Understanding Tropical Cyclone Uncertainties

2010 FL Governor's Hurricane Conference

May 27, 2010

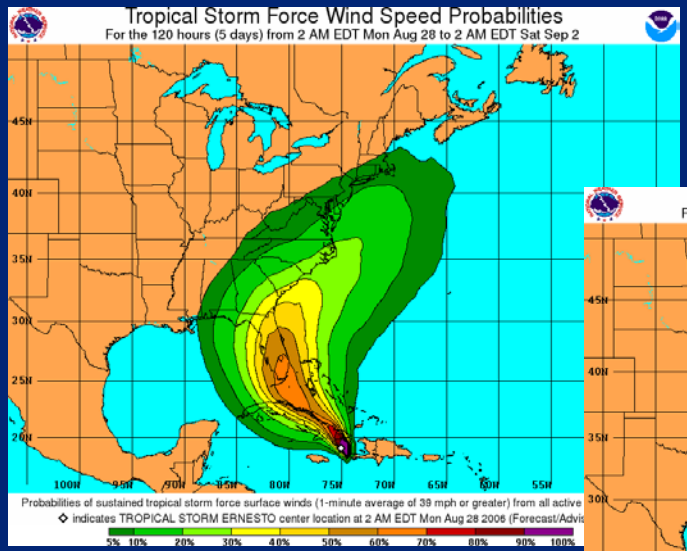
Dealing With The Unknown

- Tropical Cyclones and the surrounding environment are constantly evolving.
- These changes are virtually impossible to track on a continuous basis.
- Uncertainty is a part of EVERY Tropical Cyclone forecast.
- Probabilities can help draw a clearer picture of what can be a confusing scenario.

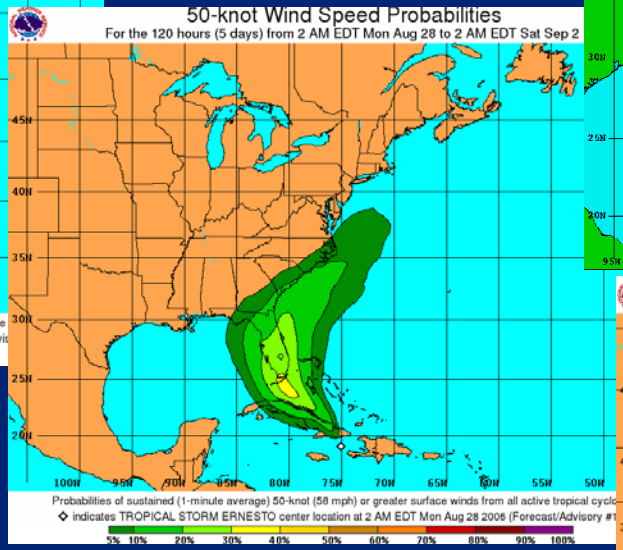
Workshop Outline

- NHC Wind Speed and Intensity Probability Products/Applications
- Local NWS Office (WFO) Probability Products/Applications
- Q & A

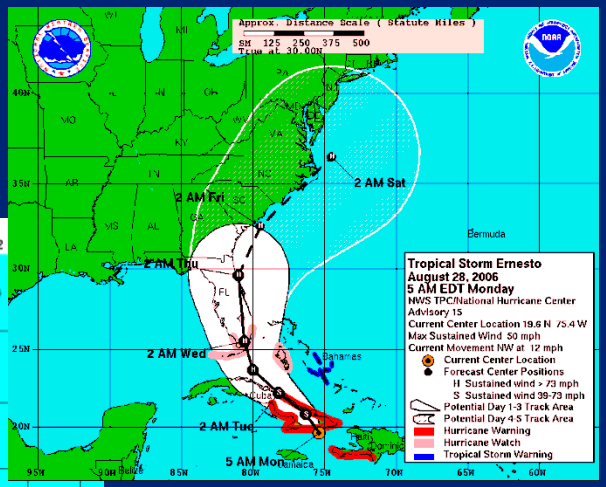
Wind Speed and Intensity Probabilities

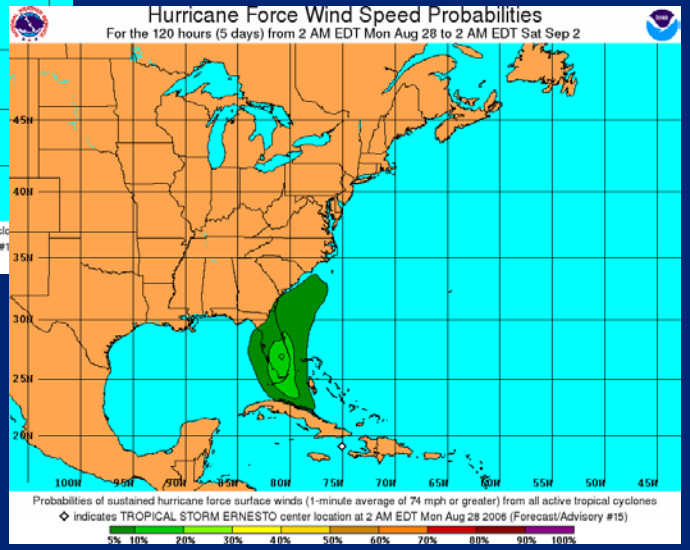


Tropical Storm Force



50-kt





Hurricane Force

Michael J. Brennan

National Hurricane Center

2010 Florida Governor's Hurricane Conference

WS51 – Understanding Tropical Cyclone Uncertainties

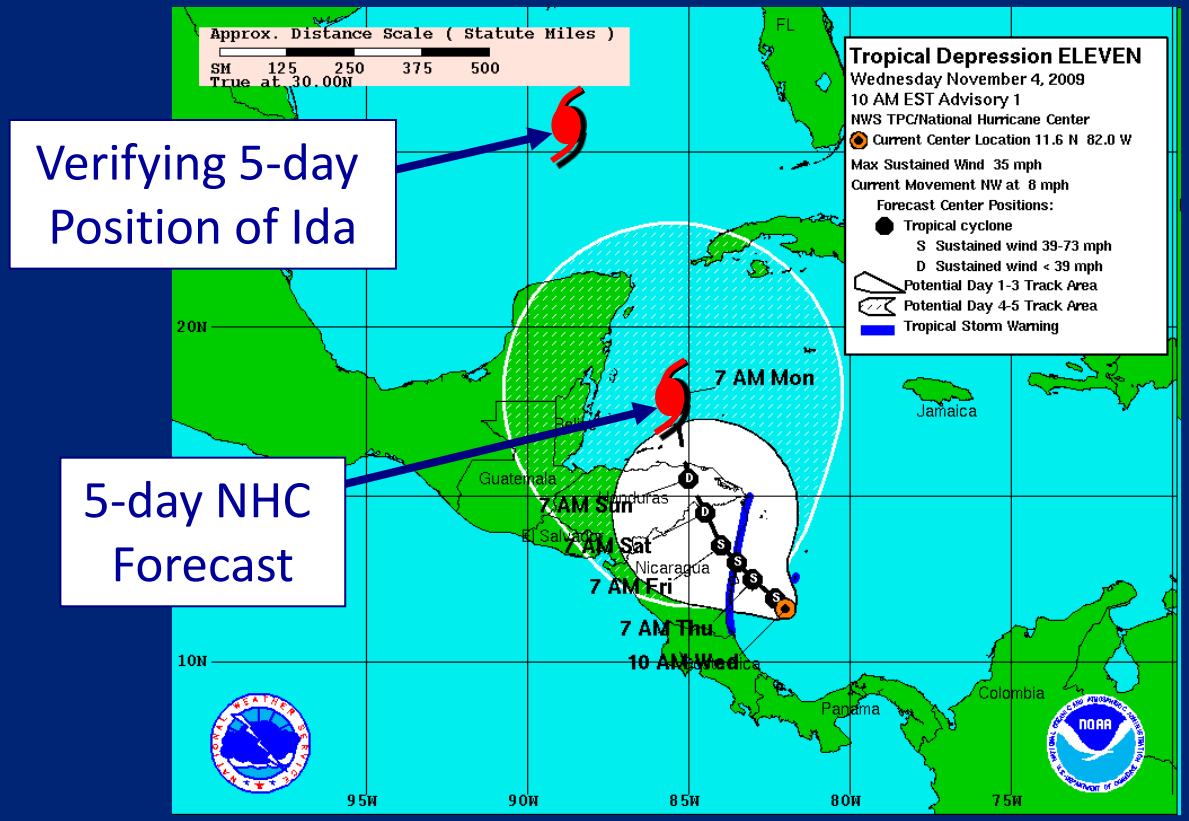
27 May 2010

How can You, as Decision Makers, Deal with Forecast Uncertainties?

TD 11 (later Hurricane Ida) Advisory Number 1

Issued 10:00 AM EST 4 November 2009

5-day position error about 600 miles



NHC probability products can help

Available Probability Products

1. Wind Speed Probability Product
   - Text and Graphics

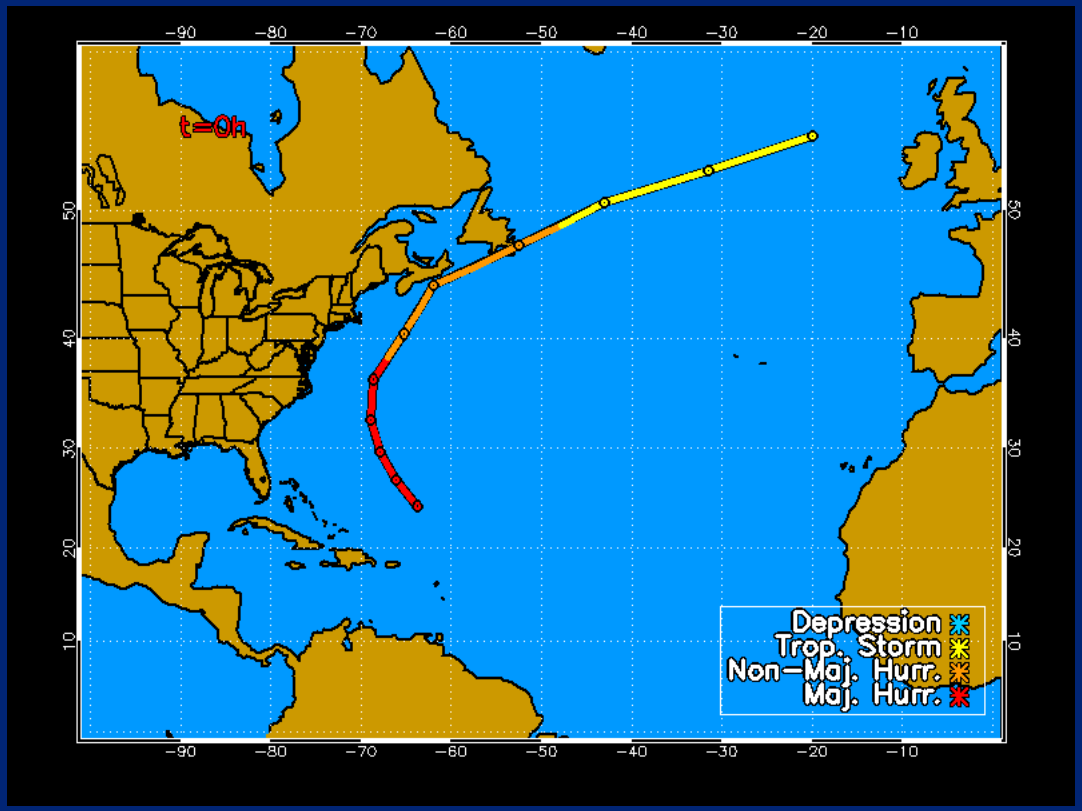
- Depict *location-specific* probabilities for wind events (tropical storm force, 50 kt [58 mph], and hurricane force)

2. Intensity Probability Table
   - Graphical Table

- Shows probability of tropical cyclone intensity (maximum wind) falling in various categories
  - Tropical depression, tropical storm, hurricane, and hurricane categories 1-5

How the Probabilities are Created

- 1,000 realistic alternative scenarios created using
  - Official NHC track, intensity and size (wind radii) forecasts
  - Historical NHC track and intensity forecast errors
  - Climatology and persistence wind radii model
- Probability of exceeding 34, 50, and 64 kt wind thresholds computed
- Accounts for inland wind decay



