Cone of Uncertainty Social and Behavioral Research

NOAA Virtual Lab Presentation
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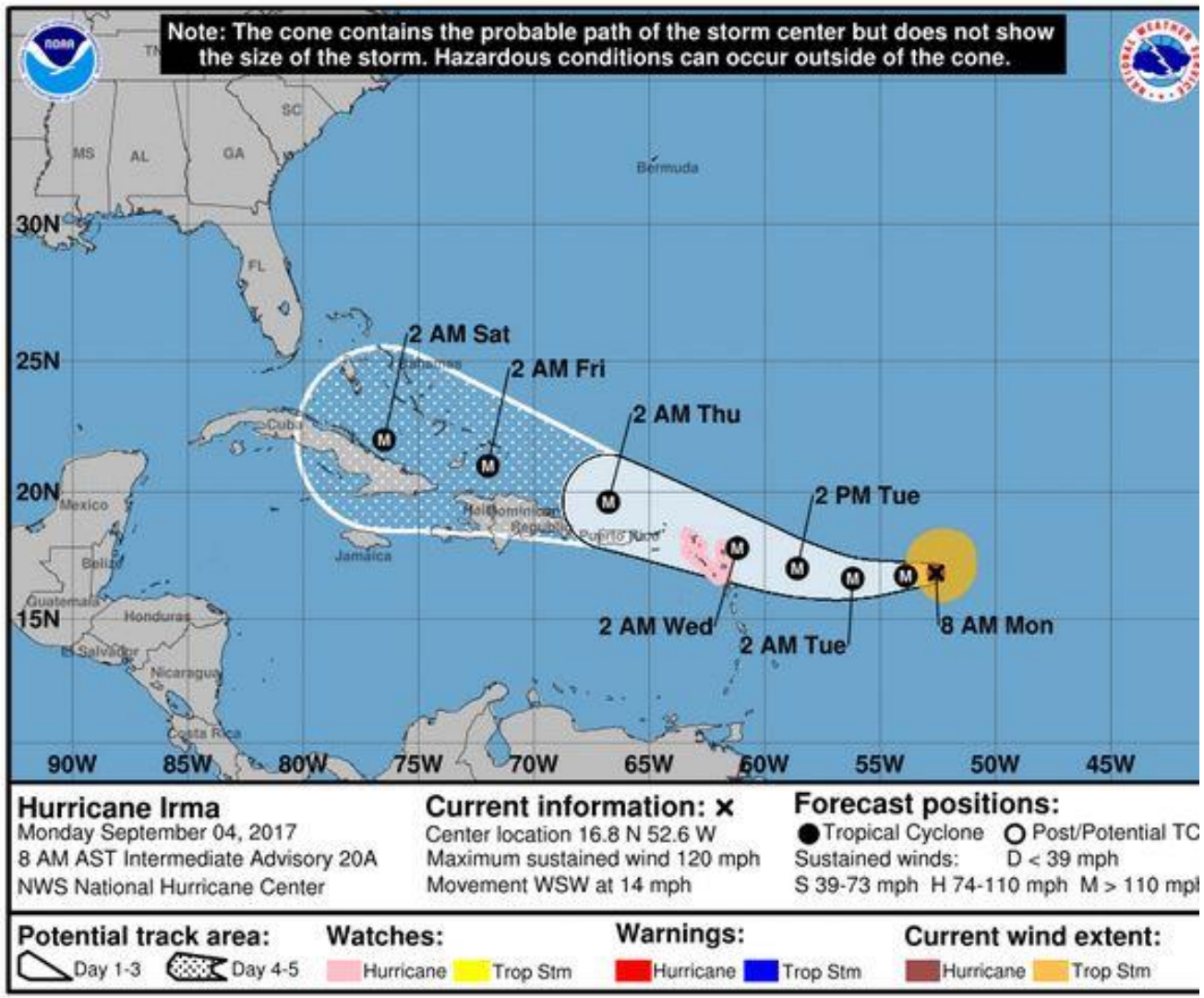
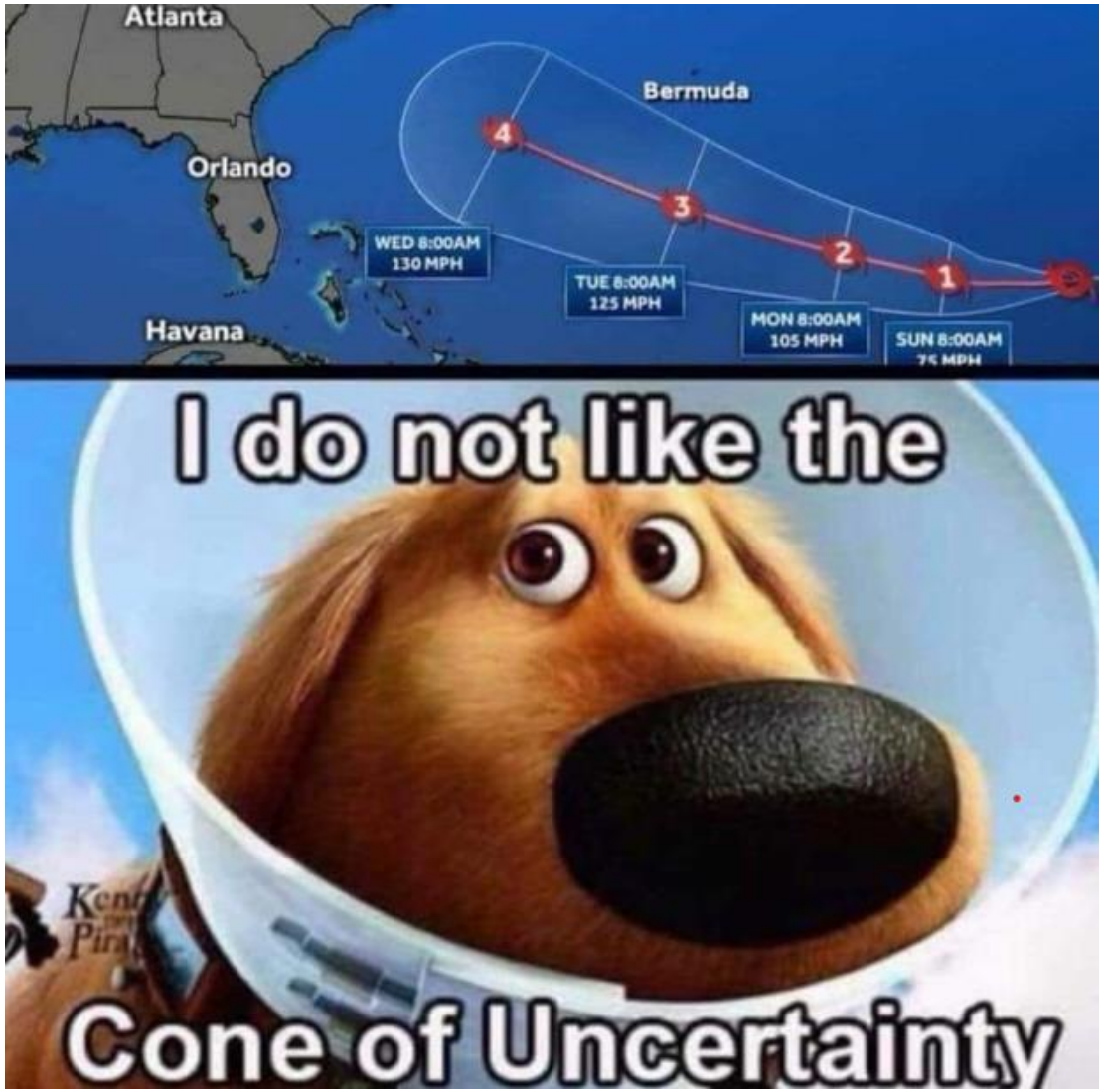


