical cyclones
- Watches and warnings serve as a cue for people to take timely protective actions
- They must include a realistic measure of forecast uncertainty to adequately alert people of their risk

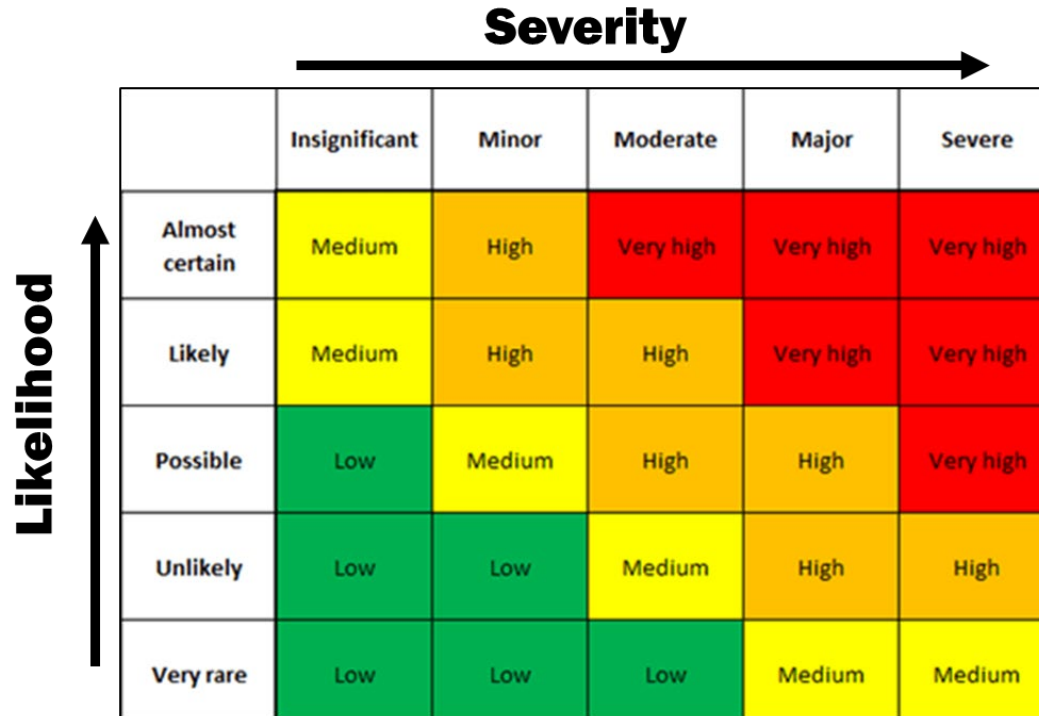
# What is Risk?

**Risk: the potential of gaining or losing something of value**

**Risk = Probability × Consequence × Vulnerability**

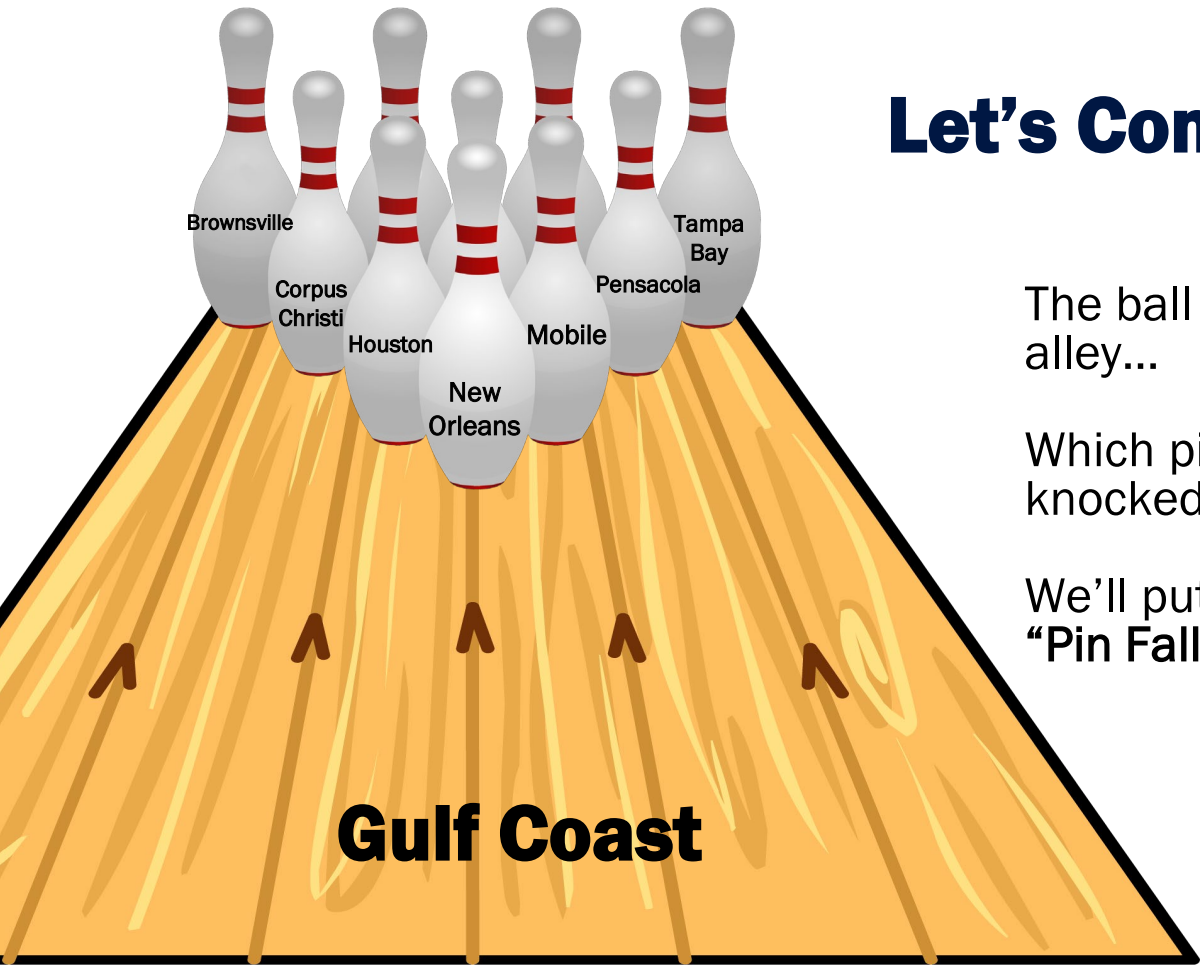
**Watches and warnings should be thought of a risk communication tools, not explicit forecasts!**