Wind Speed Probabilities

```
ZCZC MIAPWSAT4 ALL
TTAA00 KNHC DDHHMM
HURRICANE WILMA PROBABILITIES NUMBER  20
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL
0900Z THU OCT 20 2005

...THIS IS AN EXPERIMENTAL PRODUCT FOR 2005...

AT 0900Z THE CENTER OF HURRICANE
WILMA WAS LOCATED NEAR LATITUDE 18.3 NORTH...
LONGITUDE  85.0 WEST WITH
MAXIMUM SUSTAINED WINDS NEAR 130 KTS...150 MPH...240 KM/HR.

CHANCES OF EXPERIENCING WIND SPEEDS OF AT LEAST
   ...34 KT (39 MPH... 63 KPH)...
   ...50 KT (58 MPH... 93 KPH)...
   ...64 KT (74 MPH...119 KPH)...
FOR LOCATIONS AND TIME PERIODS DURING THE NEXT 5 DAYS

PROBABILITIES FOR LOCATIONS ARE GIVEN AS IP(CP) WHERE
    IP  IS THE PROBABILITY OF THE EVENT BEGINNING DURING
        AN INDIVIDUAL TIME PERIOD (INDIVIDUAL PROBABILITY)
   (CP) IS THE PROBABILITY OF THE EVENT OCCURRING BETWEEN
        06Z THU AND THE FORECAST HOUR (CUMULATIVE PROBABILITY)

PROBABILITIES ARE GIVEN IN PERCE
X INDICATES PROBABILITIES LESS T
LOCATIONS SHOWN WHEN THEIR TOTAL
   PROBABILITY IS AT LEAST 2.5 P

Z INDICATES UNIVERSAL COORDINATE


  - - - - WIND SPEED PROBABILITIES FOR SELECTED LOCATIONS - - - -

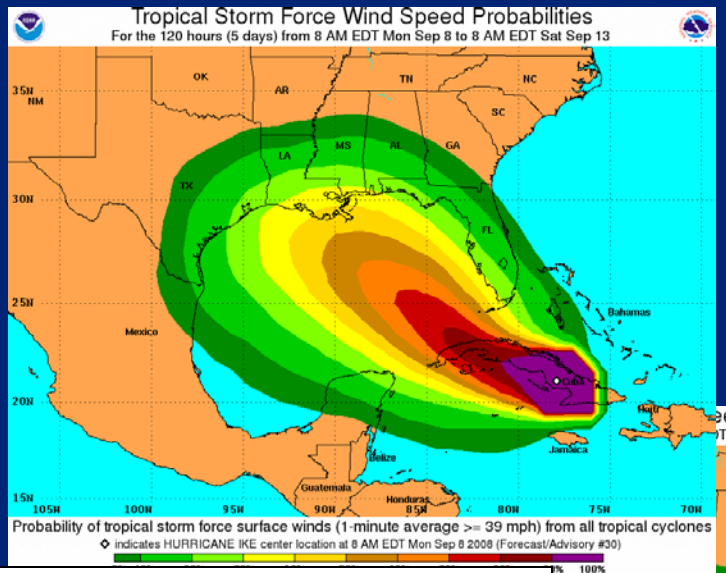

              FROM    FROM    FROM    FROM    FROM    FROM    FROM
  TIME      06Z THU 18Z THU 06Z FRI 18Z FRI 06Z SAT 06Z SUN 06Z MON
PERIODS       TO      TO      TO      TO      TO      TO      TO
           18Z THU 06Z FRI 18Z FRI 06Z SAT 06Z SUN 06Z MON 06Z TUE

FORECAST HOUR    (12)    (24)    (36)    (48)    (72)    (96)    (120)
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
LOCATION       KT

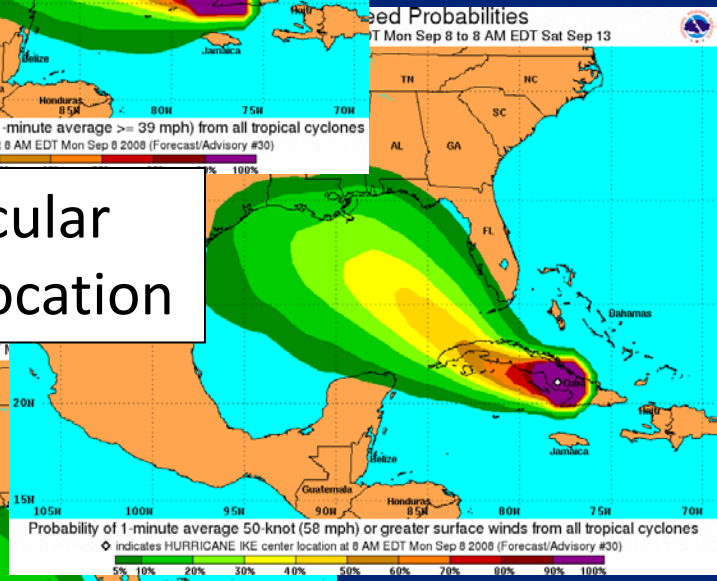
MIAMI FL       34  X   X( X)   X( X)   2( 2)  16(18)  23(41)   5(46)
MIAMI FL       50  X   X( X)   X( X)   X( X)   6( 6)  11(17)   3(20)
MIAMI FL       64  X   X( X)   X( X)   X( X)   2( 2)   5( 7)   1( 8)

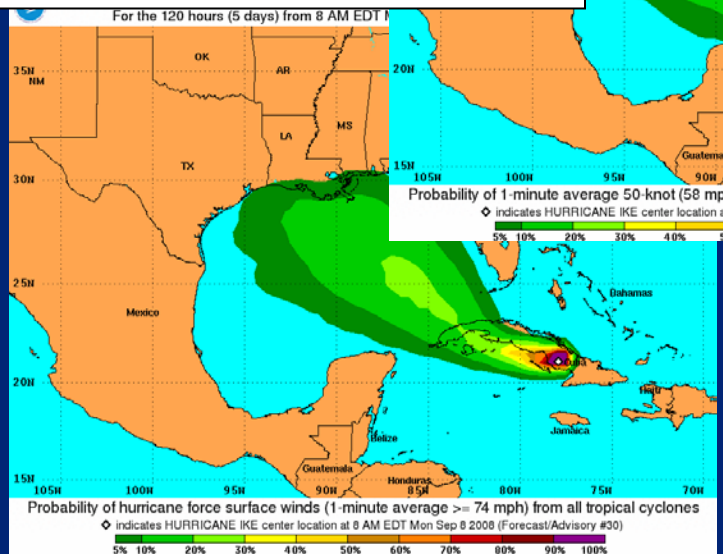
KEY WEST FL    34  X   X( X)   2( 2)   7( 9)  26(35)  18(53)   3(56)
KEY WEST FL    50  X   X( X)   X( X)   1( 1)  14(15)  11(26)   1(27)
KEY WEST FL    64  X   X( X)   X( X)   X( X)   8( 8)   5(13)   1(14)

MARCO ISLAND   34  X   X( X)   X( X)   5( 5)  20(25)  23(48)   4(52)
MARCO ISLAND   50  X   X( X)   X( X)   1( 1)  10(11)  12(23)   2(25)
MARCO ISLAND   64  X   X( X)   X( X)   X( X)   5( 5)   6(11)   X(11)
```



Show the chance of a particular event occurring at a specific location





U.S. Hurricane Watch and Warning Statistics (2000-2008)

• Average storm-total **watch** length	477 miles
• Average storm-total length w/ hurricane winds for cases when **watch** issued	89 miles
• Probability of hurricane winds at point under **watch**	**19%**
• Average storm-total **warning** length	403 miles
• Average storm-total length w/ hurricane winds for cases when **warning** issued	99 miles
• Probability of hurricane winds at point under **warning**	**25%**

Courtesy Andrea Schumacher

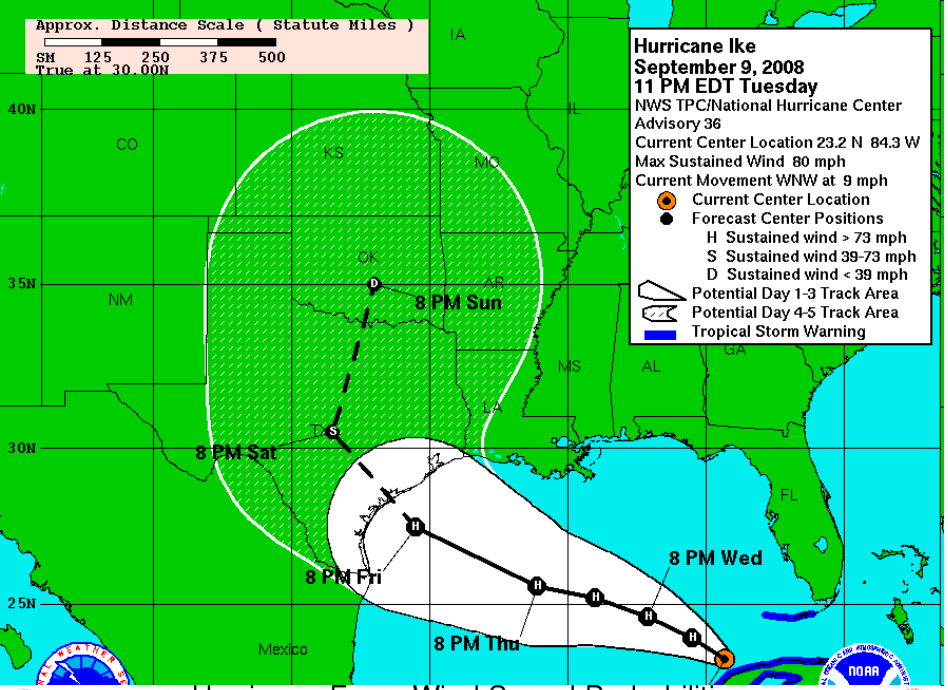
Reading and Interpreting the Wind Speed Probability Products

LOCATIONS SHOWN WHEN THEIR TOTAL CUMULATED 5 DAY
PROBABILITY IS AT LEAST 2.5 PERCENT

Z INDICATES UNIVERSAL COORDINATED TIME (GREENWICH)

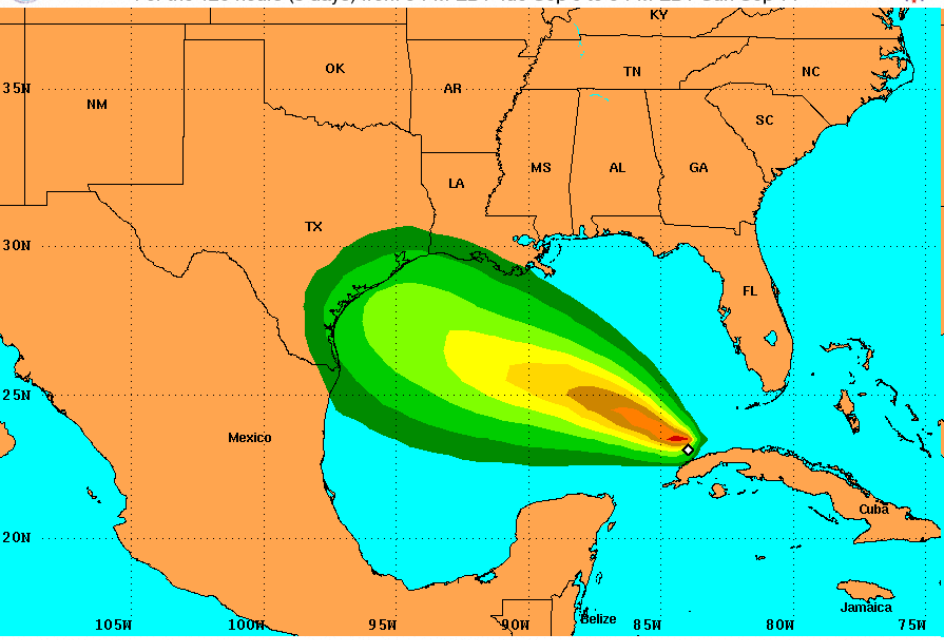
- - - - WIND SPEED PROBABILITIES FOR SELECTED LOCATIONS - - - -

TIME PERIODS		FROM 06Z THU TO 18Z THU	FROM 18Z THU TO 06Z FRI	FROM 06Z FRI TO 18Z FRI	FROM 18Z FRI TO 06Z SAT	FROM 06Z SAT TO 06Z SUN	FROM 06Z SUN TO 06Z MON	FROM 06Z MON TO 06Z TUE
FORECAST HOUR		(12)	(24)	(36)	(48)	(72)	(96)	(120)
LOCATION	KT							
MIAMI FL	34	X	X(X)	X(X)	2(2)	16(18)	23(41)	5(46)
MIAMI FL	50	X	X(X)	X(X)	X(X)	6(6)	11(17)	3(20)
MIAMI FL	64	X	X(X)	X(X)	X(X)	2(2)	5(7)	1(8)
KEY WEST FL	34	X	X(X)	2(2)	7(9)	26(35)	18(53)	3(56)
KEY WEST FL	50	X	X(X)	X(X)	1(1)	14(15)	11(26)	1(27)
KEY WEST FL	64	X	X(X)	X(X)	X(X)	8(8)	5(13)	1(14)
MARCO ISLAND	34	X	X(X)	X(X)	5(5)	20(25)	23(48)	4(52)
MARCO ISLAND	50	X	X(X)	X(X)	1(1)	10(11)	12(23)	2(25)



Hurricane Force Wind Speed Probabilities

For the 120 hours (5 days) from 8 PM EDT Tue Sep 9 to 8 PM EDT Sun Sep 14



Probability of hurricane force surface winds (1-minute average >= 74 mph) from all tropical cyclones

◇ indicates HURRICANE IKE center location at 8 PM EDT Tue Sep 9 2008 (Forecast/Advisory #36)

5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

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ZCZC MIAPWSAT4 ALL
TTAA00 KNHC DDHHMM
HURRICANE IKE WIND SPEED PROBABILITIES NUMBER  36
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL   AL092008
0300 UTC WED SEP 10 2008

AT 0300Z THE CENTER OF HURRICANE IKE WAS LOCATED NEAR LATITUDE 23.2
NORTH...LONGITUDE 84.3 WEST WITH MAXIMUM SUSTAINED WINDS NEAR 70 KTS
...80 MPH...130 KM/HR.

PORT ARTHUR TX 34  X   X( X)   X( X)   6( 6)  32(38)   8(46)   1(47)
PORT ARTHUR TX 50  X   X( X)   X( X)   1( 1)  12(13)   5(18)   1(19)
PORT ARTHUR TX 64  X   X( X)   X( X)   X( X)   5( 5)   3( 8)   X( 8)

GALVESTON TX   34  X   X( X)   1( 1)   6( 7)  38(45)  11(56)   2(58)
GALVESTON TX   50  X   X( X)   X( X)   1( 1)  20(21)   7(28)   2(30)
GALVESTON TX   64  X   X( X)   X( X)   X( X)   9( 9)   5(14)   X(14)

HOUSTON TX     34  X   X( X)   X( X)   4( 4)  33(37)  13(50)   2(52)
HOUSTON TX     50  X   X( X)   X( X)   X( X)  14(14)   8(22)   1(23)
HOUSTON TX     64  X   X( X)   X( X)   X( X)   5( 5)   4( 9)   1(10)

AUSTIN TX      34  X   X( X)   X( X)   X( X)  17(17)  17(34)   2(36)
AUSTIN TX      50  X   X( X)   X( X)   X( X)   2( 2)   6( 8)   1( 9)
AUSTIN TX      64  X   X( X)   X( X)   X( X)   1( 1)   1( 2)   X( 2)

SAN ANTONIO TX 34  X   X( X)   X( X)   X( X)  16(16)  18(34)   3(37)
SAN ANTONIO TX 50  X   X( X)   X( X)   X( X)   4( 4)   7(11)   X(11)
SAN ANTONIO TX 64  X   X( X)   X( X)   X( X)   X( X)   2( 2)   X( 2)

FREEPORT TX    34  X   X( X)   X( X)   7( 7)  40(47)  12(59)   2(61)
FREEPORT TX    50  X   X( X)   X( X)   1( 1)  22(23)  10(33)   2(35)
FREEPORT TX    64  X   X( X)   X( X)   X( X)  10(10)   5(15)   1(16)

GFMX 280N 950W 34  X   X( X)   1( 1)  13(14)  44(58)  10(68)   2(70)
GFMX 280N 950W 50  X   X( X)   X( X)   3( 3)  29(32)   8(40)   3(43)
GFMX 280N 950W 64  X   X( X)   X( X)   1( 1)  16(17)   6(23)   2(25)

PORT O CONNOR  34  X   X( X)   X( X)   5( 5)  38(43)  16(59)   4(63)
PORT O CONNOR  50  X   X( X)   X( X)   1( 1)  19(20)  10(30)   4(34)
PORT O CONNOR  64  X   X( X)   X( X)   X( X)   9( 9)   8(17)   1(18)

CORPUS CHRISTI 34  X   X( X)   X( X)   3( 3)  29(32)  16(48)   3(51)
CORPUS CHRISTI 50  X   X( X)   X( X)   X( X)  12(12)  10(22)   3(25)
CORPUS CHRISTI 64  X   X( X)   X( X)   X( X)   5( 5)   5(10)   1(11)

