COSEE Florida presents a
Water as Habitat Science Café

Predicting the Unpredictable:
Hurricane Hazards and the Science of Storms
Kieran Bhatia and Matt Onderlinde

Wednesday, June 11, 2014
6:30-8:00 PM
The Science of Hurricanes
Typical eye diameter ~20 miles

Typical hurricane diameter ~300-400 miles

* The center can have an **eye**, characterized by calm winds and sometimes clear skies.
* The eye is then surrounded by an abrupt wall of intense thunderstorms and an area typically with the strongest winds: the **eyewall**.
* Outside of the eyewall, there are typically spiral **rainbands**... these can also be quite strong and contain damaging winds, heavy rain, and even tornadoes.
Classic Lifecycle: Disturbance - Category 5

Day 0, Disturbance
Day 1, 35mph Depression
Day 2, 46mph Tropical Storm
Day 3, 63mph Tropical Storm
Day 4, 92mph Hurricane
Day 5, 127mph Hurricane
Day 6, 150mph Hurricane
Day 7, 144mph Hurricane
Day 8, 155mph Hurricane
Does Size Matter?

- Yes, the bigger a storm is, the more area it will affect with rain, wind, and storm surge, but...
- A larger storm is not necessarily a stronger storm and vice versa.
Why and When South Floridians Must Be Weather-Ready
When is it Time to Tune in?

HURRICANE SEASON

[Graph showing the peak of hurricane season from late June to early October with a label for hurricanes and tropical storms and a separate label for hurricanes.]
With Great Weather Comes Great Responsibility?

Hurricanes affecting South Florida since 1851
58 (31 major) Hurricanes Passed Through South Florida from 1851-Present
It’s not “IF”, It’s “When”

- South Florida is one of the most frequently hit sections of the entire US coastline
- Average of one hurricane per 3 years and one major hurricane every 5.2 years
What Month Has Had Most Hurricane Strikes in South FL?

A) August
B) October
C) September
D) June

Since 1851, 23 hurricanes have struck South Florida in October, compared to 17 in September 13 in August, and 2 in June

Was Hurricane Andrew a smaller than average hurricane?

A) No
B) Yes

Hurricane-force winds were reportedly only 40 miles wide but it was one of the most destructive storms in U.S history
The Uncertainty of Forecasting Hurricanes

This “Cone of Uncertainty” thing is like some kind of bad, broken record!
1) Data Acquisition

Variety of instruments define current conditions

2) Model Predictions

Weather models on the world’s fastest super computers predict the future state of the weather based on current information and approximate equations

3) “Ensemble” of Forecasts

Different equations and data used lead to a variety of predictions
4) “The Official Forecast”

- Forecasters at the National Hurricane Center examine computer model forecasts and issue the official forecast based on what they deem as the most likely scenario.
What is the Cone?

• The “forecast cone” or “cone of uncertainty” predicts the path of the storm center.

• It is not an impacts cone!

• The same size cone is used all season long for all storms... although uncertainty is higher in some situations than others.
Making the Cone

• For two out of three 24-hour forecasts, the center of the hurricane will differ from its predicted track by less than 70 miles, at 48 hours by less than 95 miles, etc.

• Using this information, we can draw a circle for the possible location of the center of the hurricane

• Outline the circles to complete the cone
Do You Understand The Cone?

• Track forecasts inherently contain uncertainty... and forecasts further out in time have **more** uncertainty.

• As track forecasts improve, the size of the cone **decreases**.

• The center of the storm should track outside of the cone **1/3** of the time.

• The forecast cone **is not** an impacts cone!
Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.

Hurricane Irene
Monday August 22, 2011
830 PM EDT Advisory 10
NWS National Hurricane Center

Current Information:
Center Location 19.7 N 68.7 W
Max Sustained Wind 100 mph
Movement WNW at 10 mph

Forecast Positions:
- Tropical Cyclone
- Post-Tropical
Sustained Winds:
- D < 39 mph
- S 39-73 mph
- H 74-110 mph
- M > 110 mph

Potential Track Area:

Day 1-3
Day 4-5

Watches:
- Pink Hurricane
- Yellow Trop.Storm

Warnings:
- Red Hurricane
- Blue Trop.Storm
Is There A Wind Speed Cone?
Is There A Wind Speed Cone?
Is There A Wind Speed Cone?

Tropical Storm Force Wind Speed Probabilities
For the 120 hours (5 days) from 8 PM EDT Tue Aug 23 to 8 PM EDT Sun Aug 28

Probability of tropical storm force surface winds (1-minute average >= 39 mph) from all tropical cyclones

diamond indicates HURRICANE IRENE center location at 8 PM EDT Tue Aug 23 2011 (Forecast/Advisory #15)
Is There A Wind Speed Cone?

Tropical Storm Force Wind Speed Probabilities
For the 120 hours (5 days) from 8 AM EDT Wed Aug 24 to 8 AM EDT Mon Aug 29

Probability of tropical storm force surface winds (1-minute average >= 39 mph) from all tropical cyclones

◊ indicates HURRICANE IRENE center location at 8 AM EDT Wed Aug 24 2011 (Forecast/Advisory #17)
Is There A Wind Speed Cone?
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Hurricane Hazards

- Storm Surge
- Wind
- Rain
- Tornadoes
- Waves/Rip Currents
Wind, Rain, and Waves: The Obvious Risks
Storm Surge: Needs More Attention

• The #1 cause of deaths in hurricanes
• Storm surge is produced by water being pushed toward the shore by the storm winds
• Low pressure of hurricane has little impact on surge in comparison to the wind
Could we see this type of flooding in South Florida?

Hurricane Katrina (2005): New Orleans
Hurricane Wilma (2005): Miami
Thank you!

The “Canes on Canes” team from University of Miami Rosenstiel School, from left: Brian McNoldy, Falko Judt, Kieran Bhatia, Jason Godwin and Matt Onderlinde.