# Risk Matrix: Low-Probability, High-Consequence Events



A risk matrix diagram showing the relationship between Likelihood and Severity. The vertical axis is labeled 'Likelihood' with an upward-pointing arrow, and the horizontal axis is labeled 'Severity' with a rightward-pointing arrow. The matrix is a 5x5 grid with colored cells representing risk levels. The colors range from green (Low) to red (Very high).

	Severity →					
	Insignificant	Minor	Moderate	Major	Severe	
Likelihood ↑	Almost certain	Medium	High	Very high	Very high	Very high
	Likely	Medium	High	High	Very high	Very high
	Possible	Low	Medium	High	High	Very high
	Unlikely	Low	Low	Medium	High	High
	Very rare	Low	Low	Low	Medium	Medium



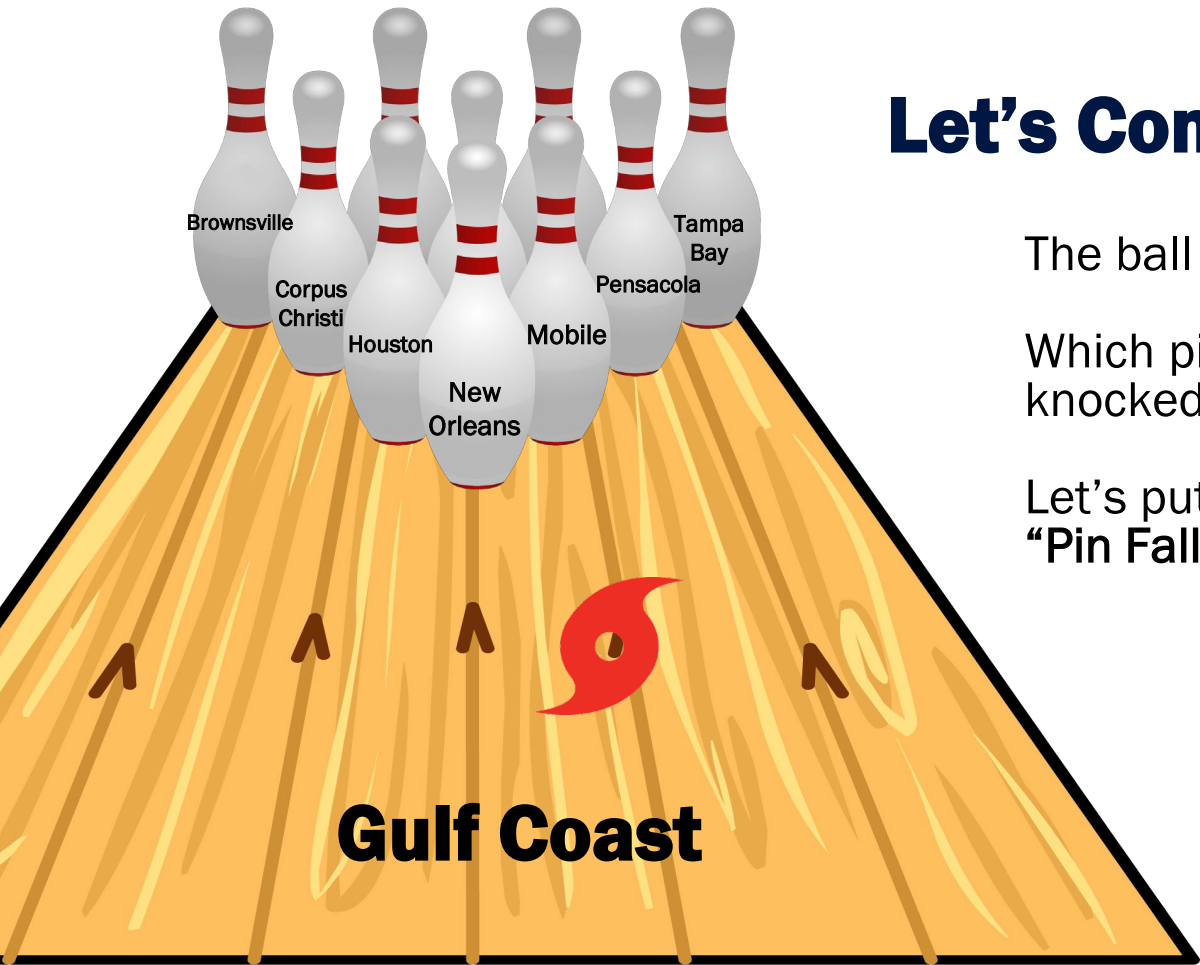
## Let's Communicate Risk...

The ball is about to be thrown down the alley...

Which pins have a possibility of being knocked over?

We'll put these pins under a "Pin Fall Watch"





## Let's Communicate Risk...

The ball is traveling down the alley...

Which pins do we now expect to be knocked over?

Let's put these pins under a "Pin Fall Warning"

Are the other pins still at risk of being knocked over?

We'll keep these pins under the "Pin Fall Watch"

# HURRICANE WATCH

---

A Hurricane Watch is issued when **hurricane conditions are possible, typically within 48 hours.**

Prepare your home by boarding up windows and moving loose items indoors. Have an emergency supply kit ready.