GFMX 270N 960W 34  X   X( X)   1( 1)   9(10)  38(48)  12(60)   4(64)
GFMX 270N 960W 50  X   X( X)   X( X)   2( 2)  24(26)   9(35)   3(38)
```

Example Interpretation of Output

What is the chance that winds of tropical storm force (34 kt or greater) will occur at Charlotte NC during the next five days?

34 kt probabilities at Charlotte NC

TIME PERIODS		FROM 18Z FRI TO 06Z SAT	FROM 06Z SAT TO 18Z SAT	FROM 18Z SAT TO 06Z SUN	FROM 06Z SUN TO 18Z SUN	FROM 18Z SUN TO 18Z MON	FROM 18Z MON TO 18Z TUE	FROM 18Z TUE TO 18Z WED
FORECAST HOUR		(12)	(24)	(36)	(48)	(72)	(96)	(120)
LOCATION	KT							
RALEIGH NC	34	X	X(X)	X(X)	2(2)	10(12)	8(20)	10(30)
RALEIGH NC	50	X	X(X)	X(X)	X(X)	2(2)	3(5)	5(10)
RALEIGH NC	64	X	X(X)	X(X)	X(X)	X(X)	2(2)	2(4)
CAPE HATTERAS	34	X	X(X)	X(X)	1(1)	4(5)	3(8)	7(15)
CAPE HATTERAS	50	X	X(X)	X(X)	X(X)	X(X)	1(1)	2(3)
CHARLOTTE NC	34	X	X(X)	X(X)	3(3)	18(21)	12(33)	9(42)
CHARLOTTE NC	50	X	X(X)	X(X)	X(X)	4(4)	6(10)	4(14)
CHARLOTTE NC	64	X	X(X)	X(X)	X(X)	2(2)	2(4)	2(6)

Example Interpretation of Output

What is the chance that winds of tropical storm force (34 kt or greater) will occur at Charlotte NC during the next five days?

42%

TIME PERIODS		FROM 18Z FRI TO 06Z SAT	FROM 06Z SAT TO 18Z SAT	FROM 18Z SAT TO 06Z SUN	FROM 06Z SUN TO 18Z SUN	FROM 18Z SUN TO 18Z MON	FROM 18Z MON TO 18Z TUE	FROM 18Z TUE TO 18Z WED
FORECAST HOUR		(12)	(24)	(36)	(48)	(72)	(96)	(120)
LOCATION	KT							
RALEIGH NC	34	X	X(X)	X(X)	2(2)	10(12)	8(20)	10(30)
RALEIGH NC	50	X	X(X)	X(X)	X(X)	2(2)	3(5)	5(10)
RALEIGH NC	64	X	X(X)	X(X)	X(X)	X(X)	2(2)	2(4)
CAPE HATTERAS	34	X	X(X)	X(X)	1(1)	4(5)	3(8)	7(15)
CAPE HATTERAS	50	X	X(X)	X(X)	X(X)	X(X)	1(1)	2(3)
CHARLOTTE NC	34	X	X(X)	X(X)	3(3)	18(21)	12(33)	9(42)
CHARLOTTE NC	50	X	X(X)	X(X)	X(X)	4(4)	6(10)	4(14)
CHARLOTTE NC	64	X	X(X)	X(X)	X(X)	2(2)	2(4)	2(6)

34 kt probabilities at Charlotte NC

Example Interpretation of Output

What is the chance that winds of tropical storm force (34 kt or greater) will occur at Charlotte NC during the next five days?

42%

When are these winds most likely to start?

34 kt probabilities at Charlotte NC