Operational Challenge to Be Addressed

Over the years, I have seen quite a few misinterpretations of the cone by the public, media, and stakeholders. … If articles have to be written to explain the intent to the public, is it too complicated for its intended purpose?

Marshall Shepherd, "The Hurricane Forecast 'Cone of Uncertainty' May Not Mean What You Think," Forbes, April 2017



Research Objectives

- How is the cone interpreted and used?
- How embedded is the cone in stakeholder decision-making?
- What decisions are made based on the cone and what are the implications of those decisions?

Timeline

Literature Review

Completed in April 2019

Looked at nearly 60 studies and NWS service assessments

Survey

Tentatively looking at deployment in the summer of 2020 with analysis in fall of 2020

Interviews

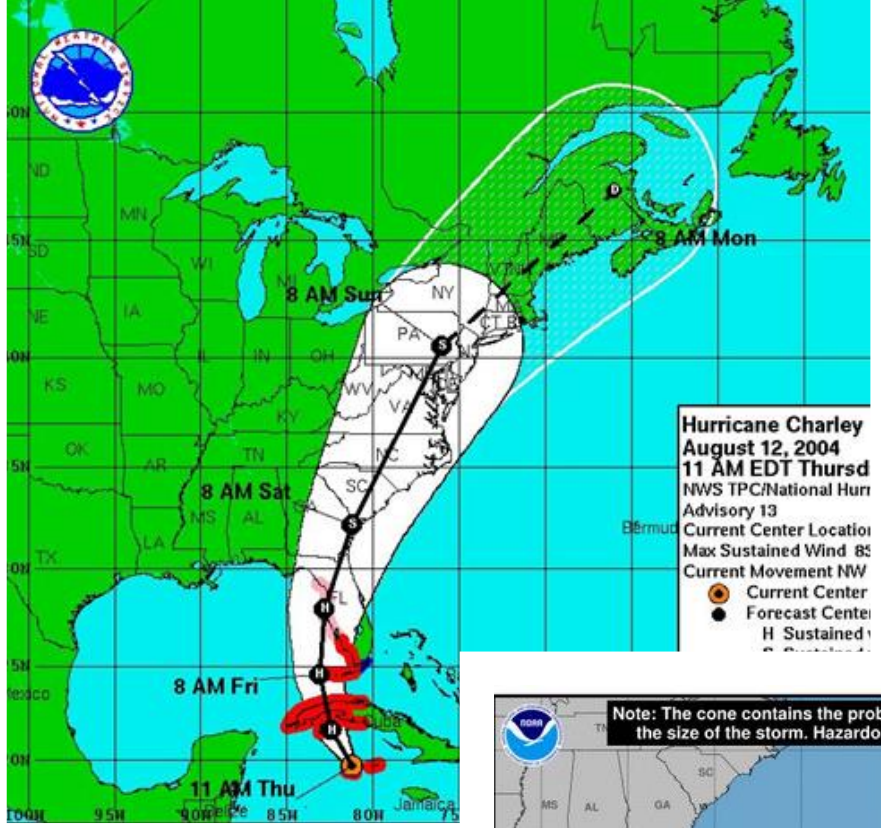
Initial set of seven interviews completed 3/13/20

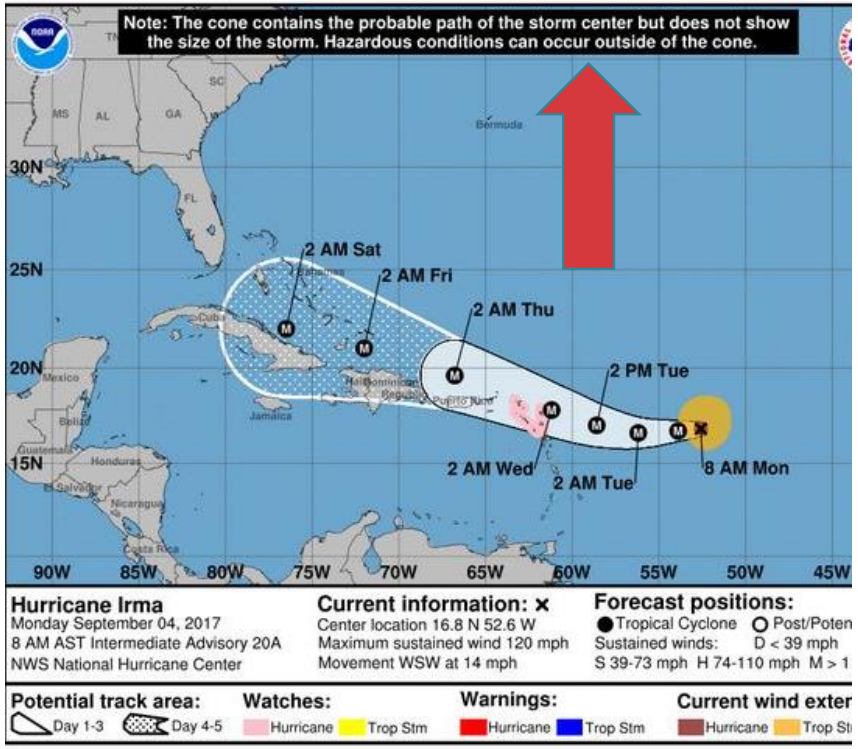
Background

From NHC website:

The cone represents the probable track of the center of a tropical cyclone, and is formed by enclosing the area swept out by a set of circles (not shown) along the forecast track (at 12, 24, 36 hours, etc.). The size of each circle is set so that two-thirds of historical official forecast errors over a 5-year sample fall within the circle.