---

**Hurricane Winds Possible.**

# HURRICANE WARNING

---

A Hurricane Warning is issued when **hurricane conditions are expected, typically within 36 hours.**

Be ready to seek shelter in a sturdy structure or evacuate if ordered.

---

**Hurricane Winds Expected!**



# TROPICAL STORM WATCH

---

A Tropical Storm Watch is issued when **tropical storm conditions are possible, typically within 48 hours.**

Prepare your home by securing loose items outside or moving them indoors. Have an emergency supply kit ready and charge your devices.

---

**Tropical Storm Winds Possible.**

# TROPICAL STORM WARNING

---

A Tropical Storm Warning is issued when **tropical storm conditions are expected, typically within 36 hours.**

Follow the advice of local officials and be ready to seek shelter in a sturdy structure.

---

**Tropical Storm Winds Expected!**



weather.gov

# **Extreme Wind Warnings** Explained



*The National Weather Service issues an Extreme Wind Warning when sustained hurricane winds of 115 mph or greater are happening now or expected within one hour. At these wind speeds, trees and wooden power poles are snapped and debris becomes dangerous missiles.*

## **Protect Yourself!**

- ✓ Take immediate shelter in an interior portion of a well-built structure.
- ✓ Stay away from windows.
- ✓ Put as many walls between you and the outside as possible.

# STORM SURGE WATCH

---

A Storm Surge Watch is issued when *life-threatening storm surge is possible*, typically within 48 hours.

Promptly follow evacuation and other instructions from local officials.

---

## Surge Possible.



weather.gov

# STORM SURGE WARNING

---

A Storm Surge Warning is issued when *there is a danger of life-threatening storm surge*, typically within 36 hours.

Promptly follow evacuation and other instructions from local officials.

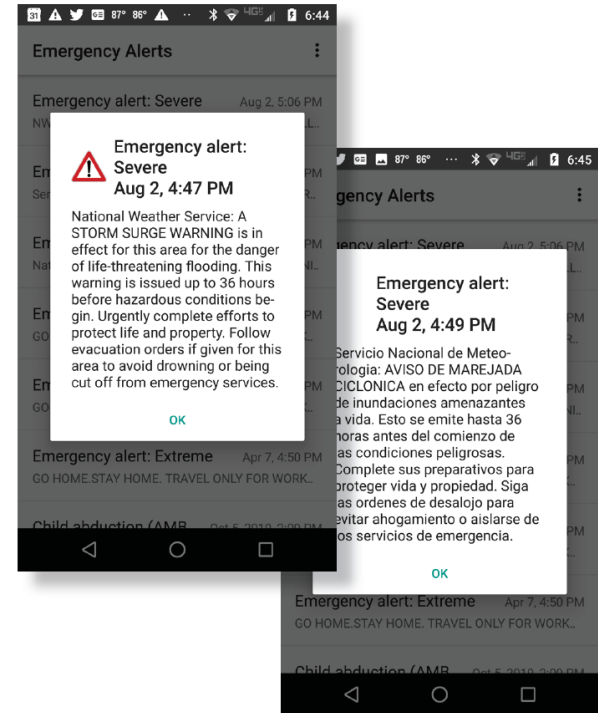
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## Surge Expected!

# WEA and Hurricanes

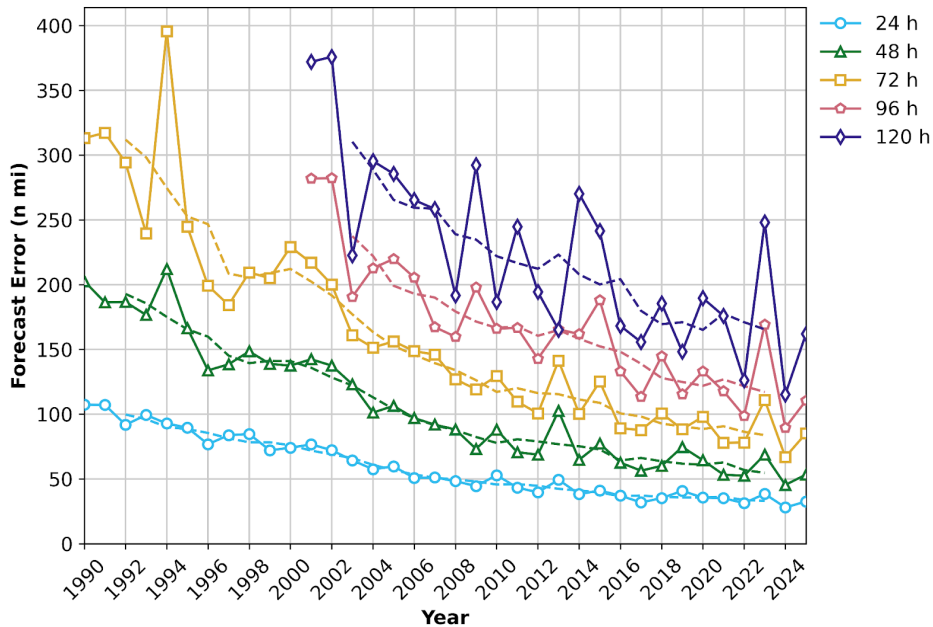
## WEA Triggered for...