TIME PERIODS		FROM 18Z FRI TO 06Z SAT	FROM 06Z SAT TO 18Z SAT	FROM 18Z SAT TO 06Z SUN	FROM 06Z SUN TO 18Z SUN	FROM 18Z SUN TO 18Z MON	FROM 18Z MON TO 18Z TUE	FROM 18Z TUE TO 18Z WED
FORECAST HOUR		(12)	(24)	(36)	(48)	(72)	(96)	(120)
LOCATION	KT							
RALEIGH NC	34	X	X(X)	X(X)	2(2)	10(12)	8(20)	10(30)
RALEIGH NC	50	X	X(X)	X(X)	X(X)	2(2)	3(5)	5(10)
RALEIGH NC	64	X	X(X)	X(X)	X(X)	X(X)	2(2)	2(4)
CAPE HATTERAS	34	X	X(X)	X(X)	1(1)	4(5)	3(8)	7(15)
CAPE HATTERAS	50	X	X(X)	X(X)	X(X)	X(X)	1(1)	2(3)
CHARLOTTE NC	34	X	X(X)	X(X)	3(3)	18(21)	12(33)	9(42)
CHARLOTTE NC	50	X	X(X)	X(X)	X(X)	4(4)	6(10)	4(14)
CHARLOTTE NC	64	X	X(X)	X(X)	X(X)	2(2)	2(4)	2(6)

Example Interpretation of Output

What is the chance that winds of tropical storm force (34 kt or greater) will occur at Charlotte NC during the next five days?

42%

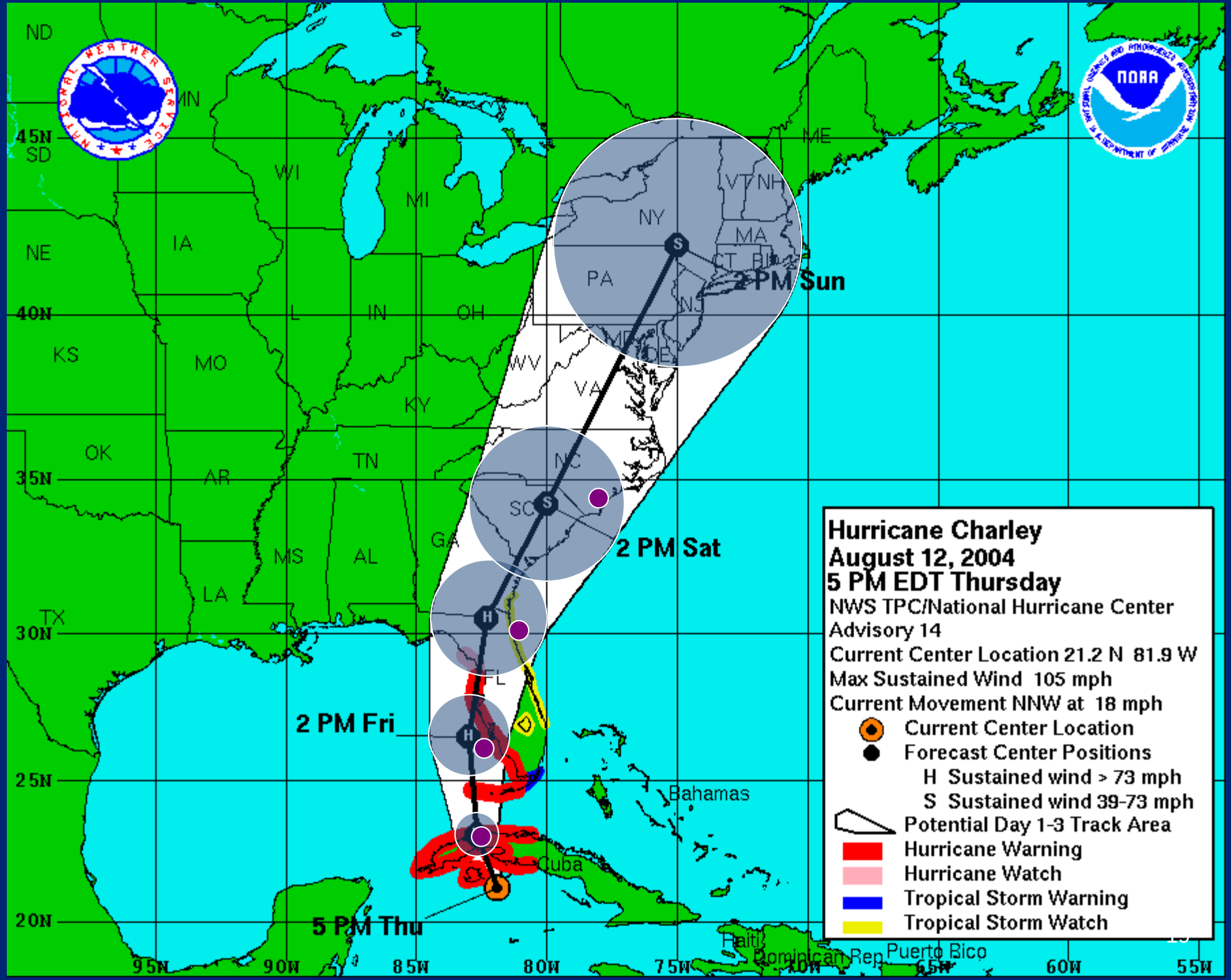
When are these winds most likely to start?

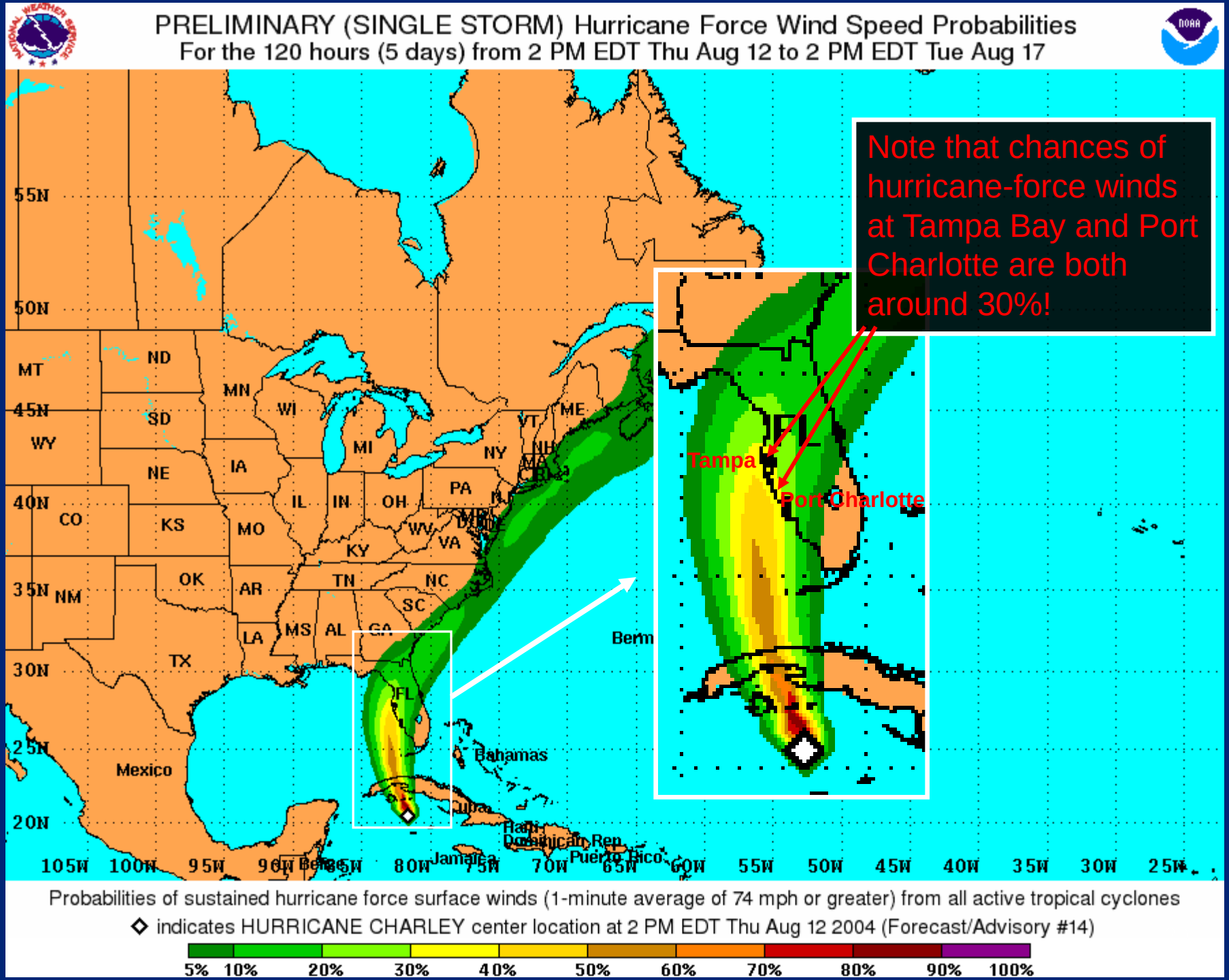
From 18Z Sun to 18Z Mon (18% chance)

TIME PERIODS		FROM 18Z FRI TO 06Z SAT	FROM 06Z SAT TO 18Z SAT	FROM 18Z SAT TO 06Z SUN	FROM 06Z SUN TO 18Z SUN	FROM 18Z SUN TO 18Z MON	FROM 18Z MON TO 18Z TUE	FROM 18Z TUE TO 18Z WED
FORECAST HOUR		(12)	(24)	(36)	(48)	(72)	(96)	(120)
LOCATION	KT							
RALEIGH NC	34	X	X(X)	X(X)	2(2)	10(12)	8(20)	10(30)
RALEIGH NC	50	X	X(X)	X(X)	X(X)	2(2)	3(5)	5(10)
RALEIGH NC	64	X	X(X)	X(X)	X(X)	X(X)	2(2)	2(4)
CAPE HATTERAS	34	X	X(X)	X(X)	1(1)	4(5)	3(8)	7(15)
CAPE HATTERAS	50	X	X(X)	X(X)	X(X)	X(X)	1(1)	2(3)
CHARLOTTE NC	34	X	X(X)	X(X)	3(3)	18(21)	12(33)	9(42)
CHARLOTTE NC	50	X	X(X)	X(X)	X(X)	4(4)	6(10)	4(14)
CHARLOTTE NC	64	X	X(X)	X(X)	X(X)	2(2)	2(4)	2(6)

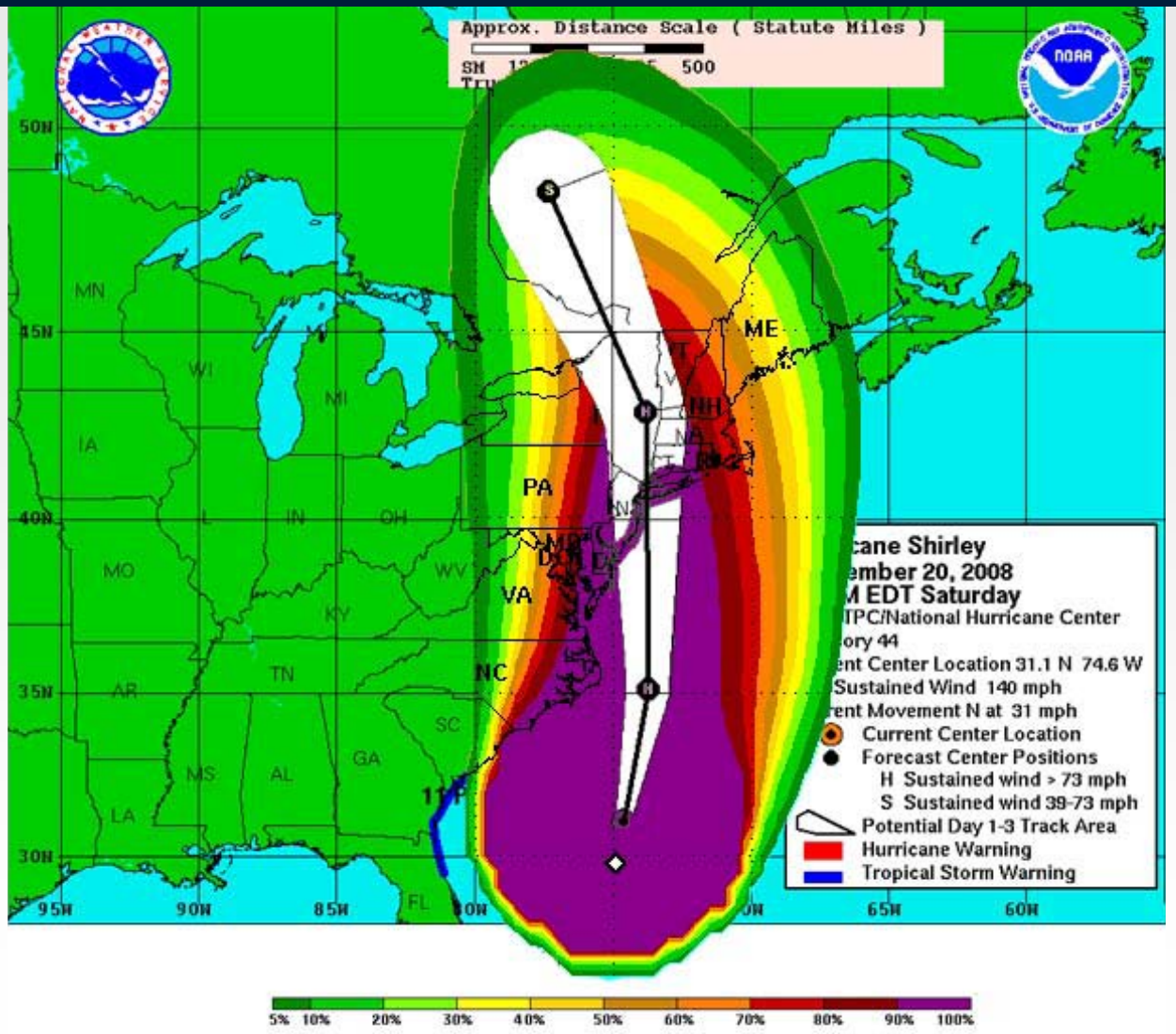
34 kt probabilities at Charlotte NC

What the Probabilities can tell you that that the Error Cone doesn't

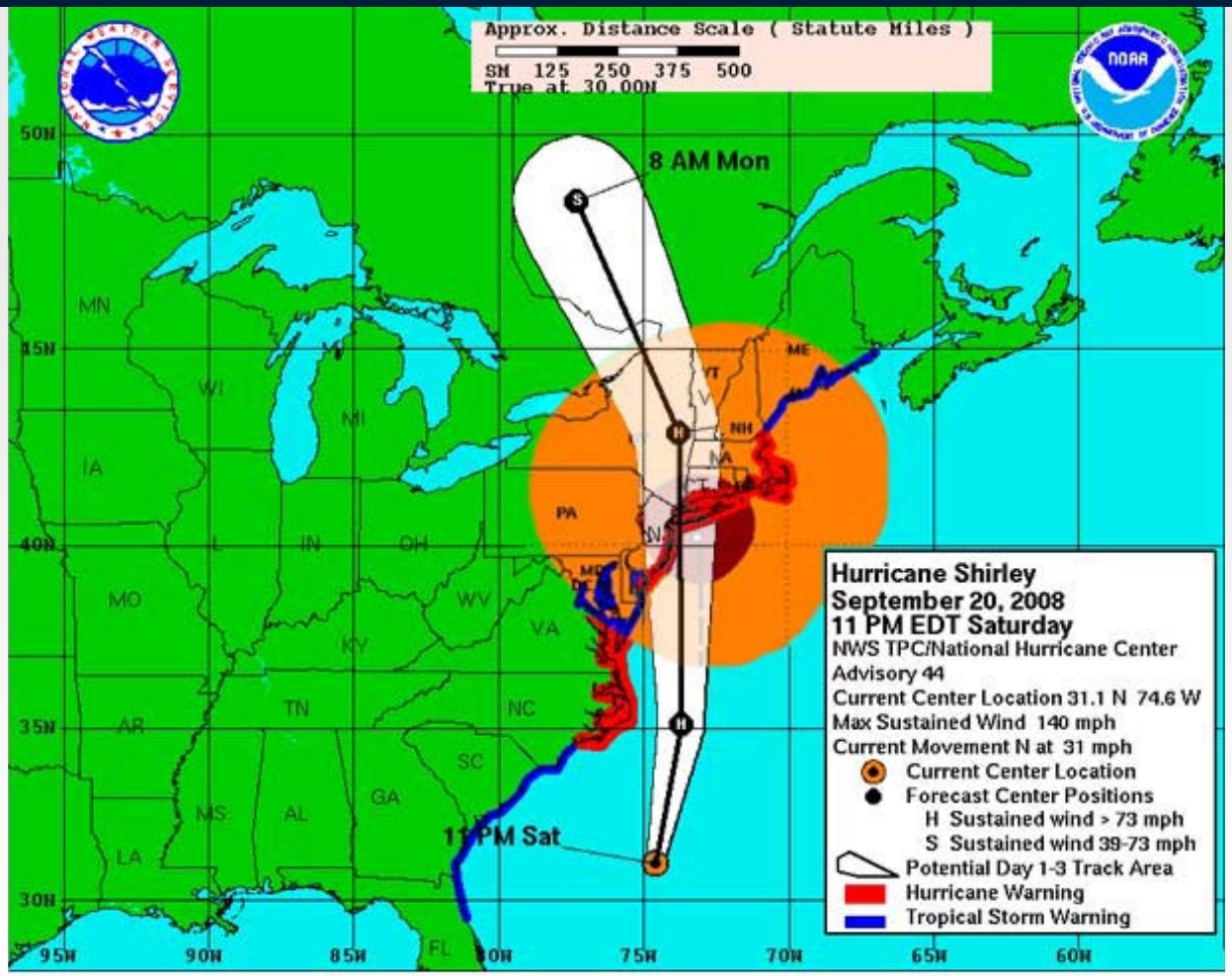

Hurricane Charley
August 12, 2004
5 PM EDT Thursday
NWS TPC/National Hurricane Center
Advisory 14
Current Center Location 21.2 N 81.9 W
Max Sustained Wind 105 mph
Current Movement NNW at 18 mph
Current Center Location
Forecast Center Positions
H Sustained wind > 73 mph
S Sustained wind 39-73 mph
Potential Day 1-3 Track Area
Hurricane Warning
Hurricane Watch
Tropical Storm Warning