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





Literature Review Findings

Members of the Public

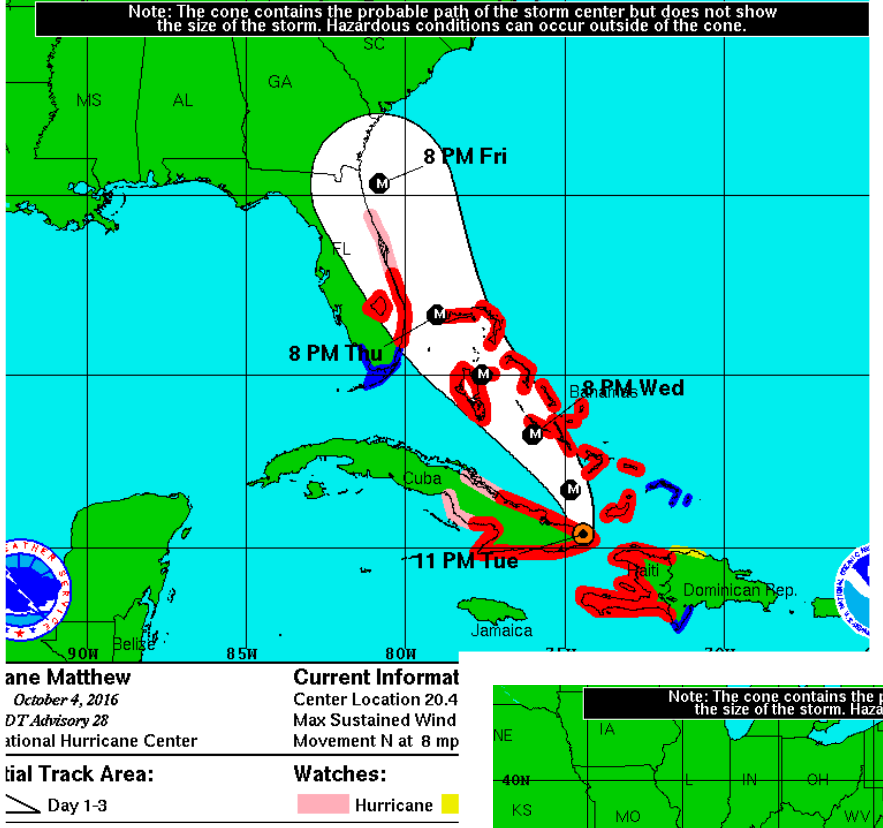
Problem	Implication
Misinterpreting the cone as the swath of damage from the storm (i.e., an impact visualization).	• Believing a person is "safe" if located outside of the cone or having an exaggerated sense of not being safe if located inside the cone.
Misinterpreting the cone as the actual size and or intensity of the hurricane.	• Believing the hurricane is increasing or decreasing in size or strength as it approaches land.

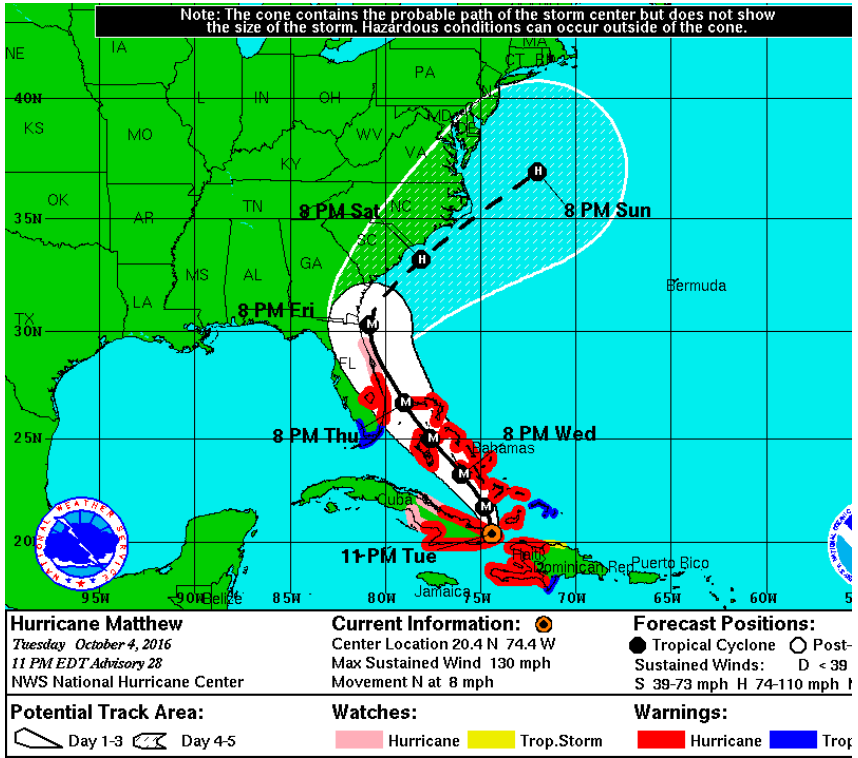
Line or No Line?

The NWS service assessment of Hurricane Matthew found that:

Significant confusion continues regarding the official NHC tropical cyclone track forecast. NWS partners and the public alike continue to focus on the "skinny black line."

NOAA. (2017). Service Assessment: October 2016 Hurricane Matthew. National Oceanic and Atmospheric Administration, National Weather Service. Silver Spring, MD. https://www.weather.gov/media/publications/assessments/HurricaneMatthew8-17.pdf





Some realization that hurricanes do not follow the track or stay within cone

Literature Review Findings:

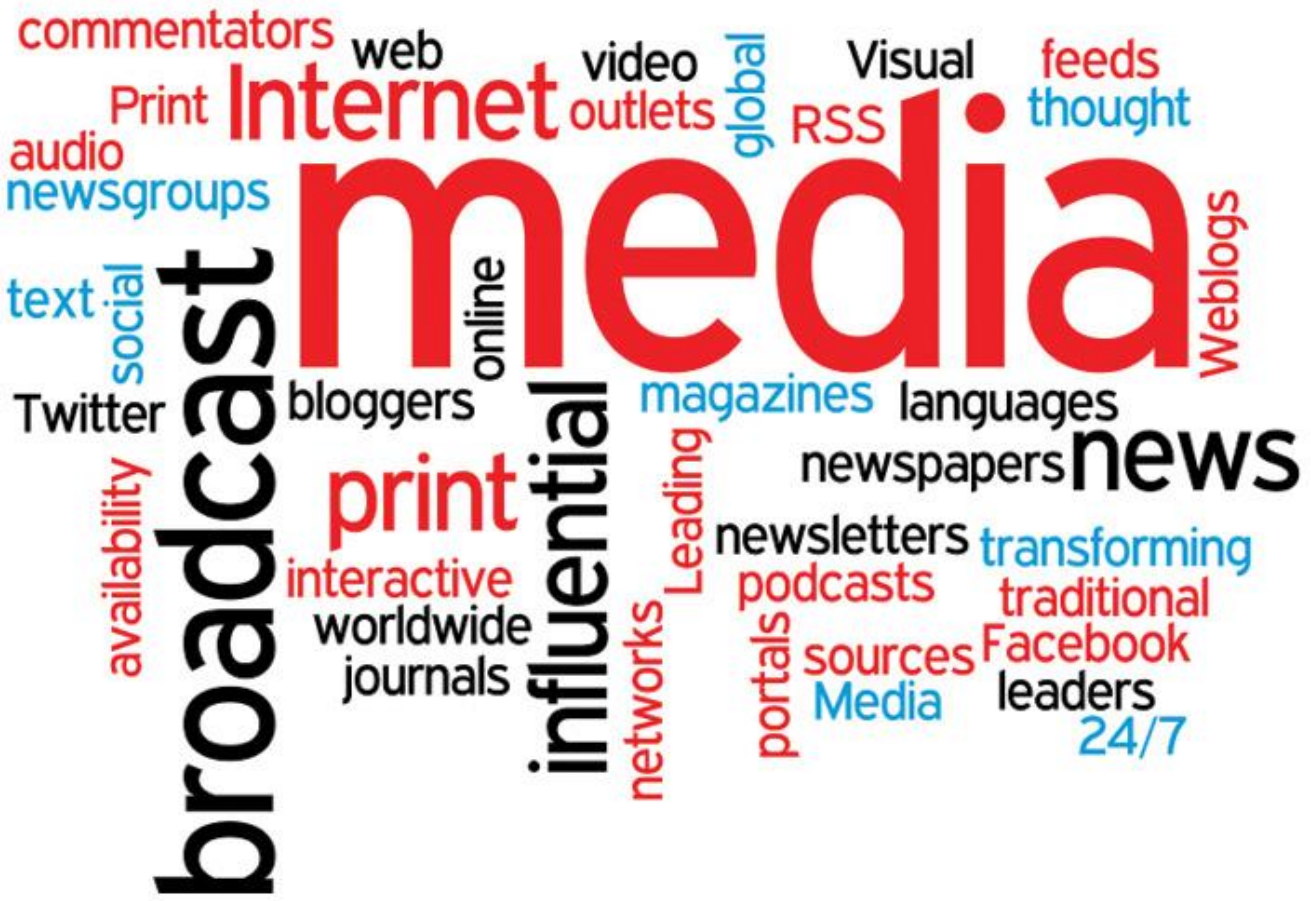
Members of the Public

Decisions

Literature Review Findings:

Members of the Public

Information Sources



Literature Review Findings:

Members of the Public

Other Factors

Literature Review Findings

Members of the Public

Influences on Decision-Making

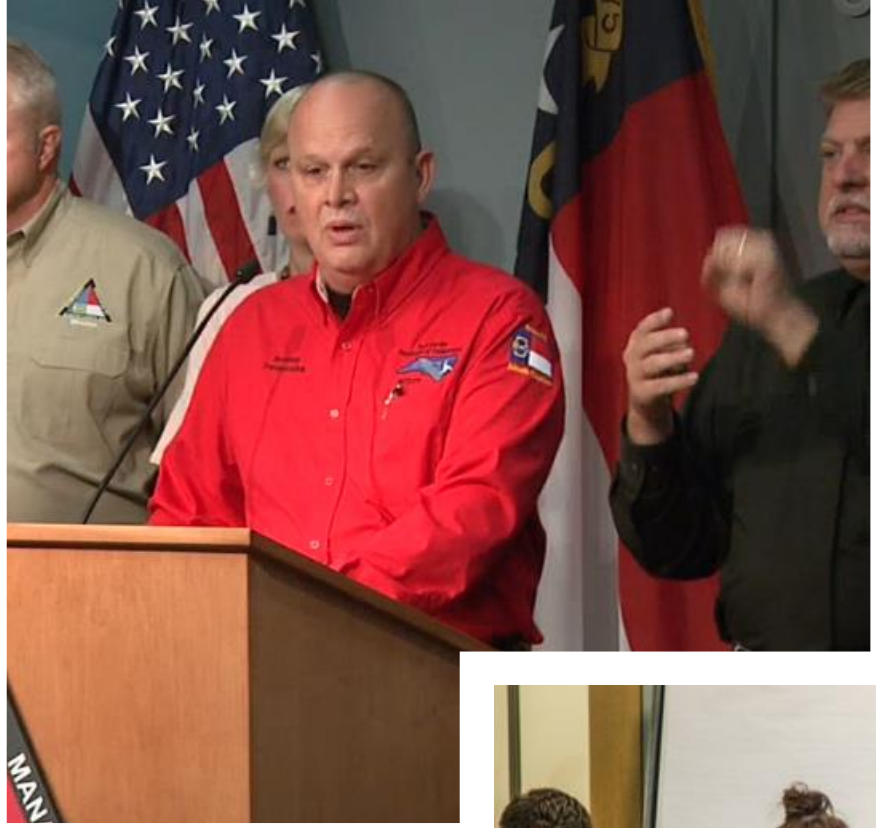
Probability and uncertainty concepts are confusing.

Does not provide information likely to influence decision-making.