- Any “NEW” Hurricane Warning
  - Tropical storm→Hurricane conditions within 36 hours
- Any “NEW” Storm Surge Warning
  - Life-threatening storm surge within 36 hours
- Any “NEW” Extreme Wind Warning
  - Winds of 115 mph or more associated with a hurricane’s eyewall within the hour



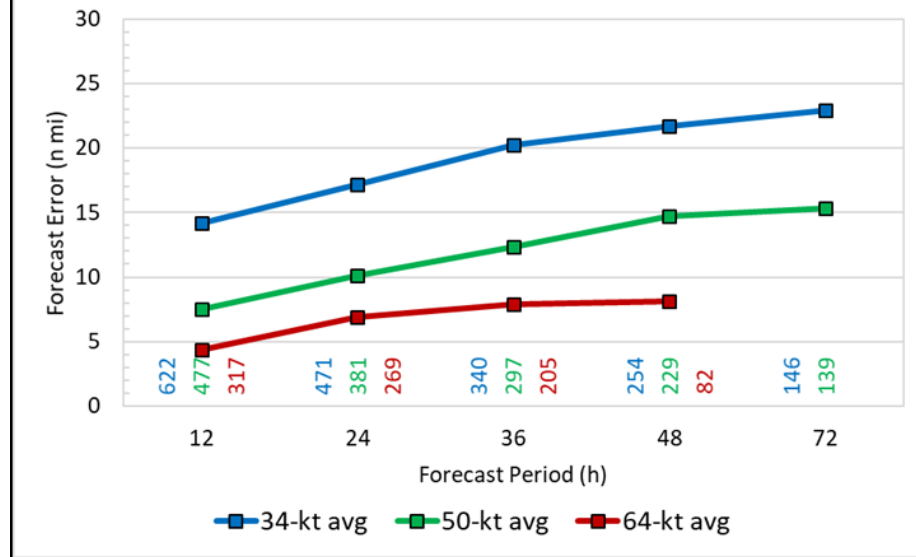
# How Much Uncertainty Do We Account For?

**NHC Official Track Error Trend  
Atlantic Basin**



48-hour NHC errors (Watch Lead Time): Track: 45-50 nm  
 36-hour NHC errors (Warning Lead Time): Track: 35-40 nm