Tropical Storm Watch
2 PM Sun
2 PM Sat
2 PM Fri
5 PM Thu
Bahamas
Cuba
Haiti
Dominican Rep.
Puerto Rico
ND
SD
MN
NE
IA
WI
MI
IL
IN
OH
KS
MO
KY
WV
VA
NC
SC
TN
OK
AR
MS
AL
GA
FL
LA
TX
PA
NY
VT
NH
ME
MA
CT
RI
NJ
MD
DE
45N
40N
35N
30N
25N
20N
95W
90W
85W
80W
75W
70W
65W
60W
55W


PRELIMINARY (SINGLE STORM) Hurricane Force Wind Speed Probabilities
For the 120 hours (5 days) from 2 PM EDT Thu Aug 12 to 2 PM EDT Tue Aug 17
Note that chances of hurricane-force winds at Tampa Bay and Port Charlotte are both around 30%!
Tampa
Port Charlotte
55N
50N
45N
40N
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
65W
60W
55W
50W
45W
40W
35W
30W
25W
MT
ND
MN
SD
WI
MI
WY
NE
IA
IL
IN
OH
NY
PA
VT
ME
NH
CO
KS
MO
WV
VA
KY
NC
TN
SC
OK
AR
NM
LA
MS
AL
GA
TX
FL
Mexico
Bahamas
Cuba
Haiti
Dominican Rep
Puerto Rico
Jamaica
Bermuda
Probabilities of sustained hurricane force surface winds (1-minute average of 74 mph or greater) from all active tropical cyclones
◇ indicates HURRICANE CHARLEY center location at 2 PM EDT Thu Aug 12 2004 (Forecast/Advisory #14)
5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Impacts can Occur Well Outside the Cone



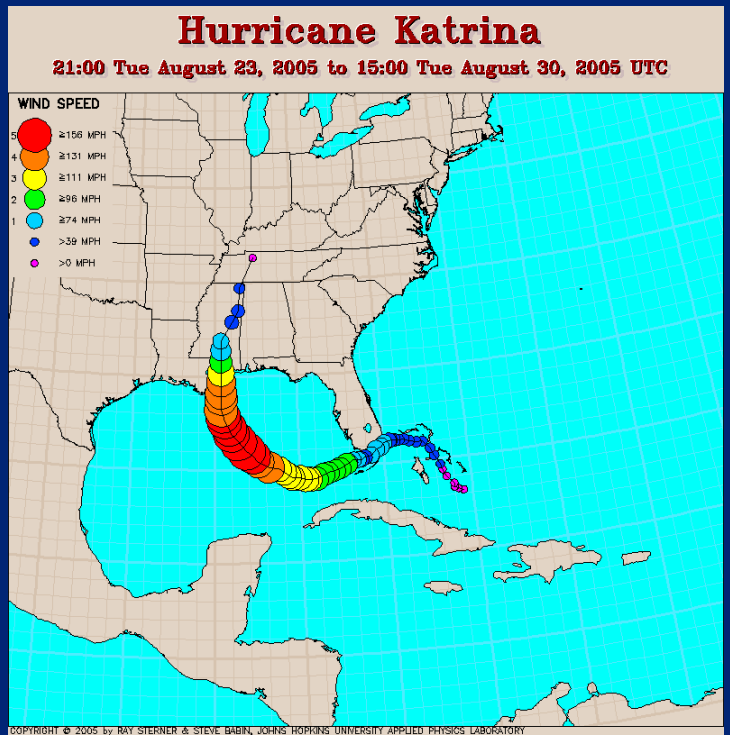
Impacts can Occur Well Outside the Cone

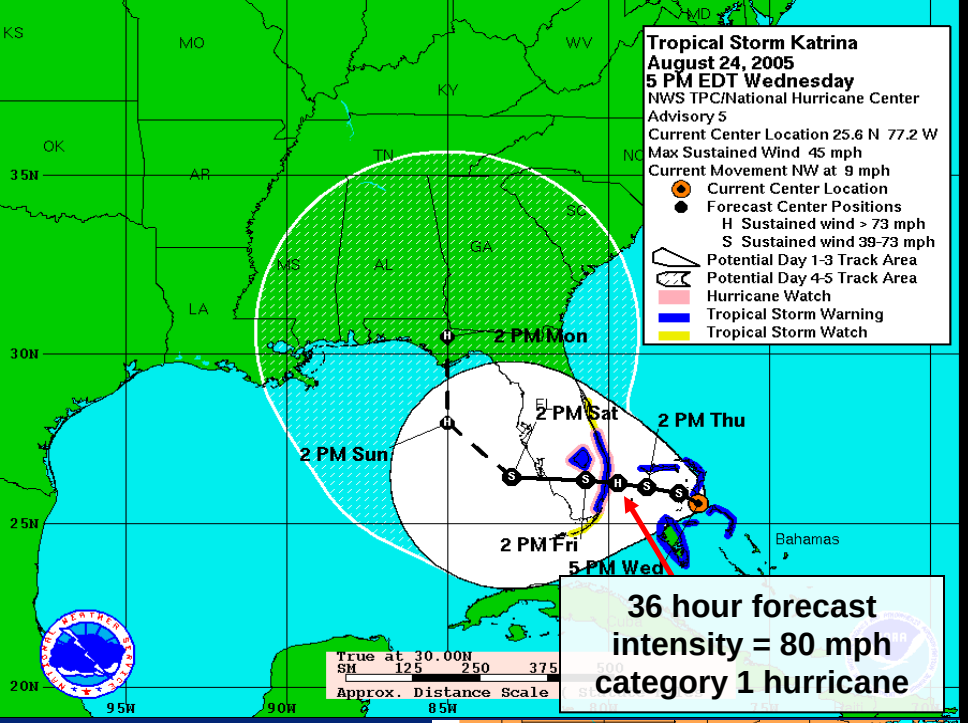


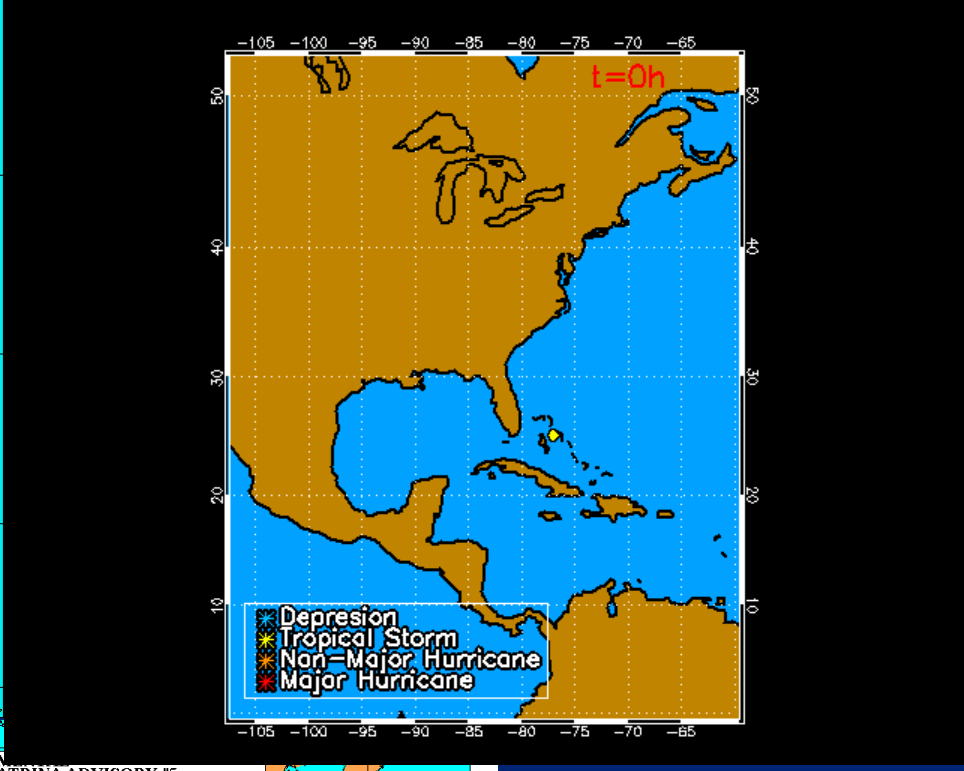
Hurricane Katrina (2005)

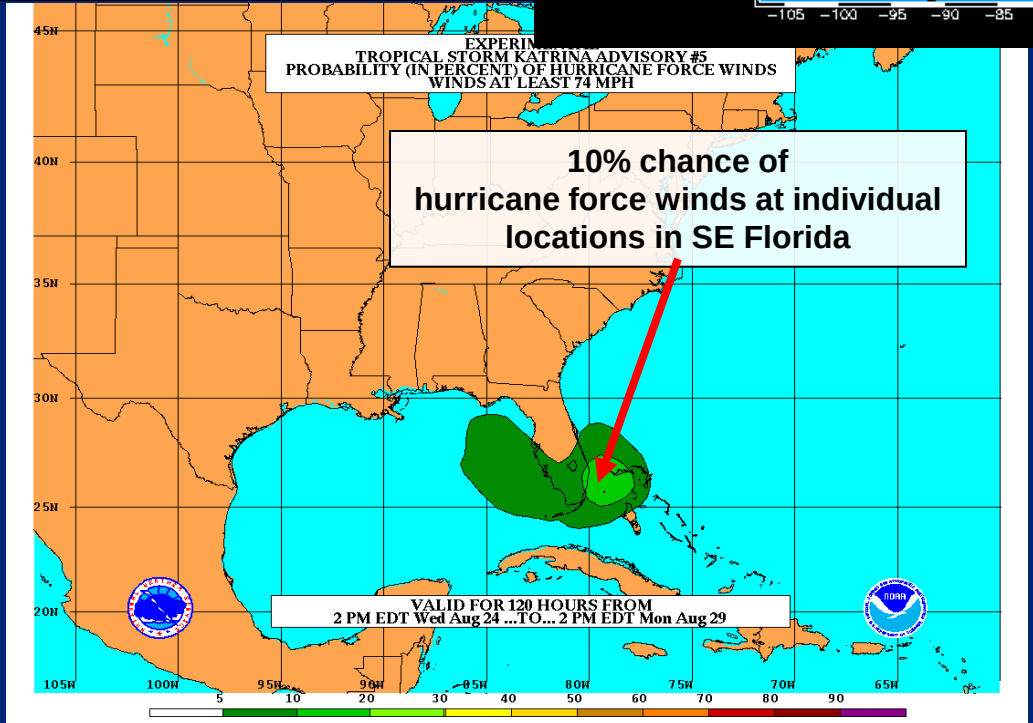
- Two examples of how probabilities evolve

1. Landfall of a marginal hurricane in South Florida
   - Small probabilities of hurricane force winds over much of south FL due to uncertainty in track and intensity
2. Landfall of a major hurricane along the Gulf Coast
   - Initially small probabilities at locations along the Gulf Coast increase markedly along the track of Katrina as landfall approaches
   - Hurricane conditions are almost a certainty *somewhere*



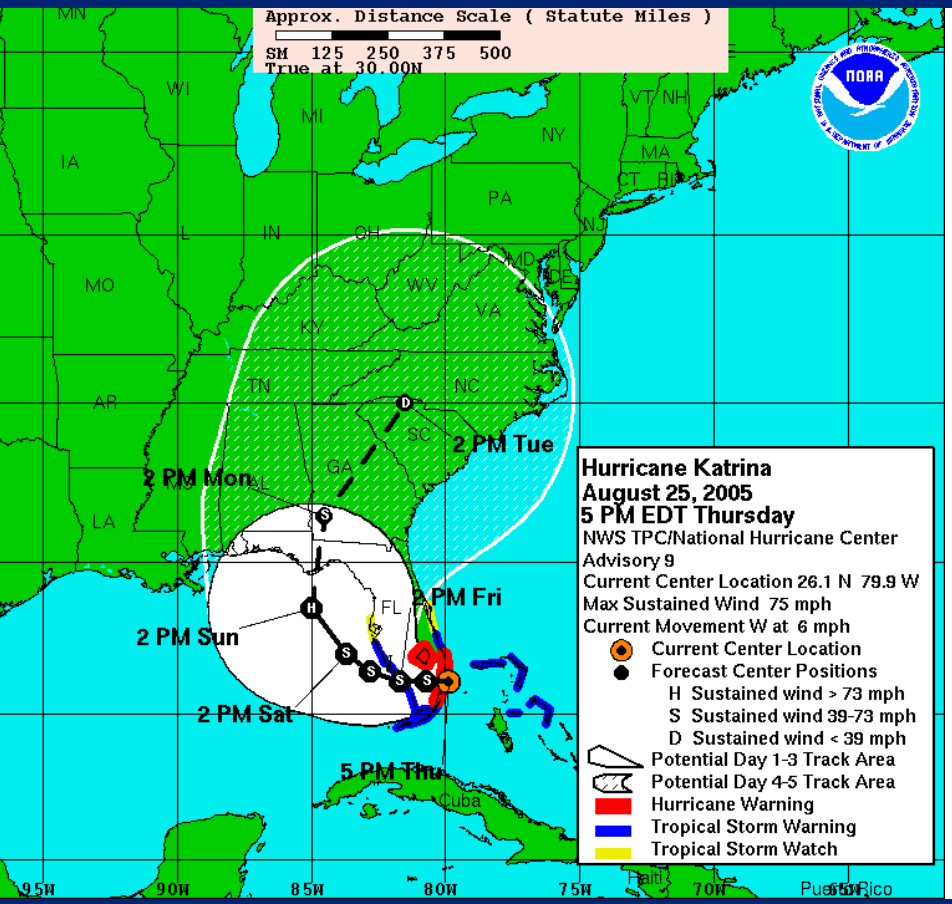

Tropical Storm Katrina
August 24, 2005
5 PM EDT Wednesday
NWS TPC/National Hurricane Center
Advisory 5
Current Center Location 25.6 N 77.2 W
Max Sustained Wind 45 mph
Current Movement NW at 9 mph
Current Center Location
Forecast Center Positions