Literature Review Findings:

Emergency Managers

Cone is the most well-known product, but use many other products and information sources

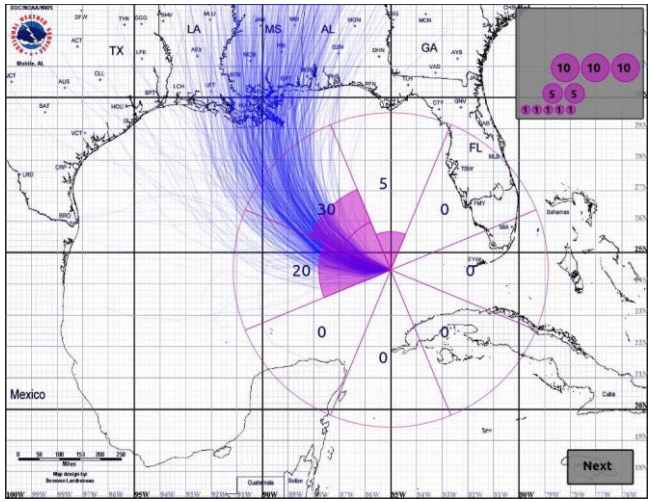


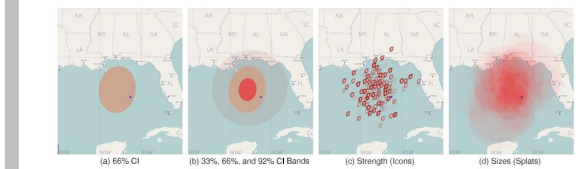
Literature Review Findings:

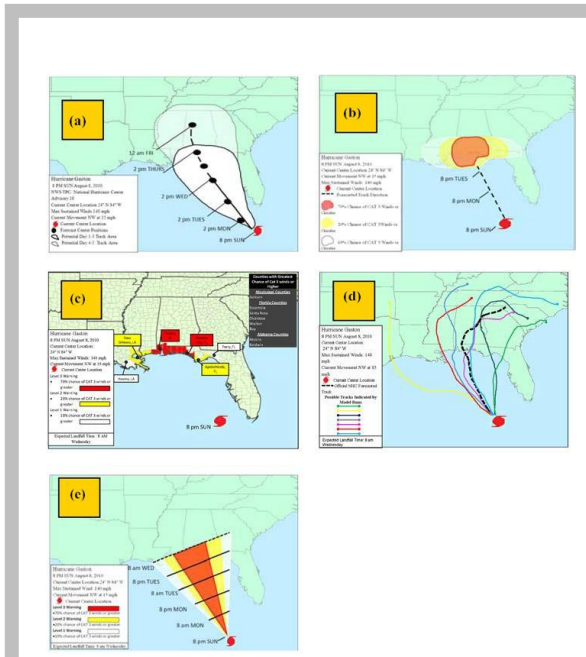
Broadcast Meteorologists

Broadcasters create their own but also use verbal messaging and body language

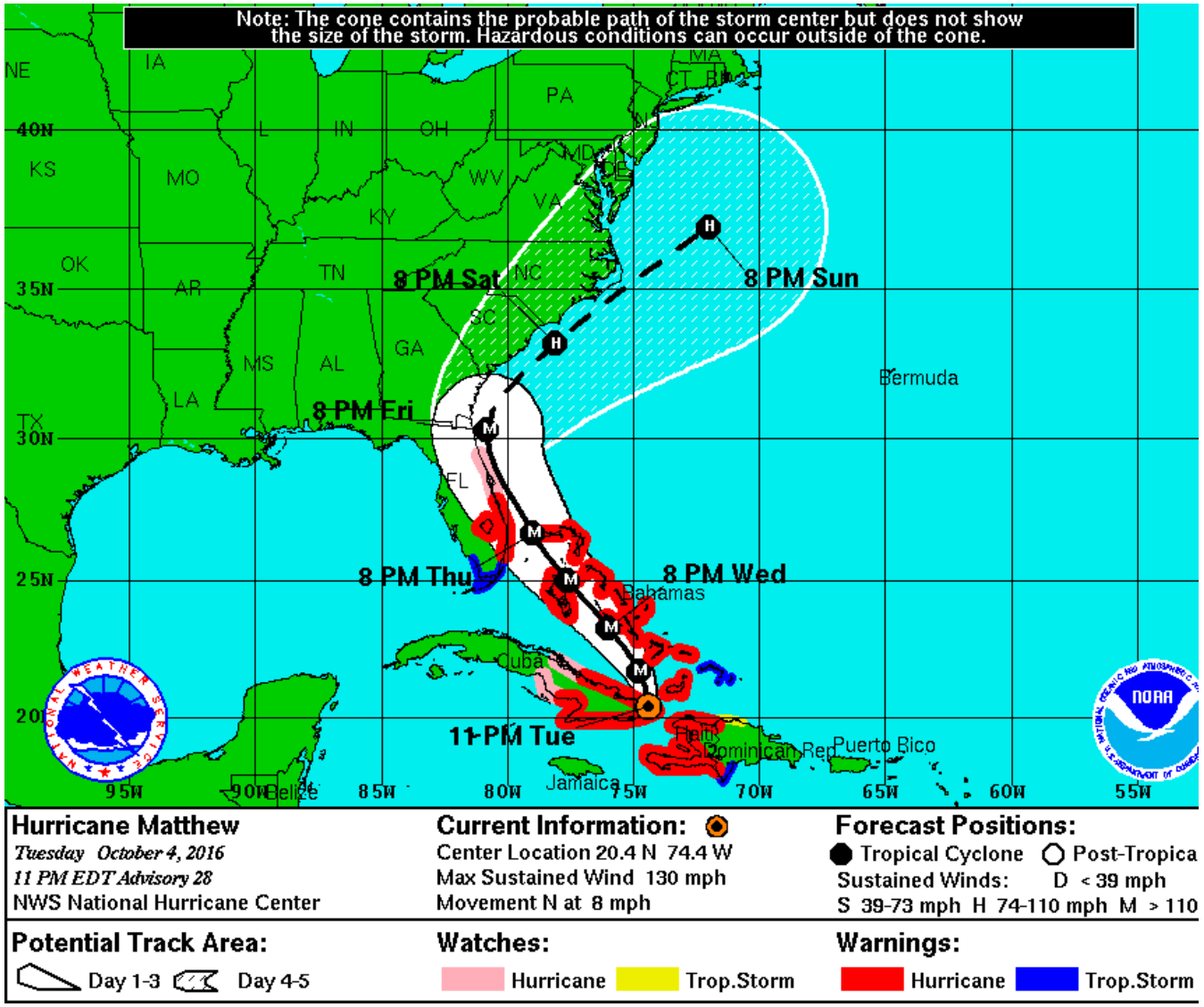
Alternative Visualizations

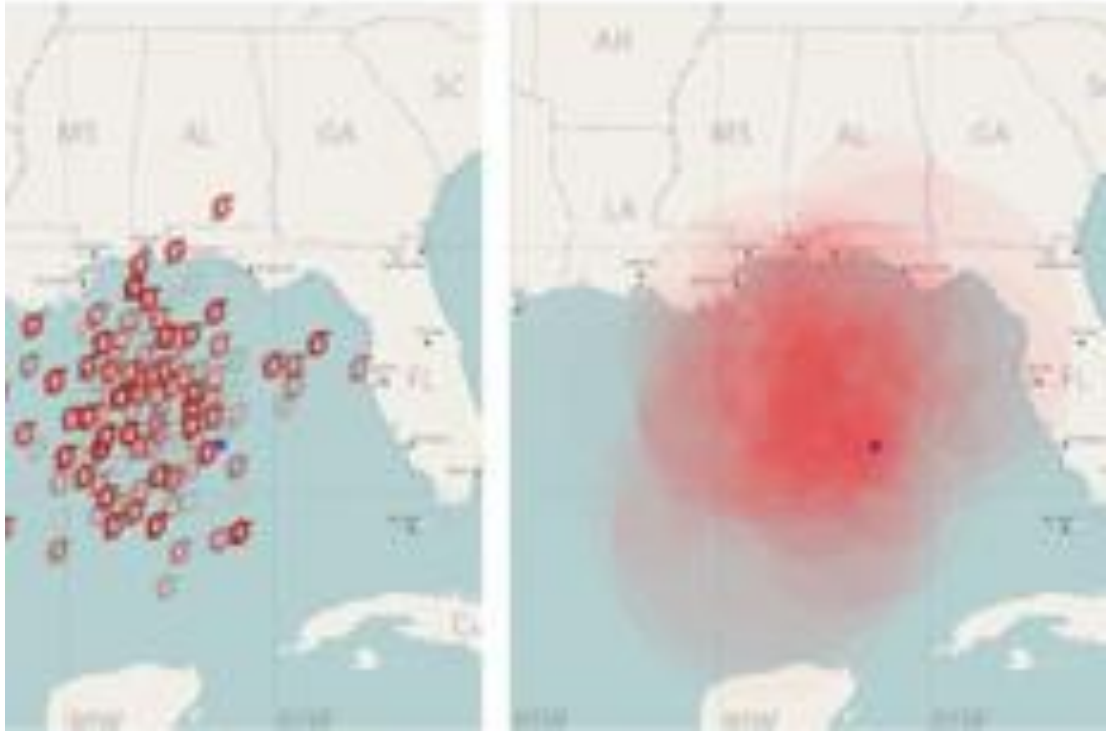


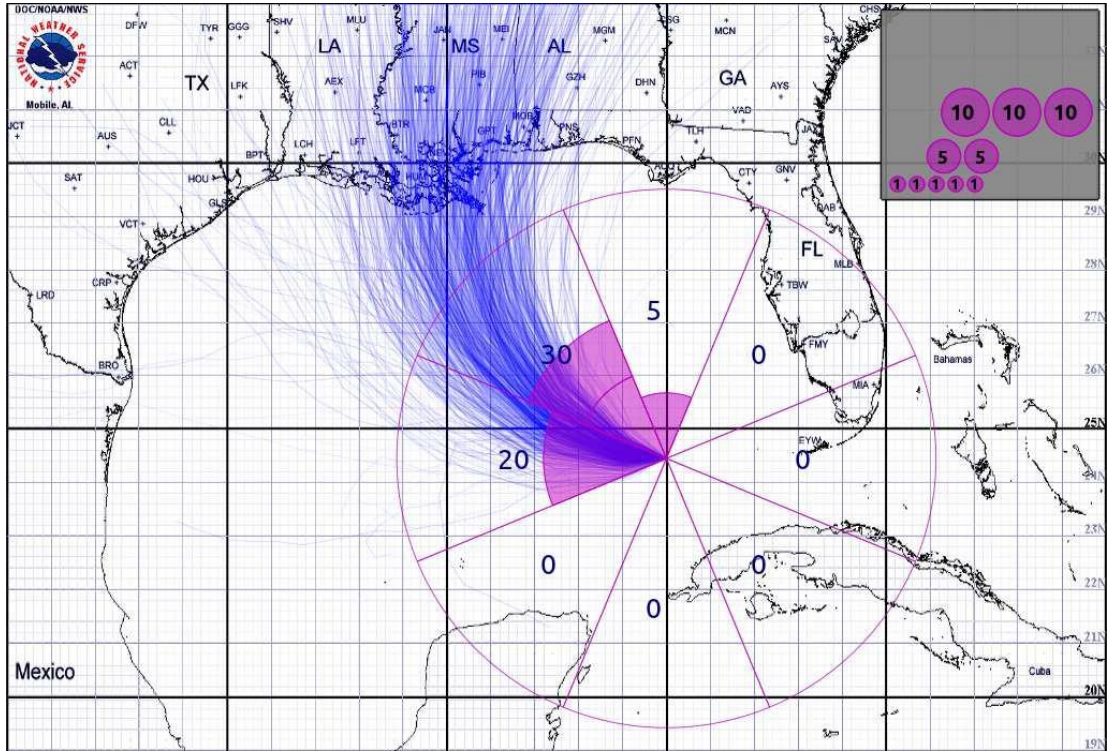




Summary Displays