**NHC Official Wind Radii Errors  
Atlantic Basin with Recon (2013-2022)**

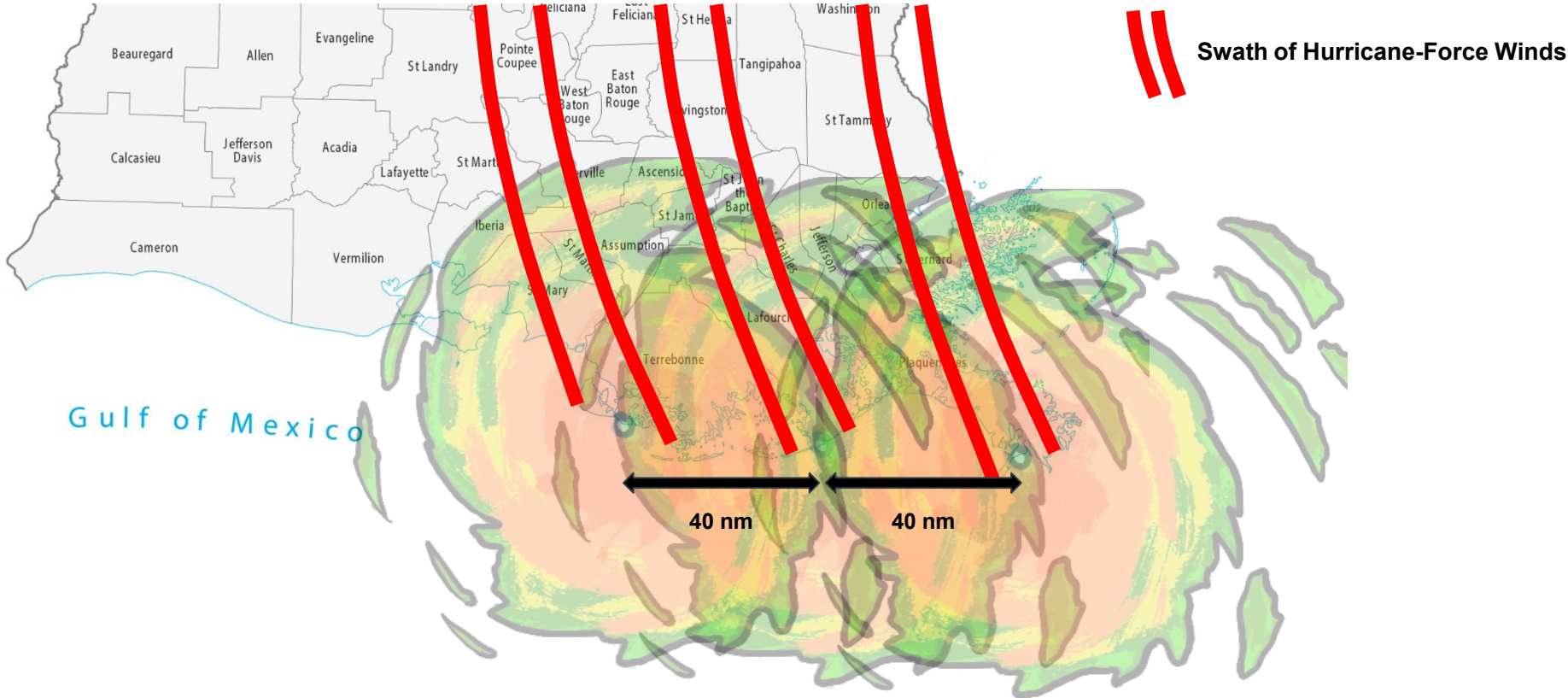


TS Radii: 20-25 nm  
 TS Radii: ~20 nm

HU Radii: 5-10 nm  
 HU Radii: 5-10 nm

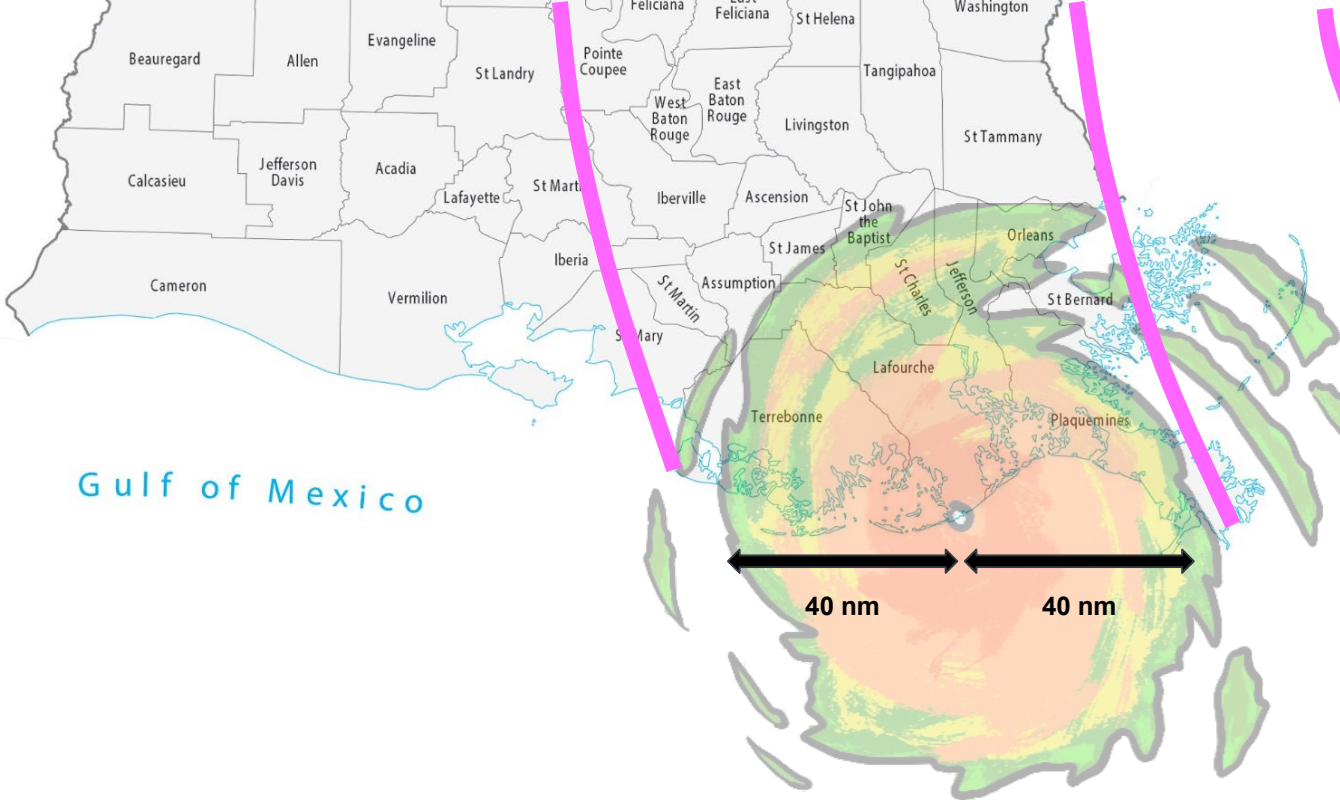
# Watches and Warnings as Risk Communication Tools

NHC's track forecasts are off by