H Sustained wind > 73 mph
S Sustained wind 39-73 mph
Potential Day 1-3 Track Area
Potential Day 4-5 Track Area
Hurricane Watch
Tropical Storm Warning
Tropical Storm Watch
2 PM Mon
2 PM Sun
2 PM Sat
2 PM Thu
2 PM Fri
5 PM Wed
Bahamas
True at 30.00N
SM 125 250 375
Approx. Distance Scale
36 hour forecast intensity = 80 mph category 1 hurricane

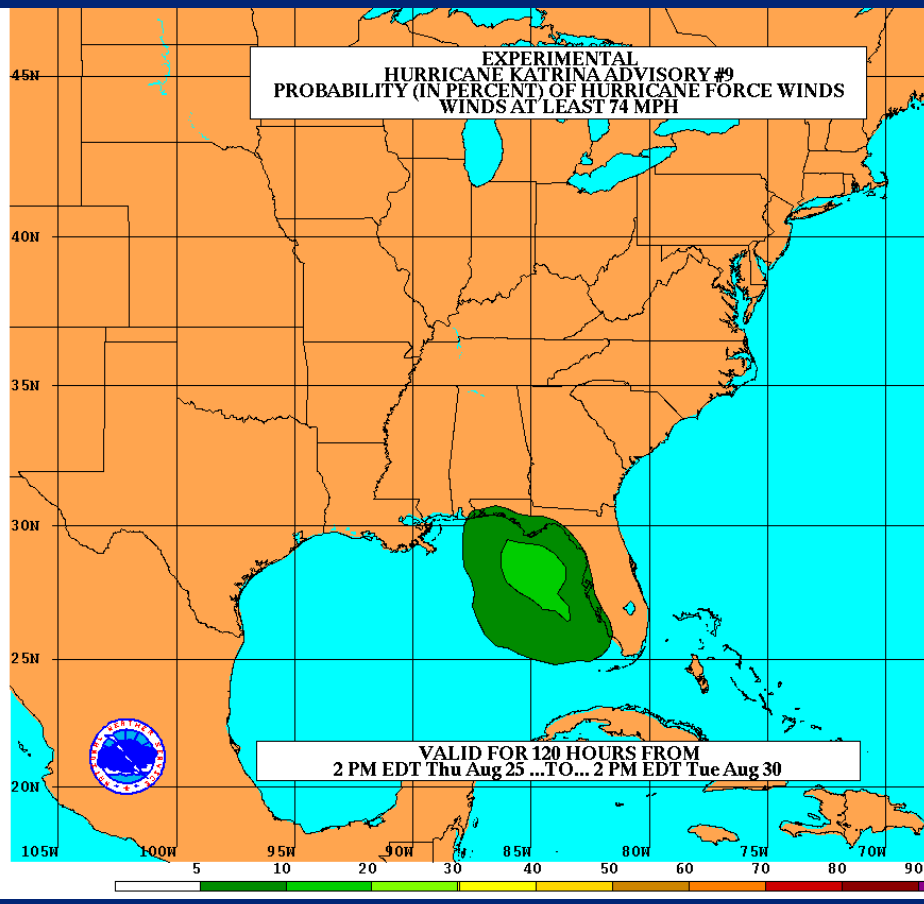

t=0h
Depresion
Tropical Storm
Non-Major Hurricane
Major Hurricane


TROPICAL STORM KATRINA ADVISORY #5
PROBABILITY (IN PERCENT) OF HURRICANE FORCE WINDS
WINDS AT LEAST 74 MPH
10% chance of hurricane force winds at individual locations in SE Florida
VALID FOR 120 HOURS FROM
2 PM EDT Wed Aug 24 ...TO... 2 PM EDT Mon Aug 29

Magnitudes of Cumulative Probabilities Vary Greatly But Realistically

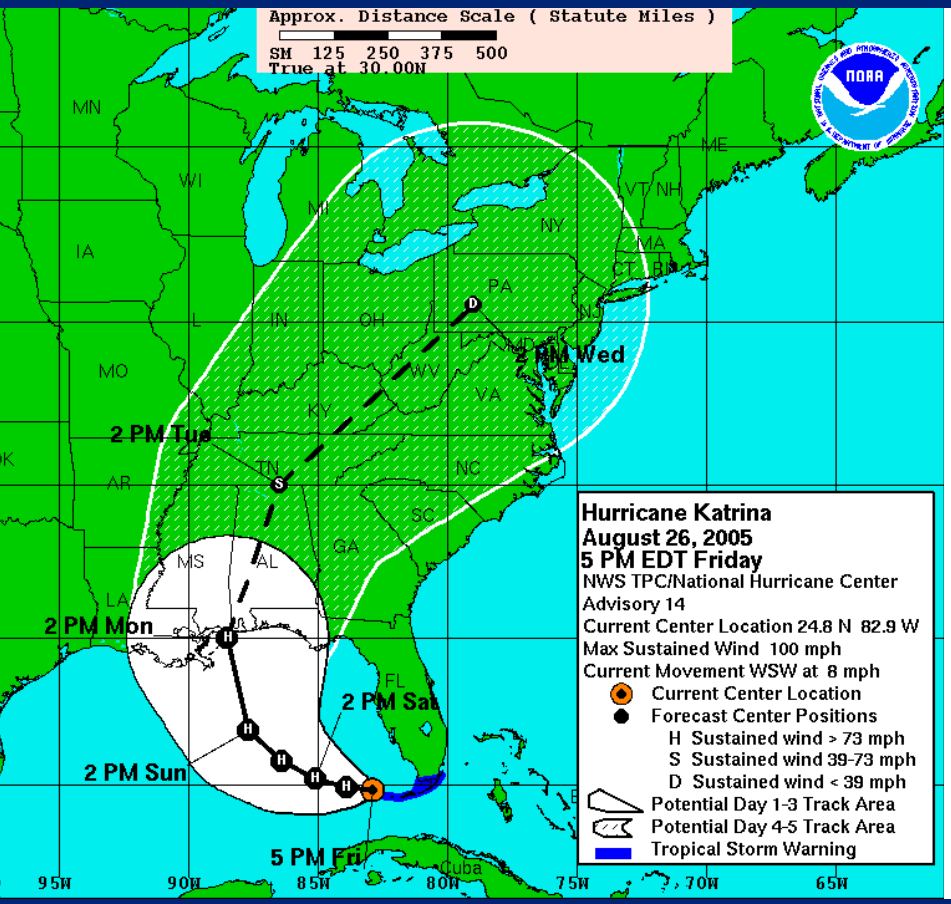
Katrina Advisory #9

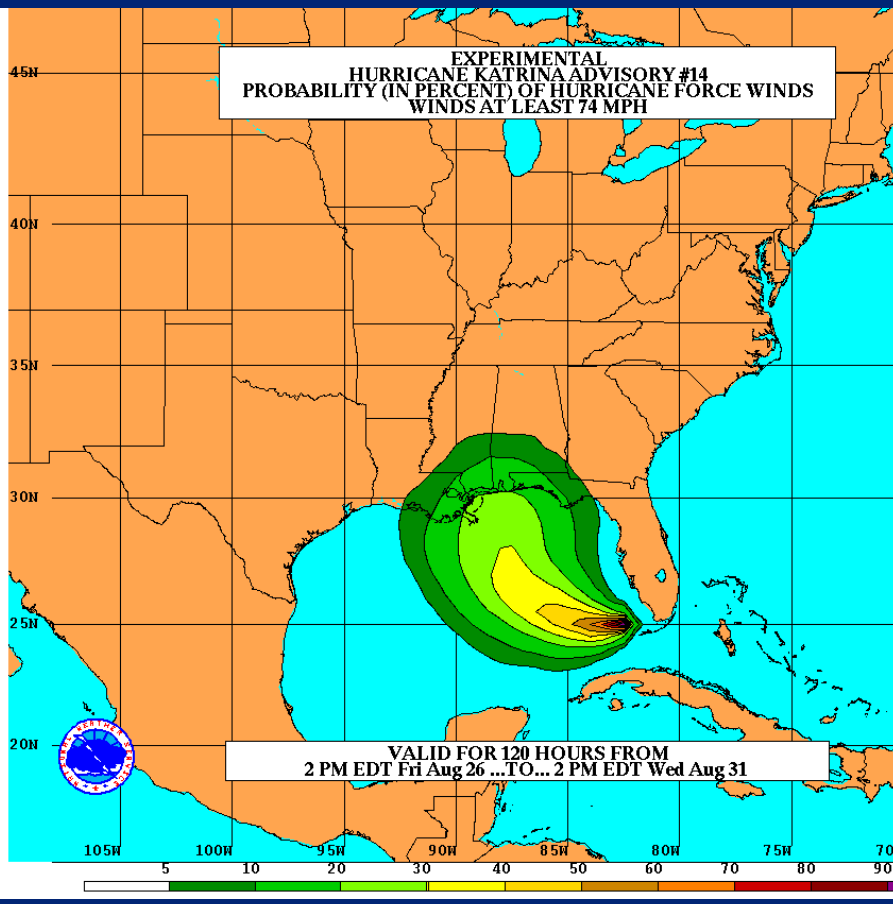




Magnitudes of Cumulative Probabilities Vary Greatly But Realistically

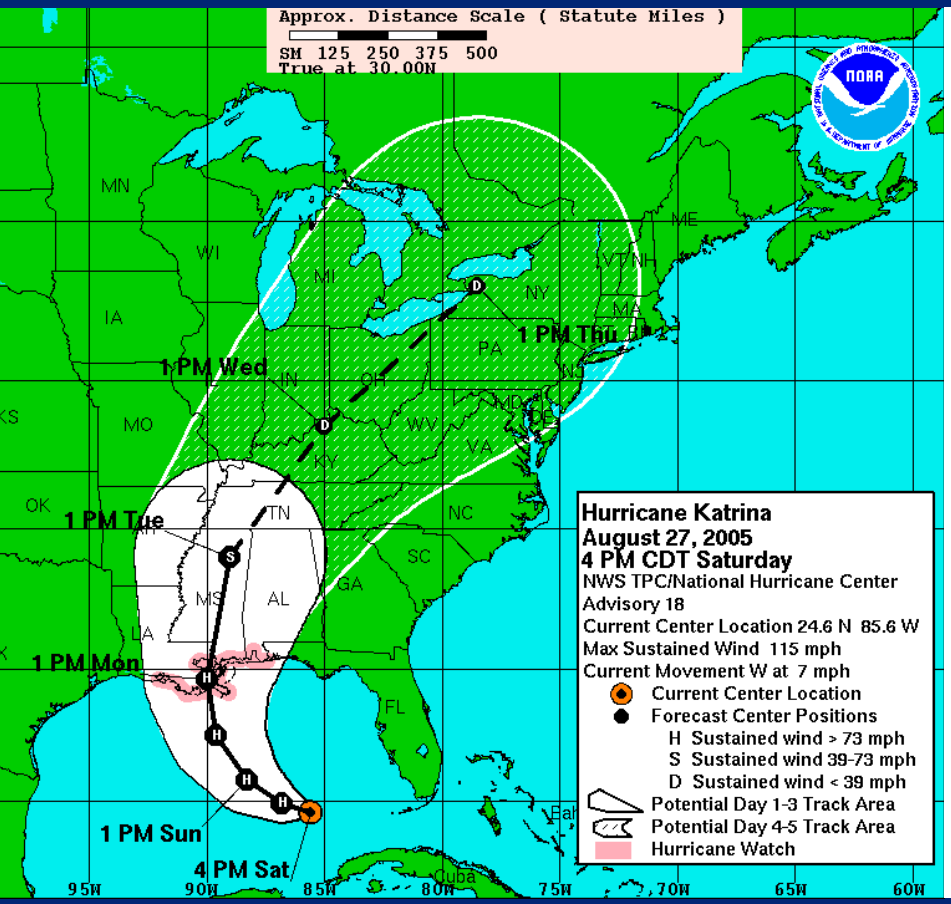
Katrina Advisory #14

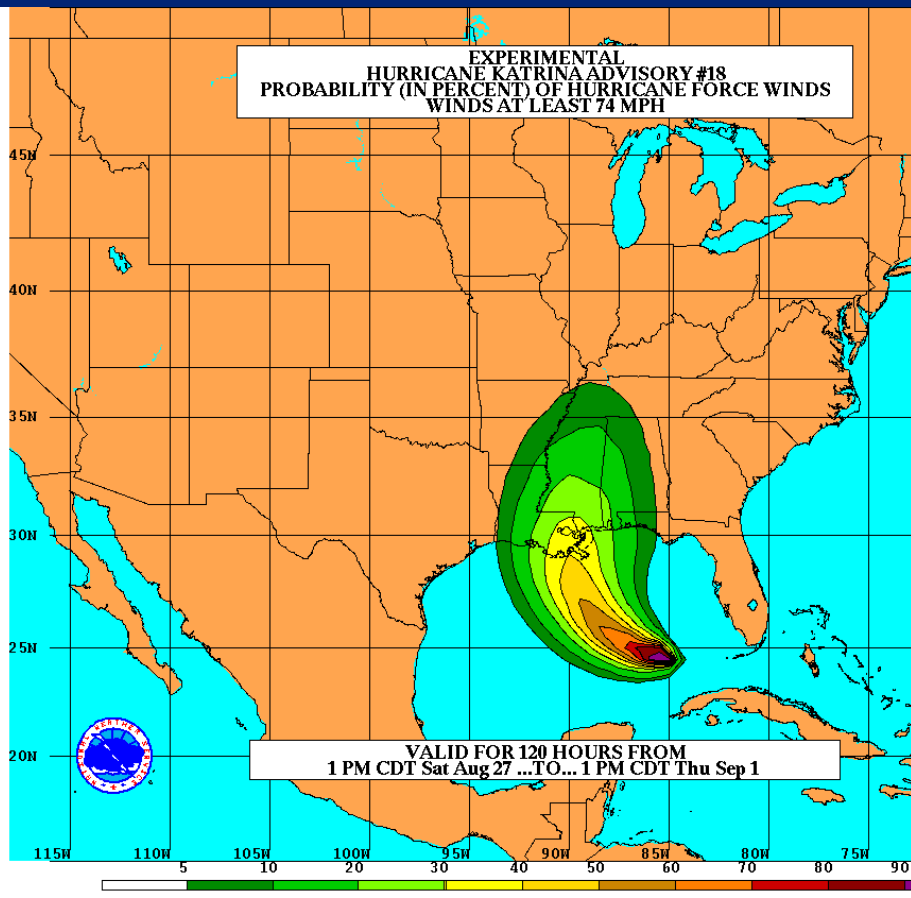




Magnitudes of Cumulative Probabilities Vary Greatly But Realistically

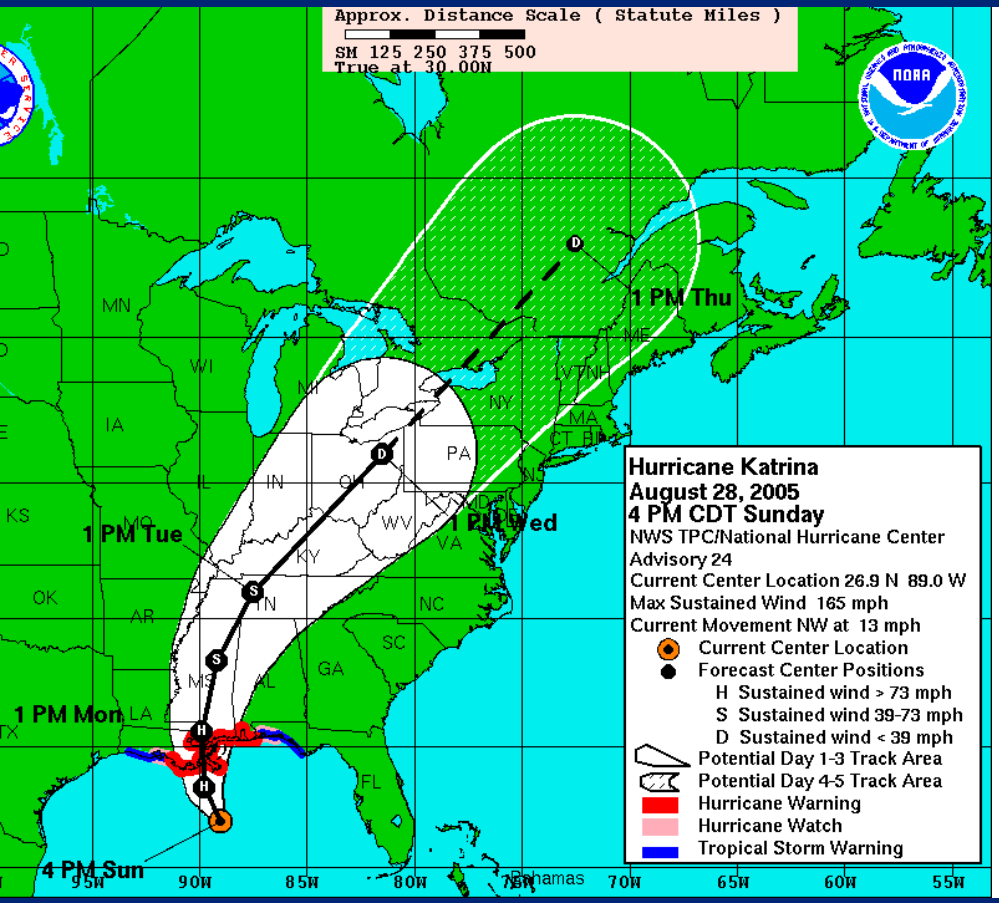
Katrina Advisory #18

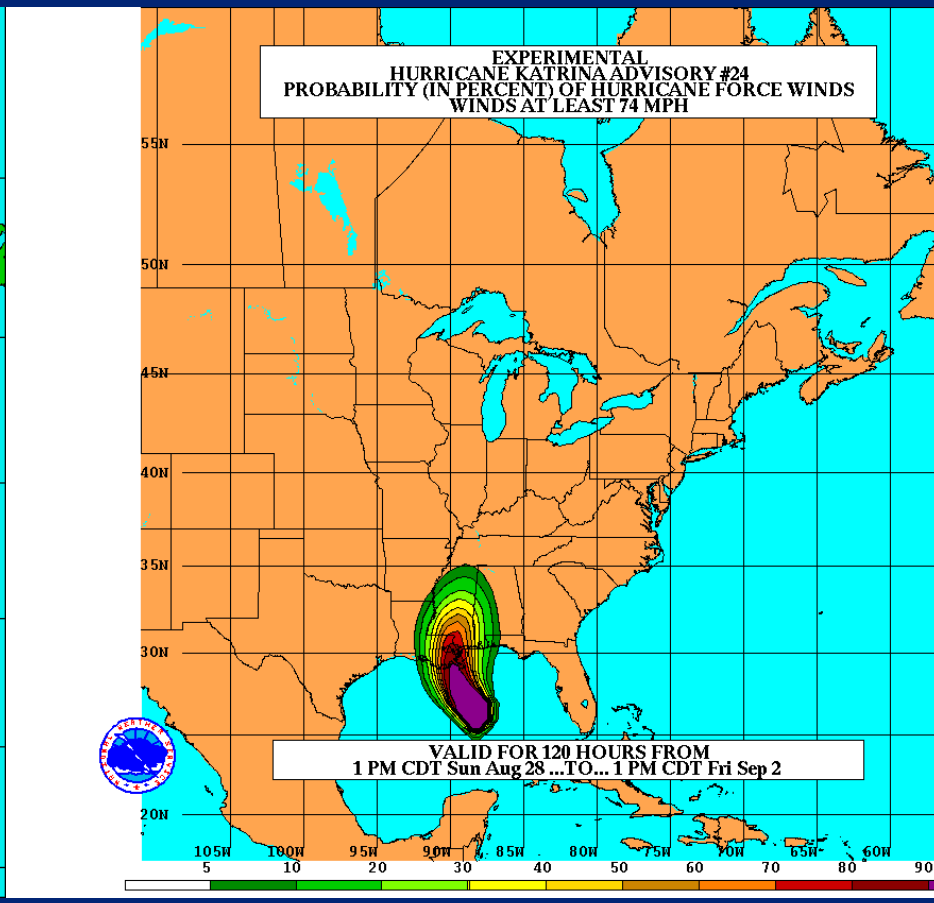




Magnitudes of Cumulative Probabilities Vary Greatly But Realistically

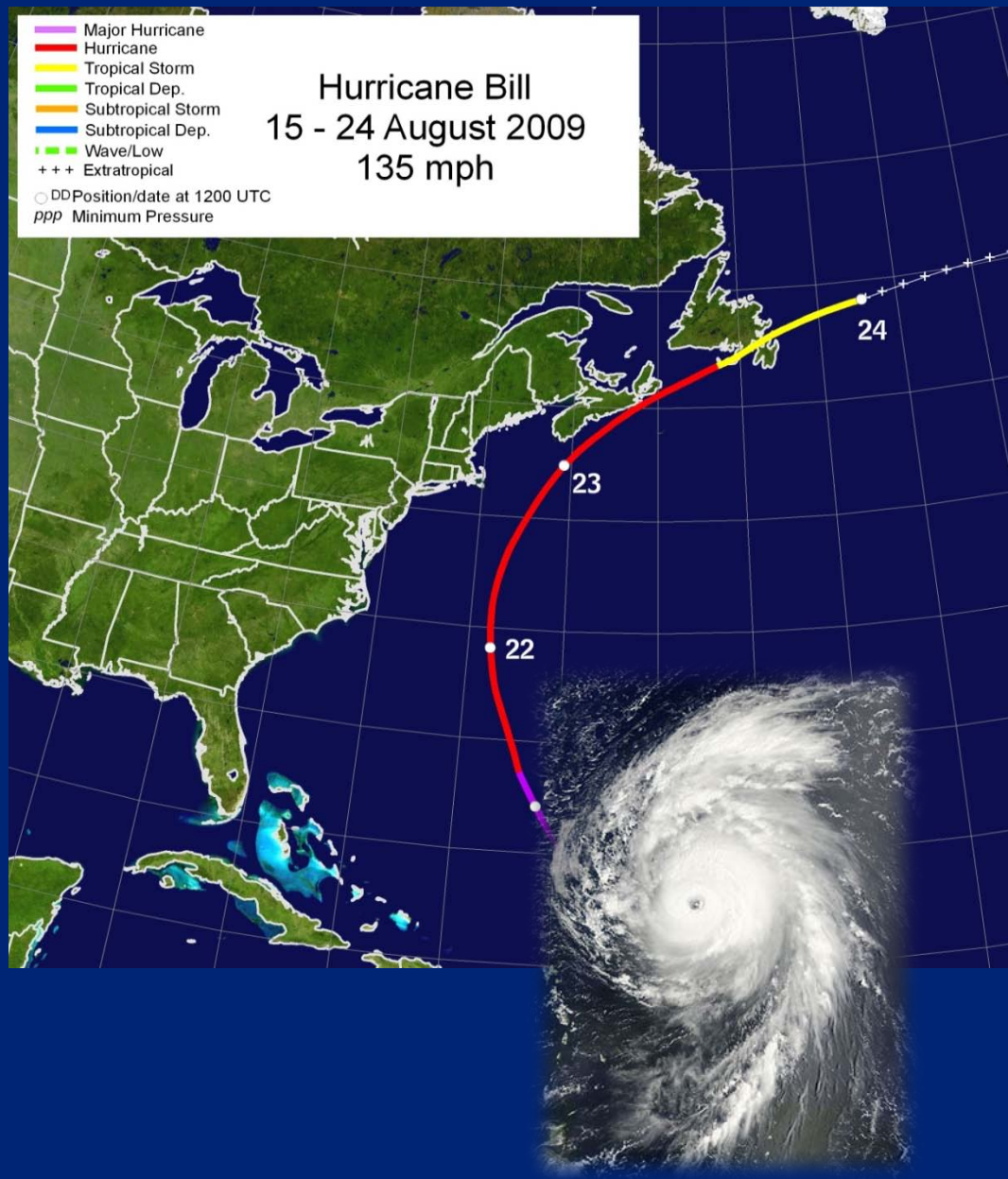
Katrina Advisory #24





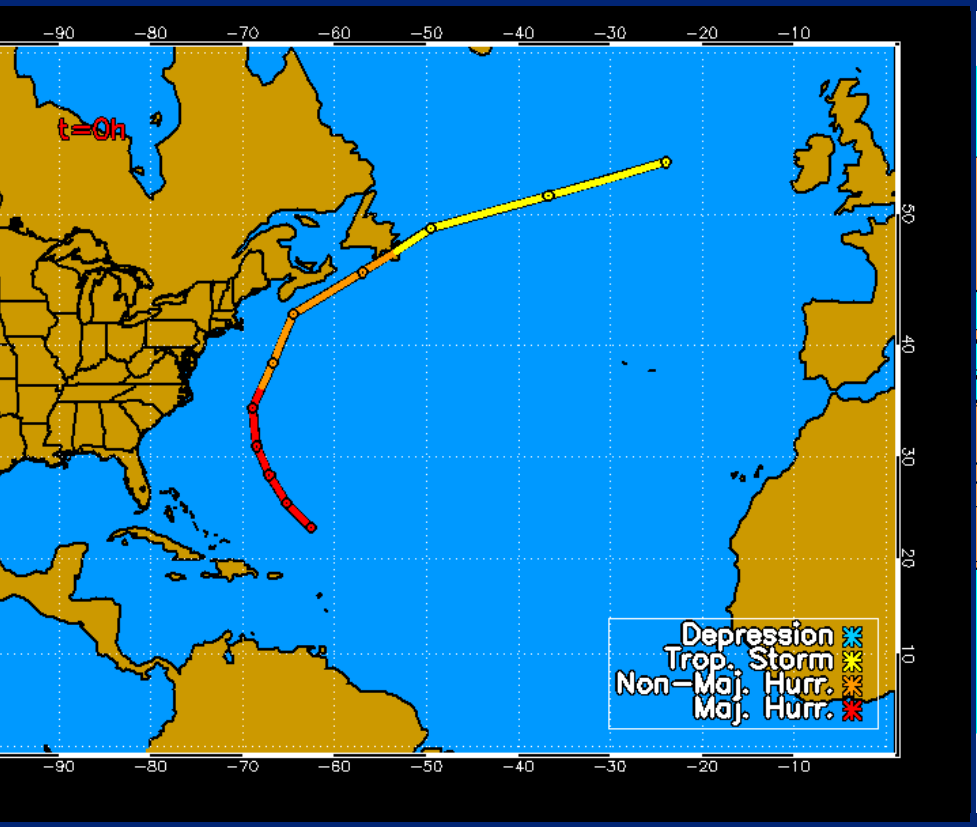
Hurricane Bill (2009)

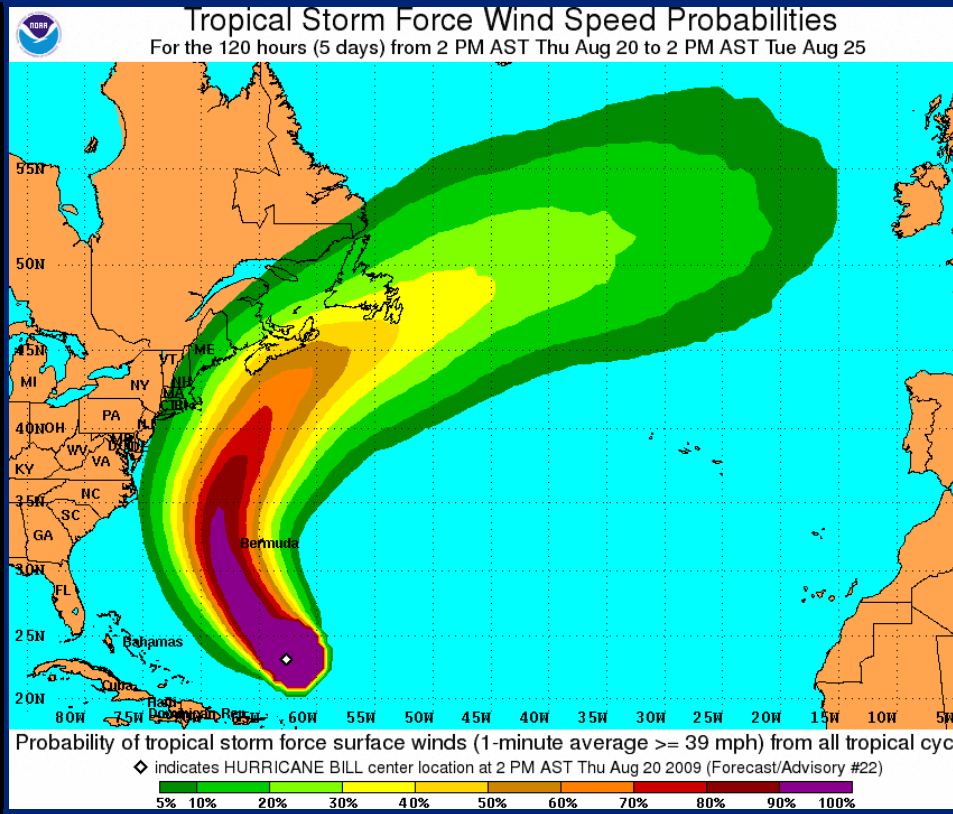
- Strong hurricane approaching the coast of New England but not expected to make landfall
- A “hit or miss” scenario, where some coastal areas could see tropical storm force winds, or nobody would (at least in the northeastern U.S.)
- Small changes in the forecast track or wind field in the western semicircle resulted in large changes in the wind speed probabilities



Hurricane Bill

Advisory 22 – Issued 5 pm EDT 20 Aug 2009





Cumulative 120-h 34-kt wind probabilities

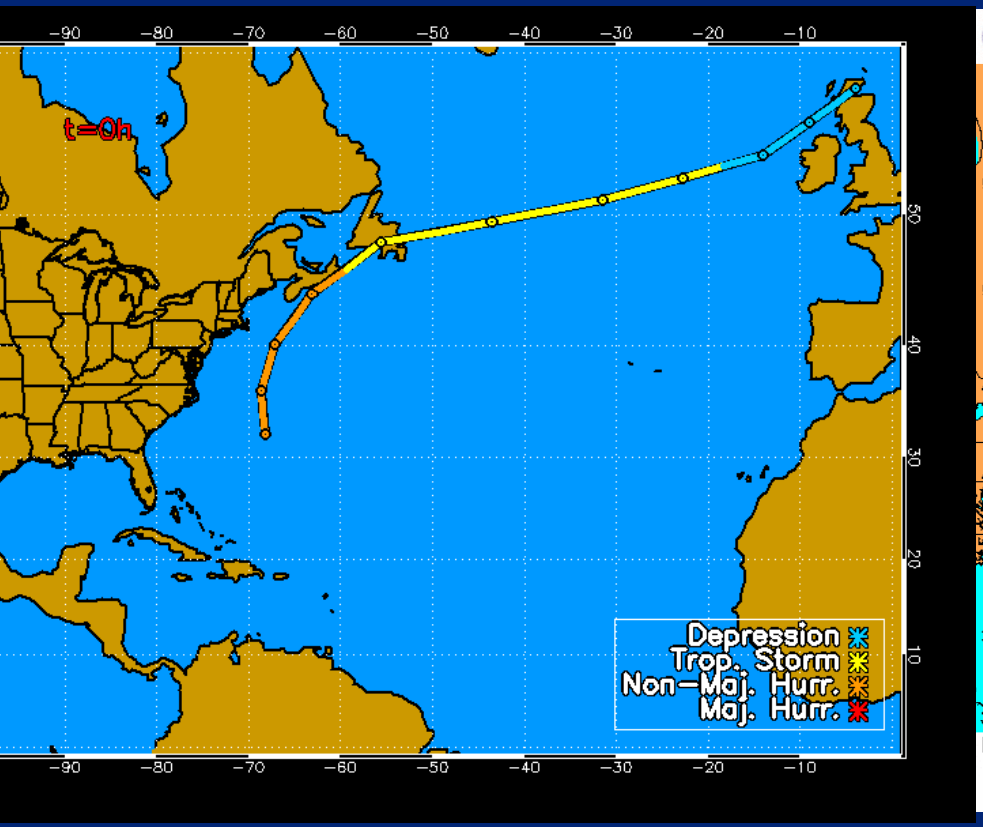
Nantucket: 24%

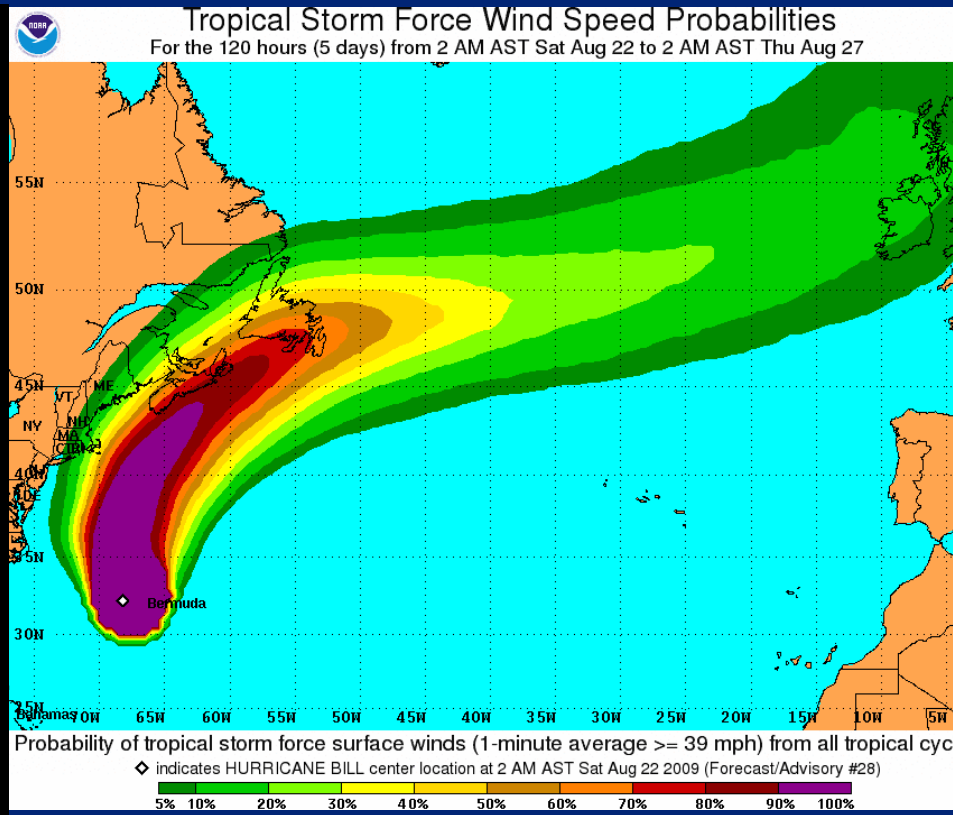
Hyannis: 20%

Hurricane Bill

Advisory 28 – Issued 5 am EDT 22 Aug 2009