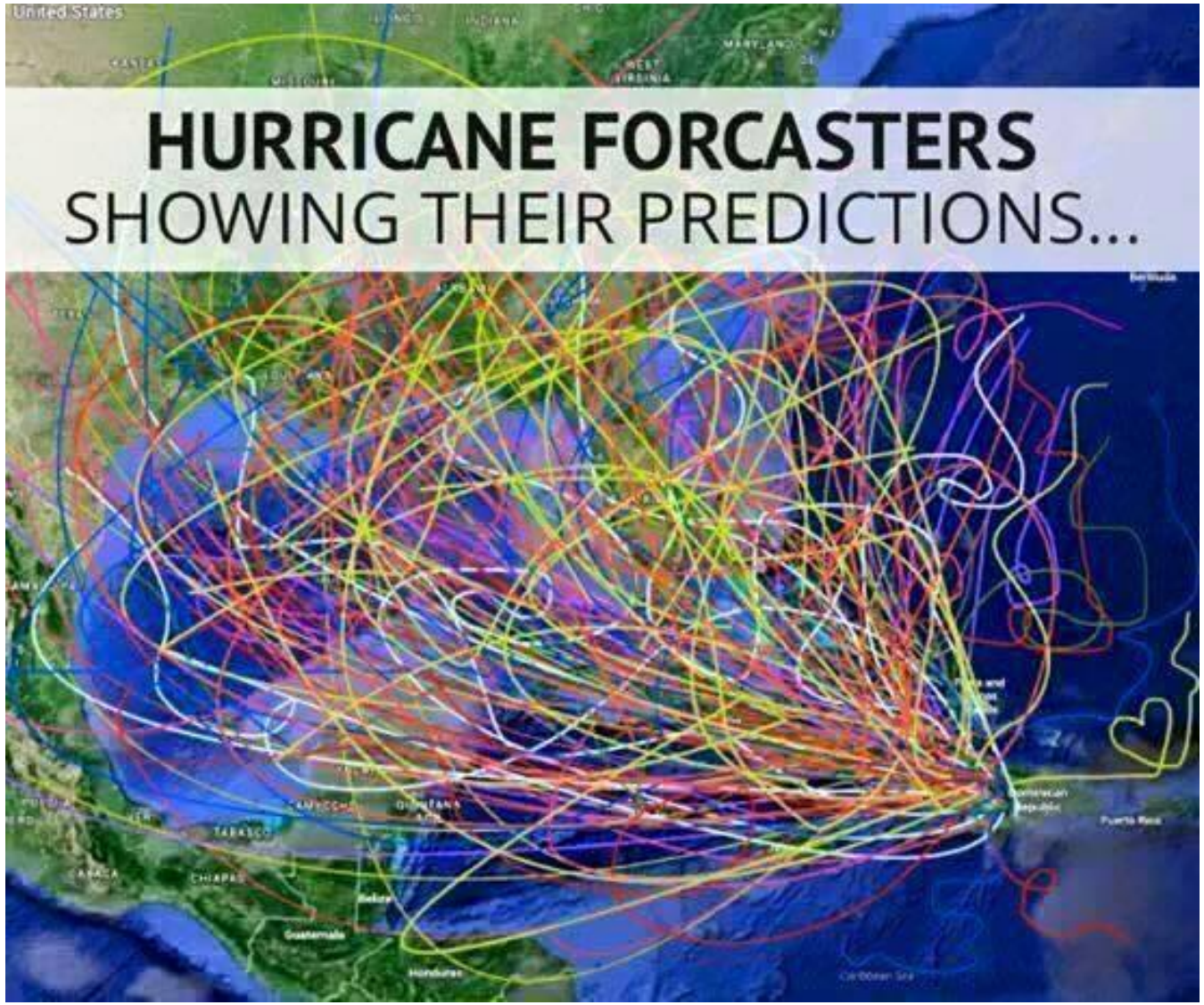


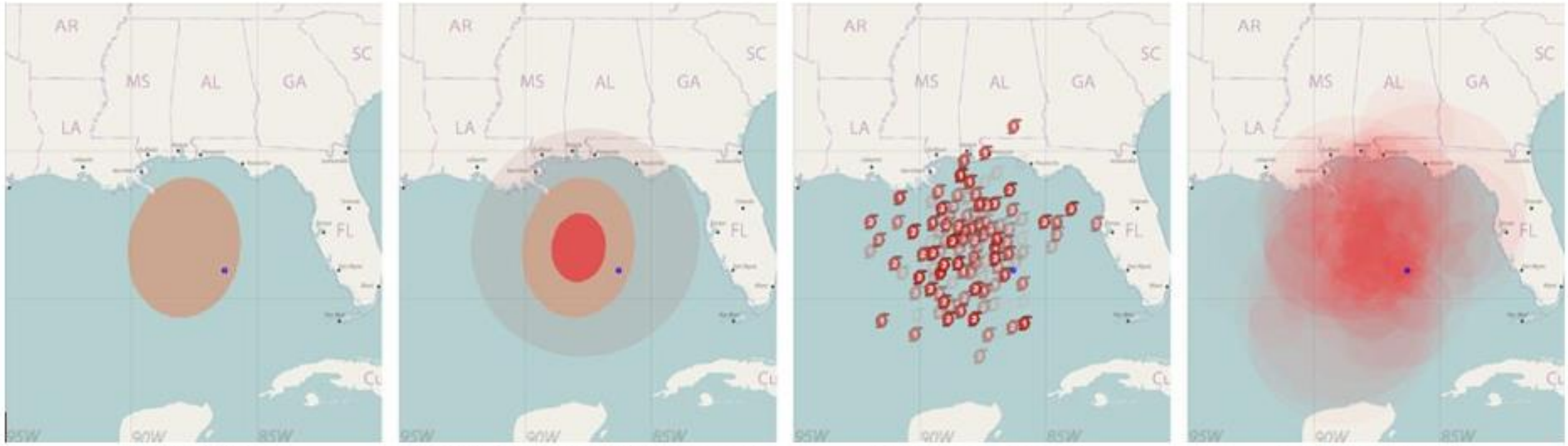




Ensemble Displays

Downsides to Ensemble Displays

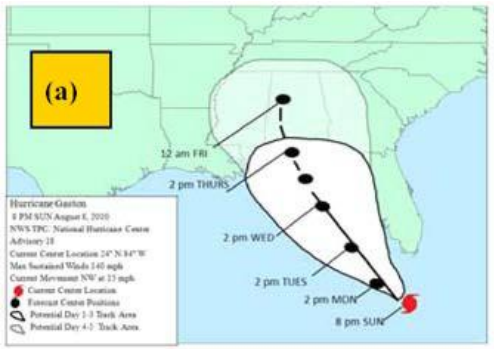


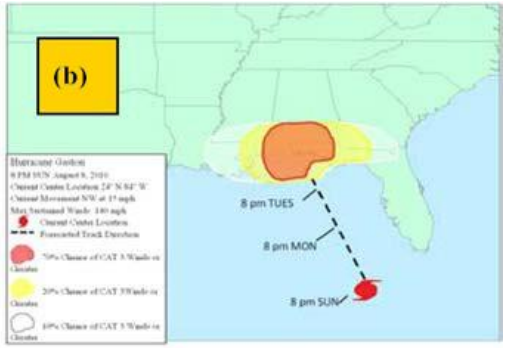


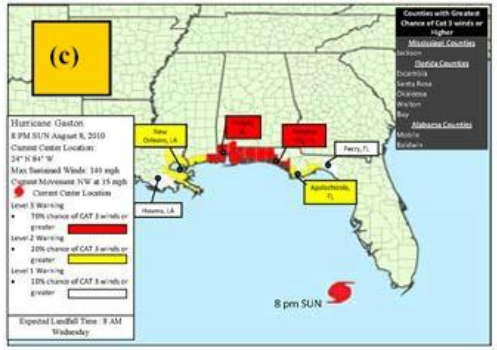
(a) 66% CI (b) 33%, 66%, and 92% CI Bands (c) Strength (Icons) (d) Sizes (Splats)