an average of 35-40 nm at 36 hours (warning lead time)



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NHC's track forecasts are off by an average of 35-40 nm at 36 hours (warning lead time)



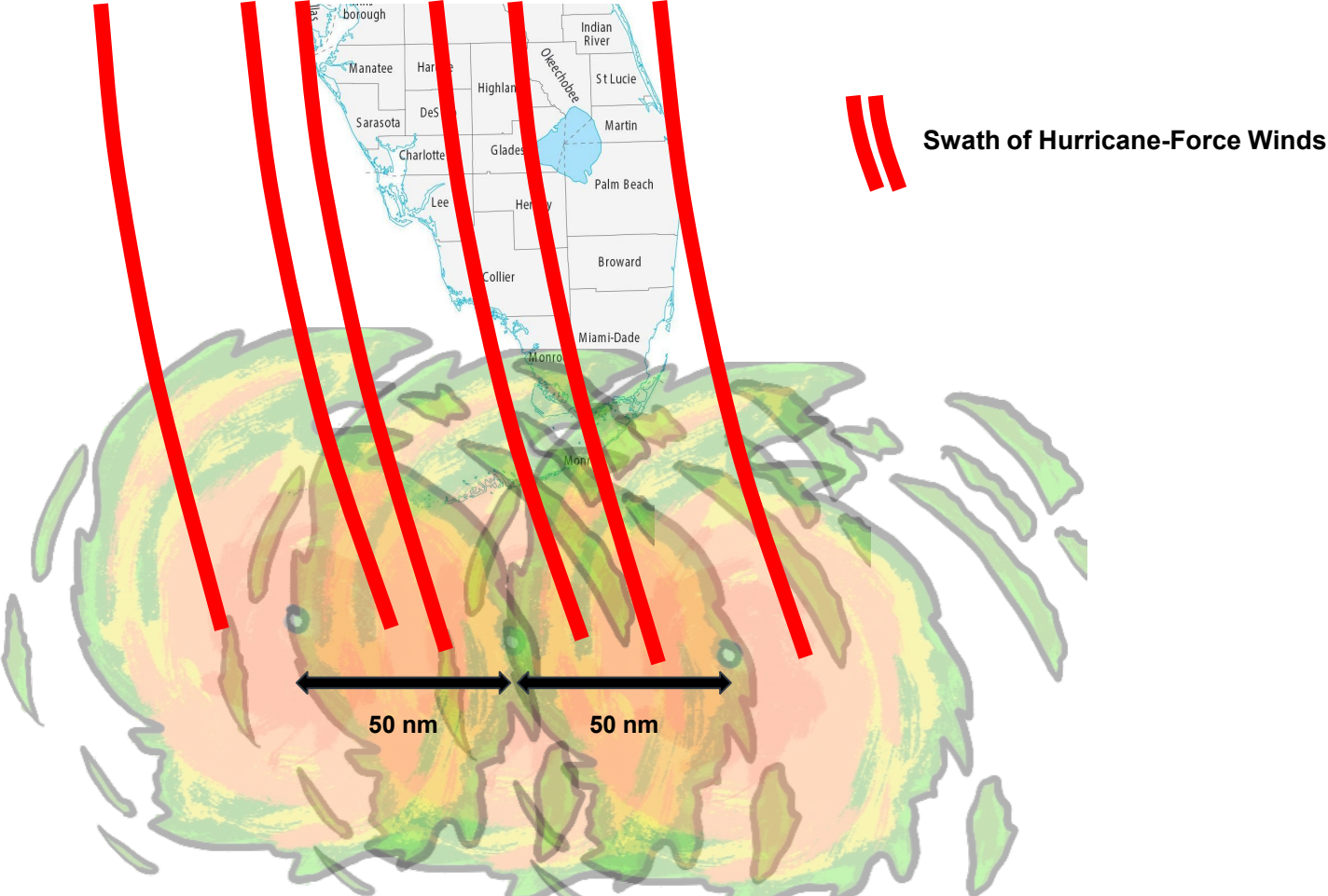
Potential Swath of Hurricane-Force Winds Where a Hurricane Warning Should be Issued