Tropical Storm Warning Issued





Cumulative 120-h 34-kt wind probabilities

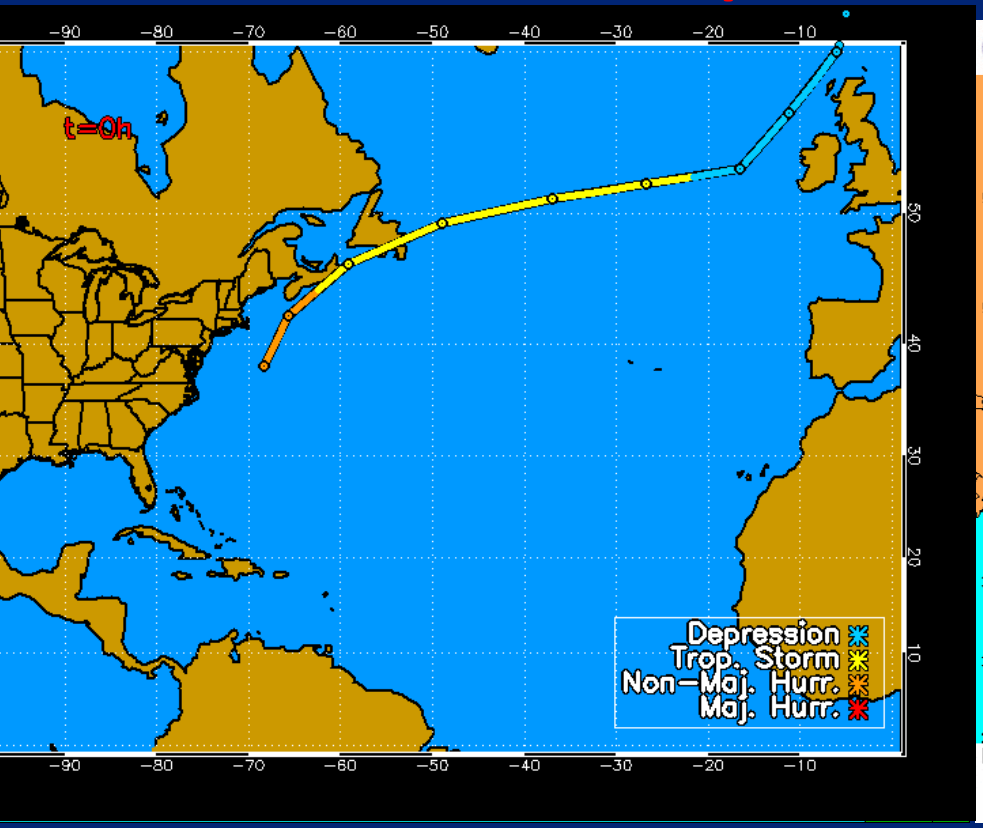
Nantucket: 40%

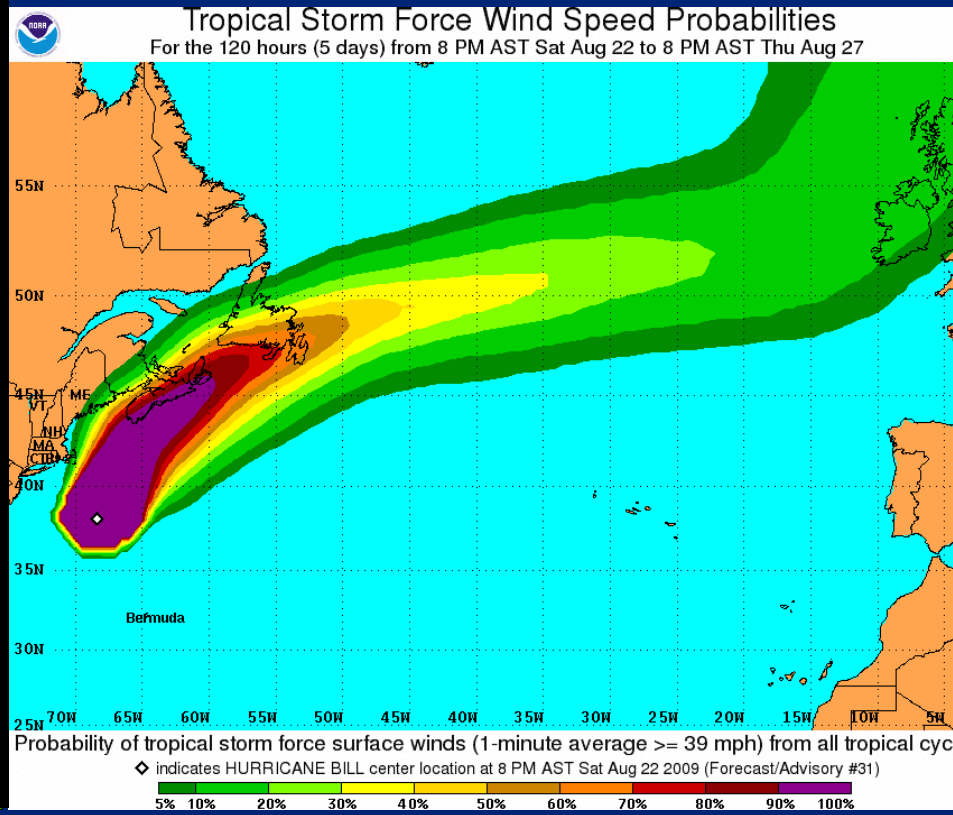
Hyannis: 29%

Hurricane Bill

Advisory 31 – Issued 11 pm EDT 22 Aug 2009

Tropical Storm Warning





Cumulative 120-h 34-kt wind probabilities

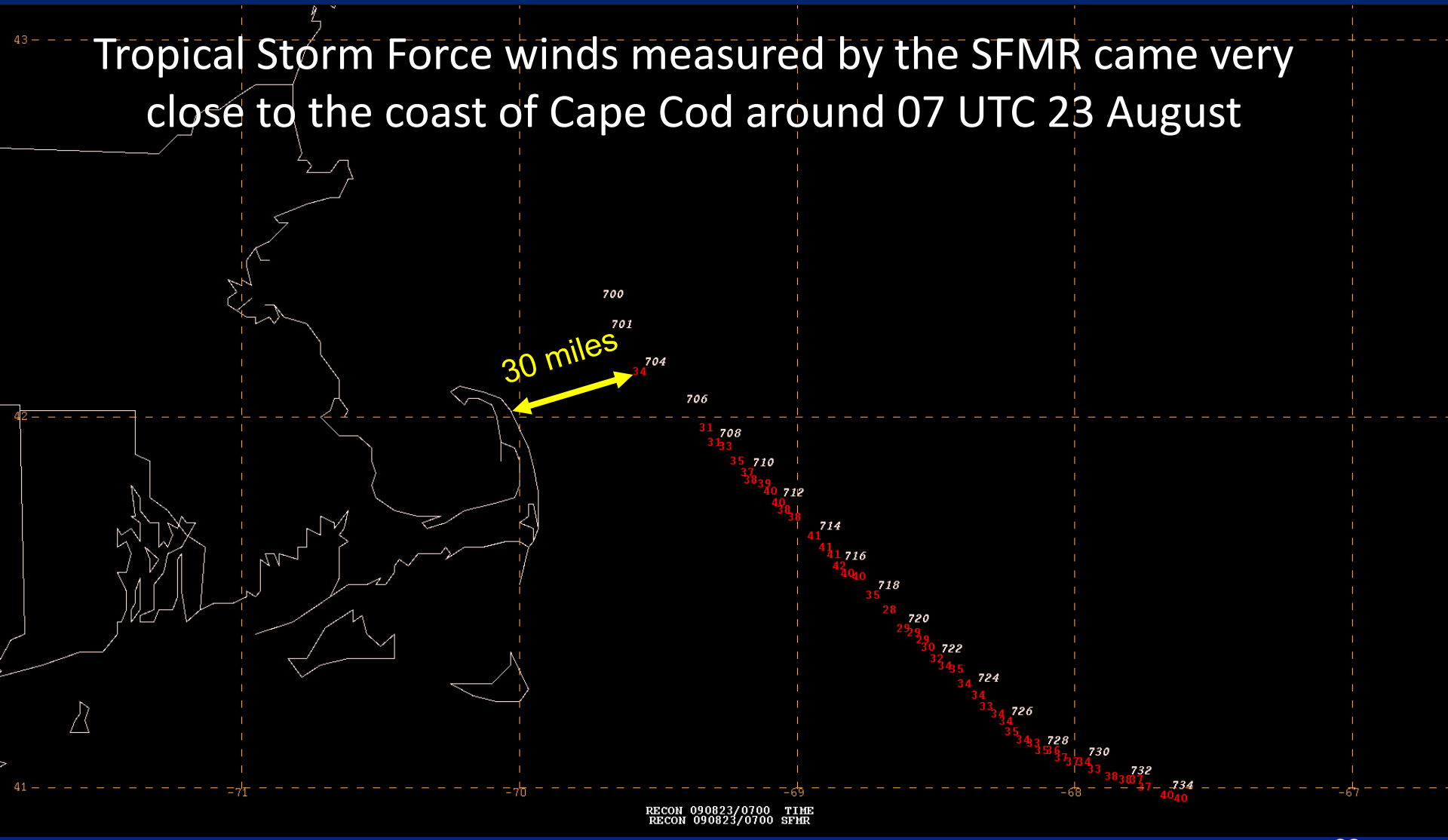
Nantucket: 10%

Hyannis: 5%

Hurricane Bill

Verification – A Close Call!

Tropical Storm Force winds measured by the SFMR came very close to the coast of Cape Cod around 07 UTC 23 August



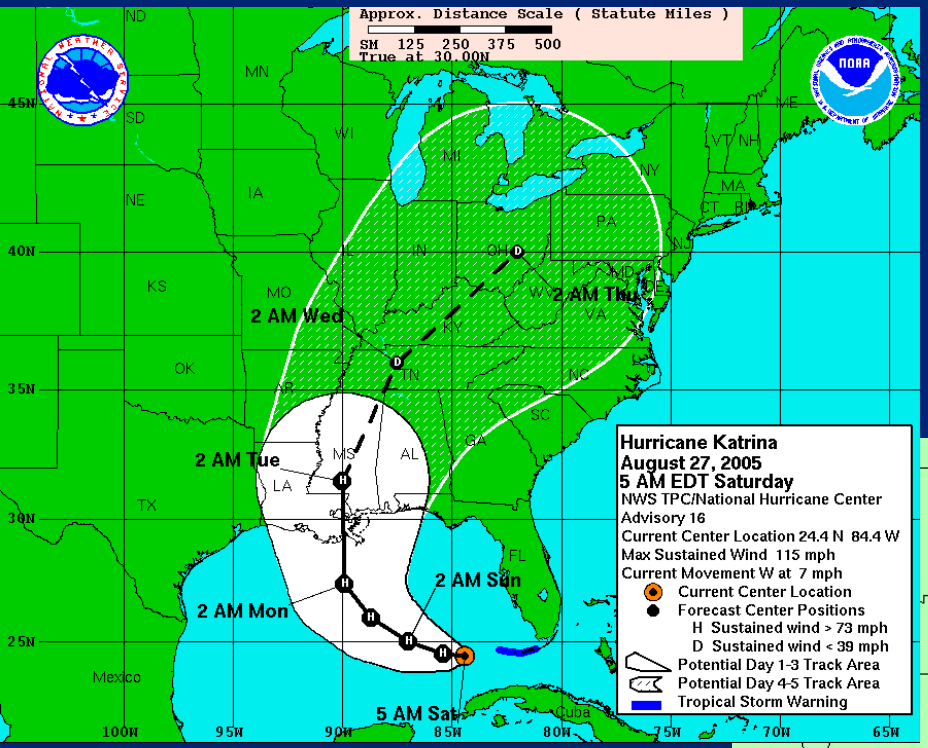
Lesson

- Recurving storms can result in an “all or nothing” scenario
  - Some area may receive winds (e.g., NC Outer Banks, SE Massachusetts) or winds may not impact any land areas
- Small changes in the track forecast may result in large changes in the probabilities for any given location
  - “Small” probabilities are important!
  - Be prepared to act quickly if the forecast changes and threat increases for your area

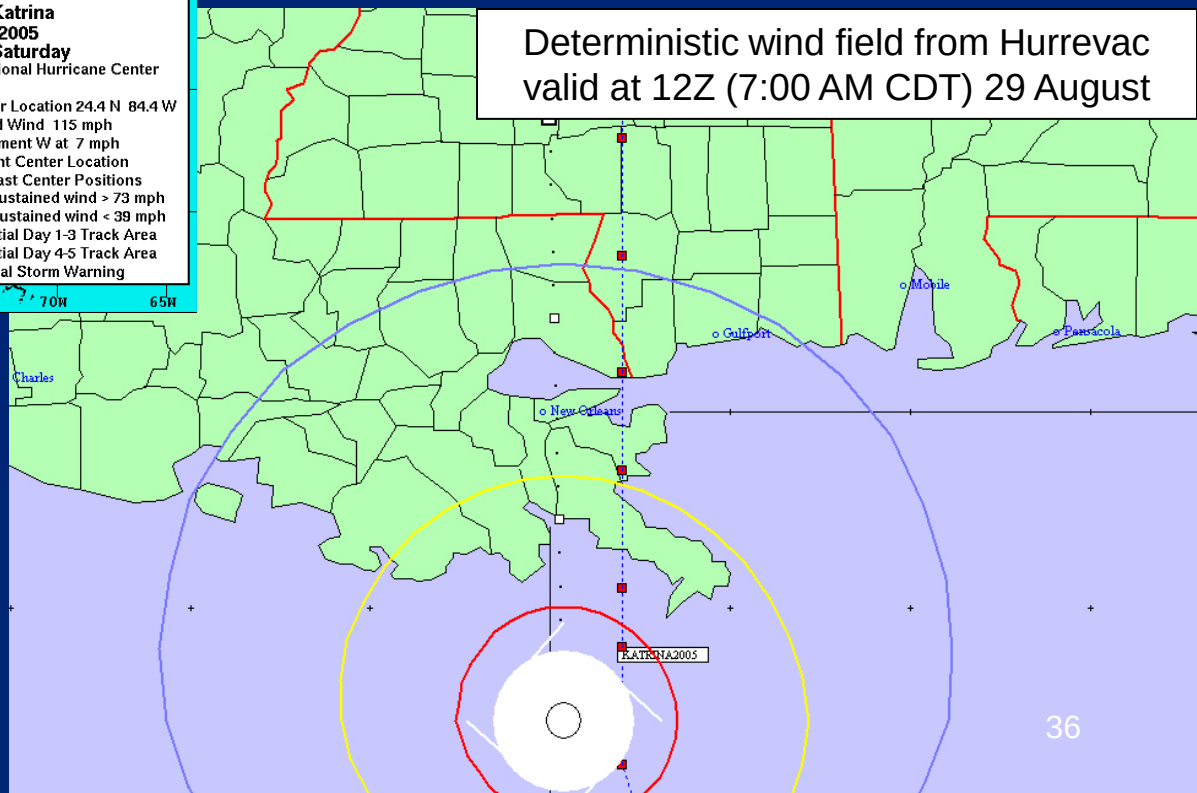
Using the Probabilities for Timing Uncertainty

Onset of 34-kt Winds

Katrina (2005)



- Onset of 34-kt winds based on deterministic forecast from Advisory 16
  - New Orleans, LA – Monday 29 Aug. 08Z (3:00 AM CDT)
  - Gulfport, MS – Monday 29 Aug. 11Z (6:00 AM CDT)



Wind Speed Probabilities
Katrina (2005) Advisory 16

- - - - WIND SPEED PROBABILITIES FOR SELECTED LOCATIONS - - - -

TIME PERIODS	FROM 06Z SAT TO 18Z SAT	FROM 18Z SAT TO 06Z SUN	FROM 06Z SUN TO 18Z SUN	FROM 18Z SUN TO 06Z MON	FROM 06Z MON TO 06Z TUE	FROM 06Z TUE TO 06Z WED	FROM 06Z WED TO 06Z THU
FORECAST HOUR	(12)	(24)	(36)	(48)	(72)	(96)	(120)
NEW ORLEANS LA	34 X	1(1)	9(10)	28(38)	34(72)	5(77)	X(77)
GULFPORT MS	34 X	1(1)	8(9)	23(32)	35(67)	5(72)	1(73)

Wind Speed Probabilities
Katrina (2005) Advisory 16

- - - - WIND SPEED PROBABILITIES FOR SELECTED LOCATIONS - - - -

TIME PERIODS	FROM 06Z SAT TO 18Z SAT	FROM 18Z SAT TO 06Z SUN	FROM 06Z SUN TO 18Z SUN	FROM 18Z SUN TO 06Z MON	FROM 06Z MON TO 06Z TUE	FROM 06Z TUE TO 06Z WED	FROM 06Z WED TO 06Z THU
FORECAST HOUR	(12)	(24)	(36)	(48)	(72)	(96)	(120)