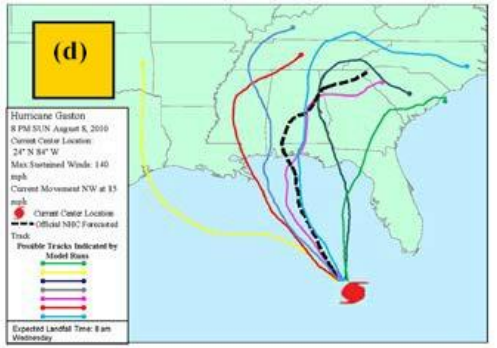
Dynamic Visualizations

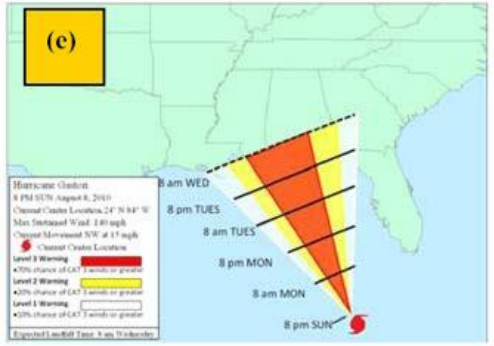
Simple and Communicative









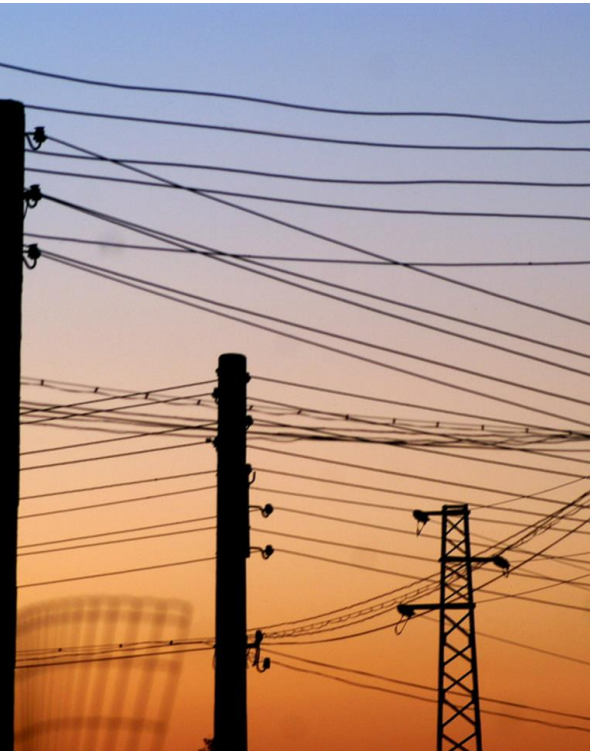
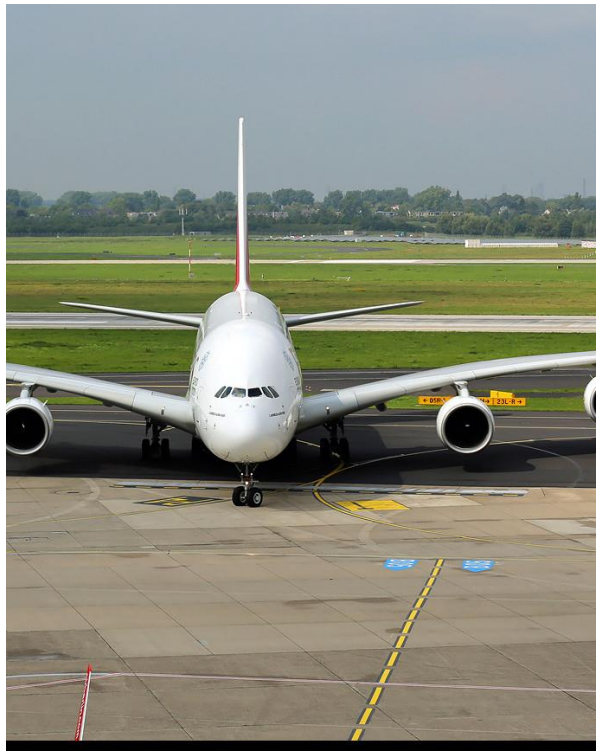


Information on Hazards

Looking Ahead

Localized Information

Impacts


Survey:

Energy/utilities, transportation, marine, and tourism sectors

Survey Objectives

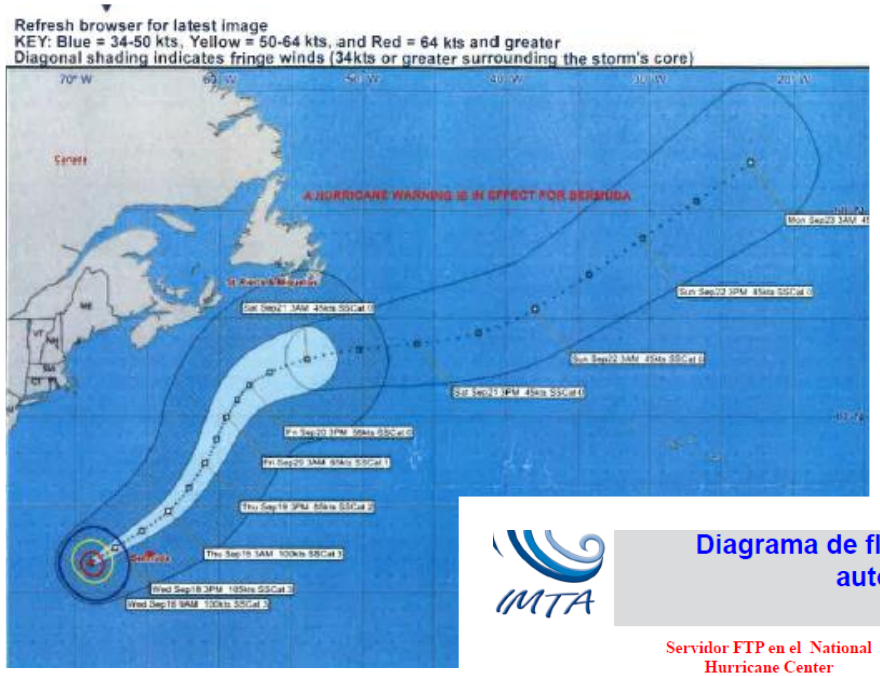
How do they interpret the Cone Graphic?

What decisions to they make based on the Graphic?

What other information do they need/access to inform decision-making?

What are the strengths and weaknesses of the graphic?

Interviews with International Meteorologists



Questions?