Gulf of Mexico

40 nm

40 nm

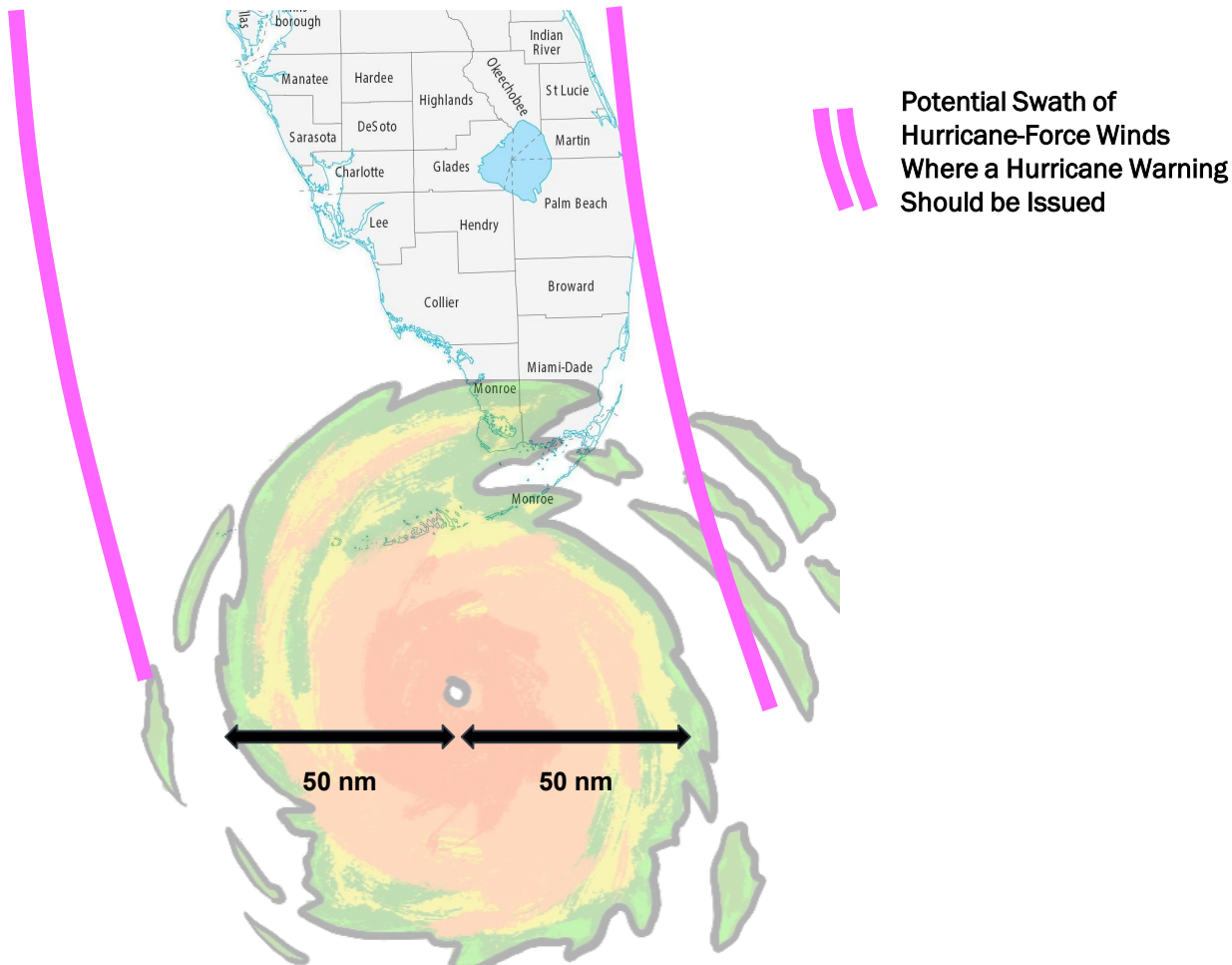
# Watches and Warning: Parallel Tracks



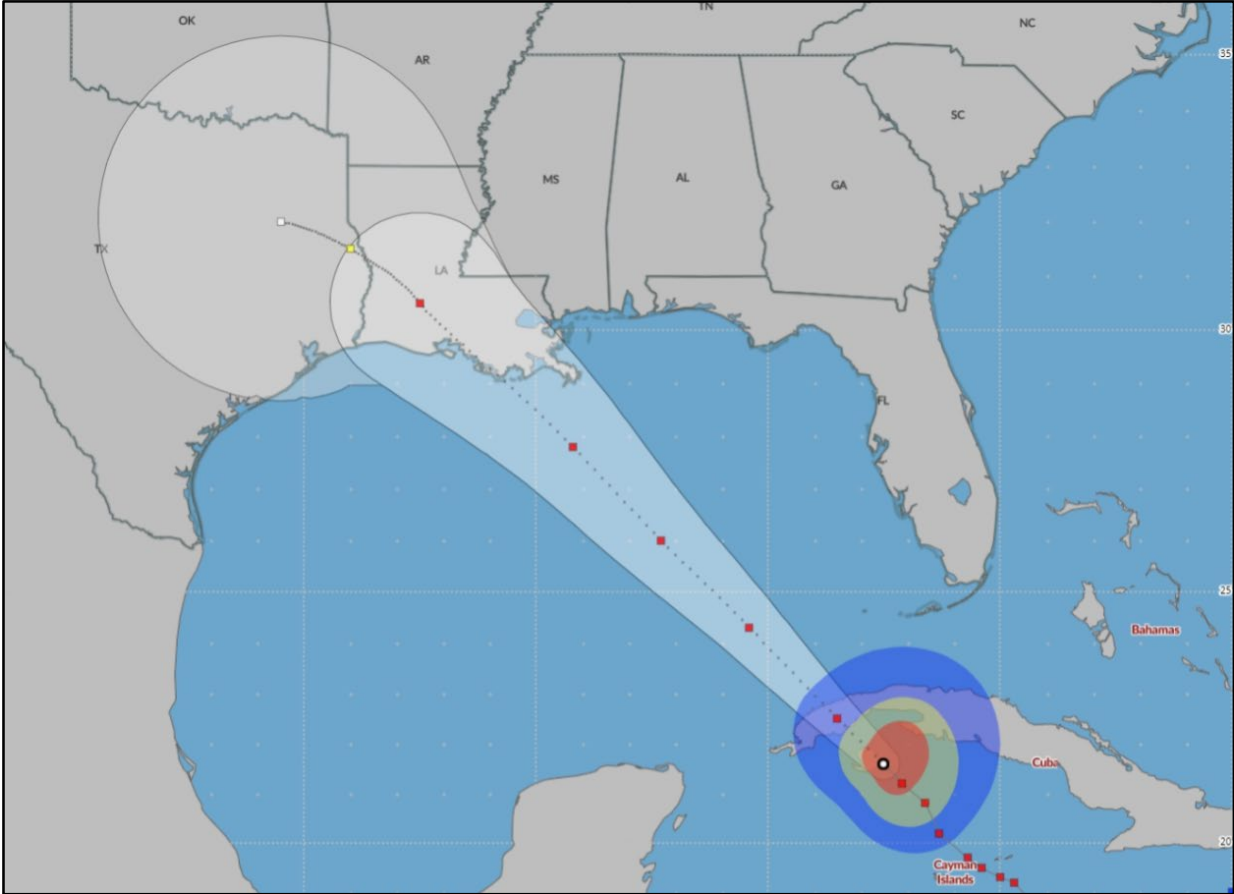
# Watches and Warning: Parallel Tracks

A track parallel to shore could:

- Put ***more*** area under a watch or warning than a perpendicular track
- Potentially result in no one in the watch/warning area getting the hazard (but the risk is still there!)



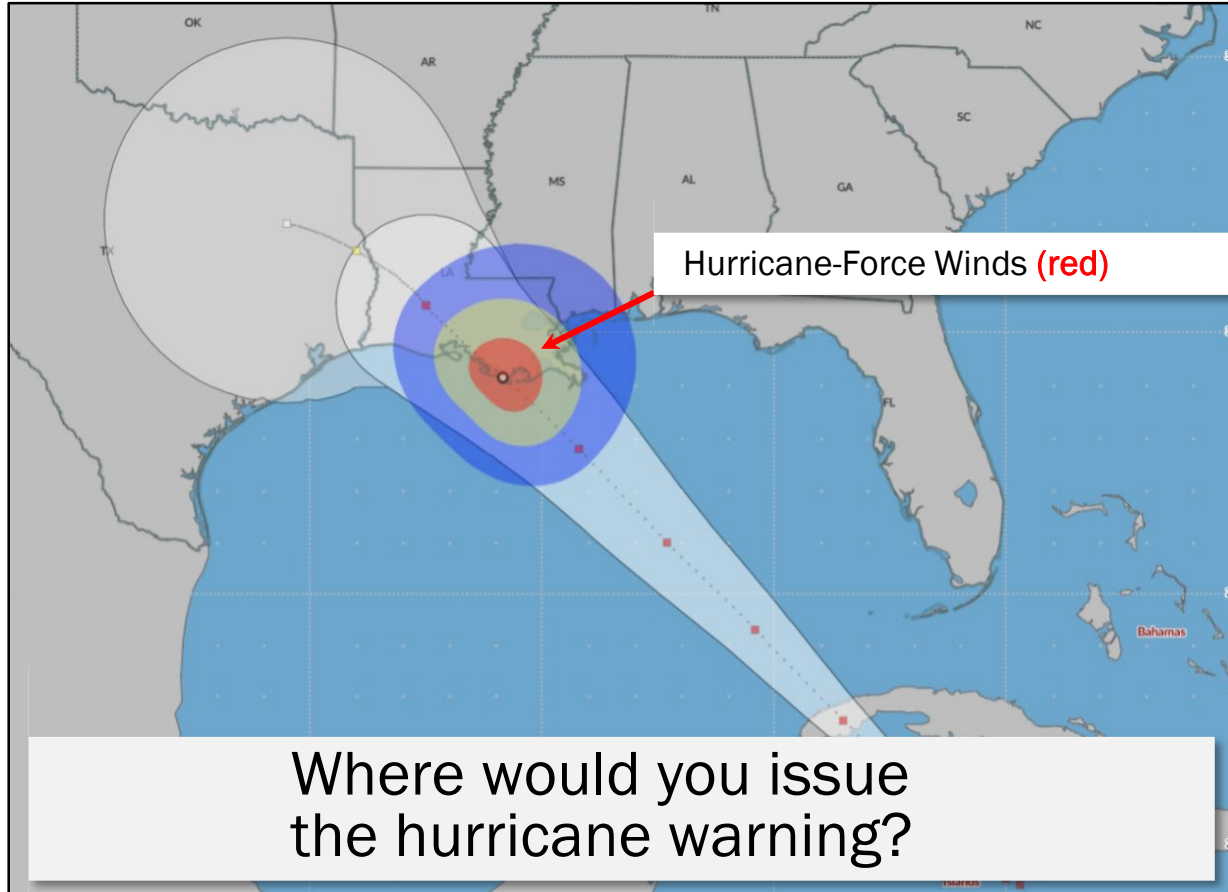
# Watch/Warning Decision-Making



# Watch/Warning Decision-Making



# Watch/Warning Decision-Making

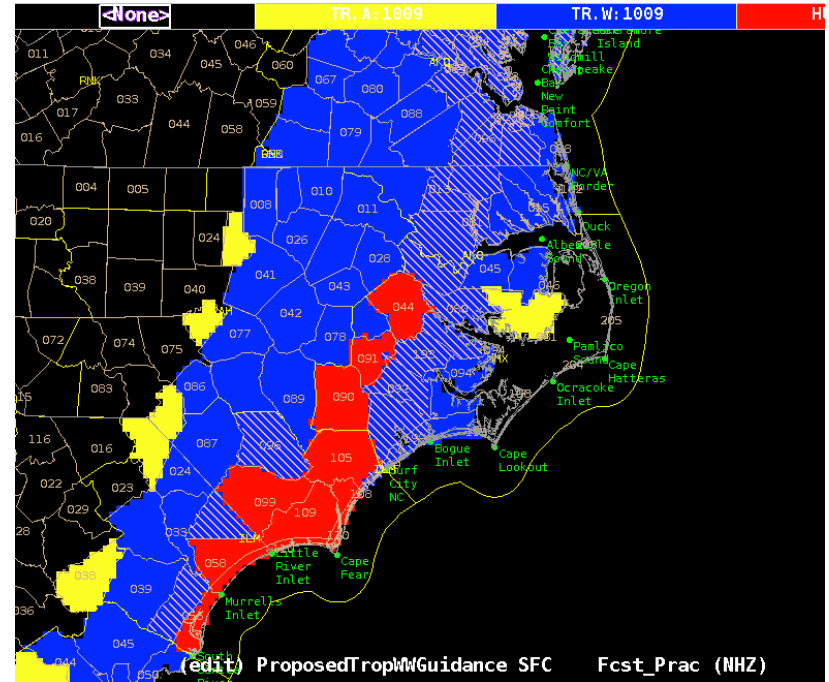


# Watch/Warning Decision-Making



# Inland Watch/Warning Decision Making

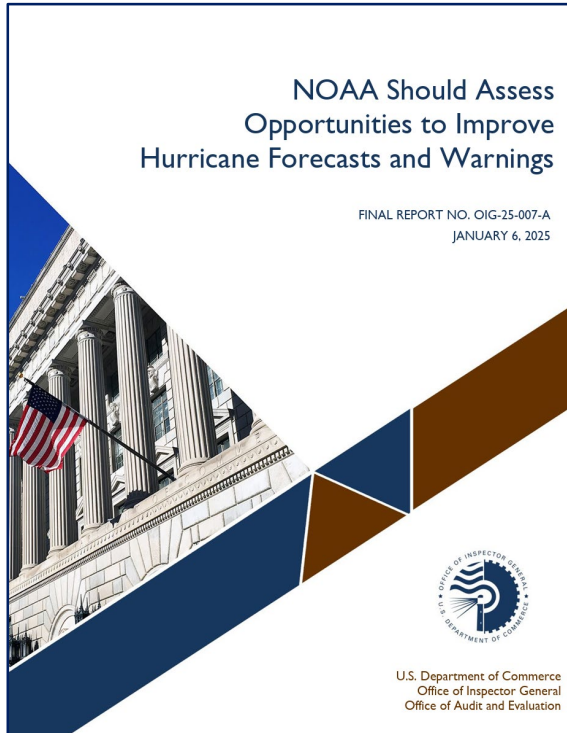
- NHC sets coastal watches/warnings, through collaboration with local NWS offices
- NHC provides preliminary probabilistic wind guidance and recommendations to NWS offices to help with inland watch/warning decisions
- Probabilistic thresholds for watch/warning recommendations tend to be low (remember the risk equation!)



# Other Watch/Warning Considerations

- Maintain continuity with previous watches/warnings.
- Expectations about future changes to the NHC forecast.
- Assessment of uncertainty substantially different from historical error distribution.
  - Particularly challenging forecasts
  - Potential tropical cyclones
- Vulnerability of area under consideration
- Time of day; day of week; holidays

# The Future of Tropical Watches and Warnings



A Department of Commerce Office of Inspector General report in 2025 recommended that NOAA should “*assess the extent to which tropical cyclone watches and warnings provide adequate advance notice to the public commensurate with NHC capabilities and emergency manager requirements and revises those products as warranted*”

# The Future of Tropical Watches and Warnings

NHC is investigating the modernization of tropical watches and warnings in three main areas:

1. Risk-based wording
2. Inclusion of wind gusts in watch/warning criteria
3. Increased and/or dynamic lead times

Come to our session ***Shaping the Future of Hurricane Products: Interactive Feedback Session*** on Thursday (8:30-10:00 am) in this same room (Salon 11) for more information!