NEW ORLEANS LA	34 X	1(1)	9(10)	28(38)	34(72)	5(77)	X(77)
GULFPORT MS	34 X	1(1)	8(9)	23(32)	35(67)	5(72)	1(73)

Most likely period of onset of 34-kt winds at New Orleans and Gulfport is between 06Z (1:00 AM CDT) Monday 29 Aug. and 06Z (1:00 AM CDT Tuesday 30 Aug.

Wind Speed Probabilities

Katrina (2005) Advisory 16

- - - - WIND SPEED PROBABILITIES FOR SELECTED LOCATIONS - - - -

TIME PERIODS	FROM 06Z SAT TO 18Z SAT	FROM 18Z SAT TO 06Z SUN	FROM 06Z SUN TO 18Z SUN	FROM 18Z SUN TO 06Z MON	FROM 06Z MON TO 06Z TUE	FROM 06Z TUE TO 06Z WED	FROM 06Z WED TO 06Z THU
FORECAST HOUR	(12)	(24)	(36)	(48)	(72)	(96)	(120)
NEW ORLEANS LA	34 X	1(1)	9(10)	28(38)	34(72)	5(77)	X(77)
GULFPORT MS	34 X	1(1)	8(9)	23(32)	35(67)	5(72)	1(73)

However, the probability that 34-kt winds will start **prior to** 06Z (1:00 AM CDT) Monday 29 Aug. at both New Orleans and Gulfport is nearly as large!

What Actually Happened?

- Onset of 34-kt winds occurred between 00Z and 06Z Monday 8/29 at New Orleans and Gulfport
  - At least **3 hours** earlier than shown by Hurrevac at New Orleans
  - At least **5 hours** earlier than shown by Hurrevac at Gulfport

Lesson

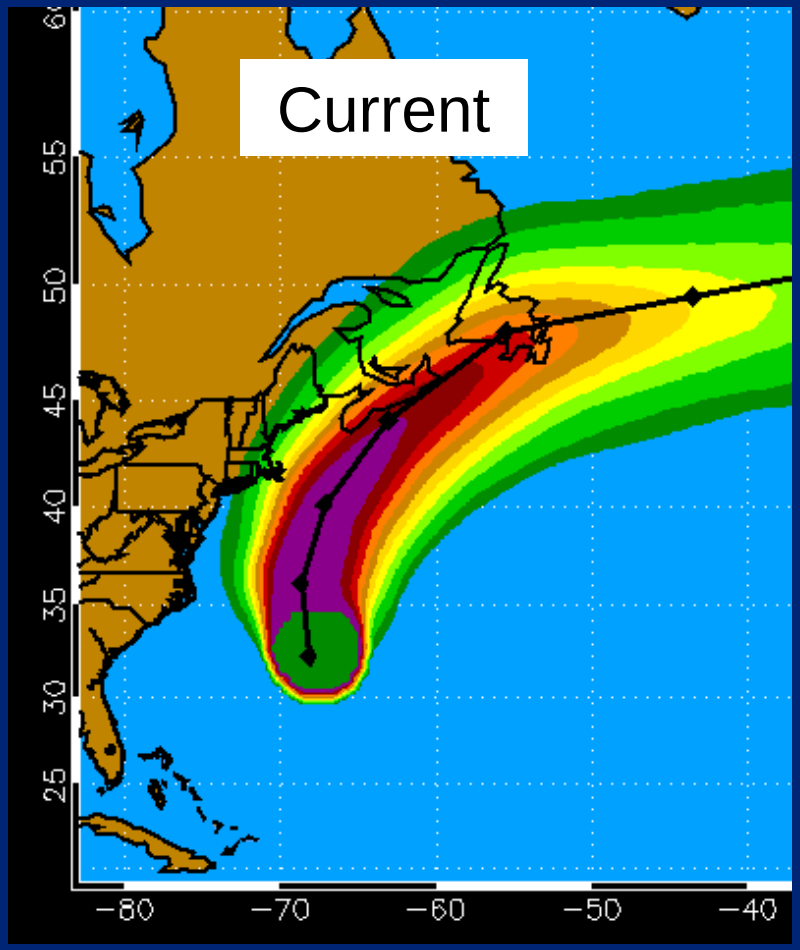
- Important information about the onset of wind conditions contained in the probabilities *beyond what you see in Hurrevac*
- Examine trends from advisory to advisory
  - How are probabilities of onset changing?
  - Are chances of onset nearly equal between two consecutive time periods?

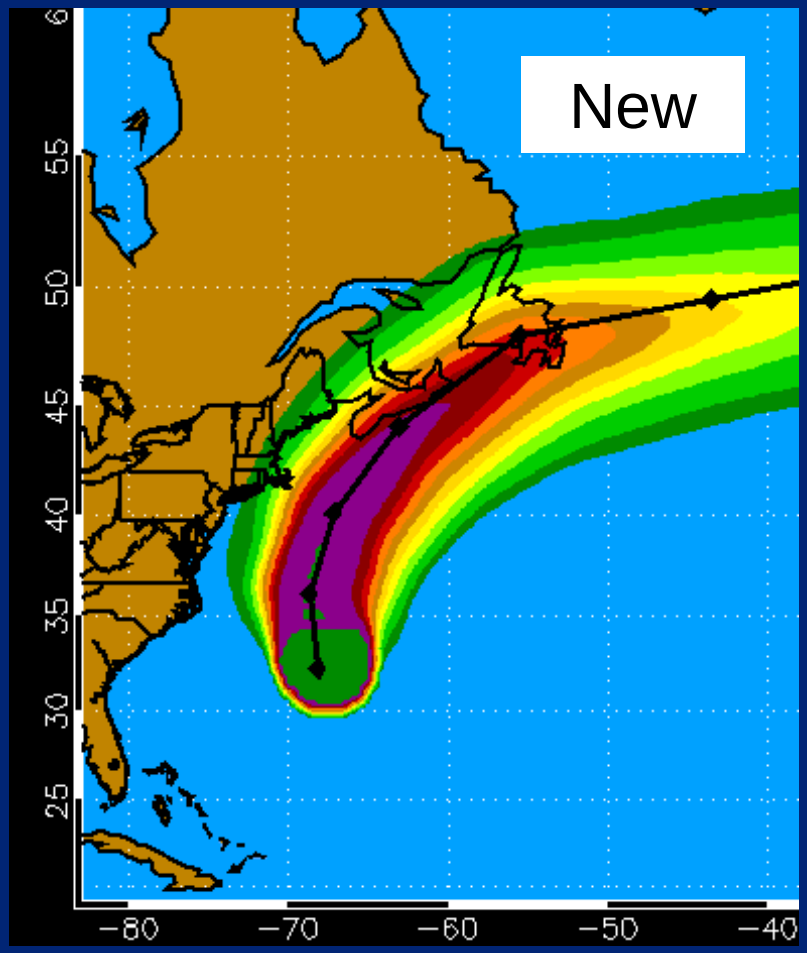
Changes to Probability Products for 2010

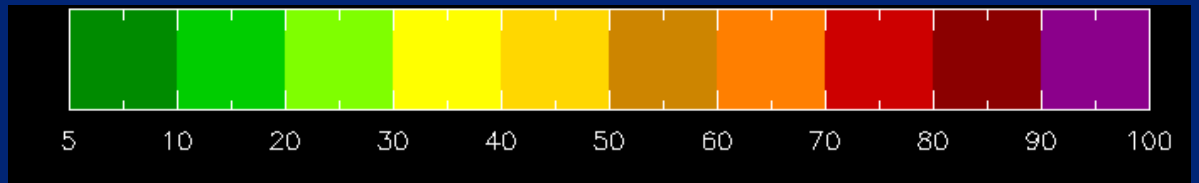
- Wind speed and intensity probability products will better reflect the actual track forecast uncertainty
- Old method sampled all previous NHC track forecast errors regardless of the situation
- New method will sample different errors depending on how much spread there is in the track model guidance
- Situations where track model spread is *small* should have *narrower* probability swath
  - Larger probabilities along track forecast
  - Smaller probabilities along the edges

How would New Probabilities Look for Bill?

Advisory 28 – 5 am 22 Aug 2009



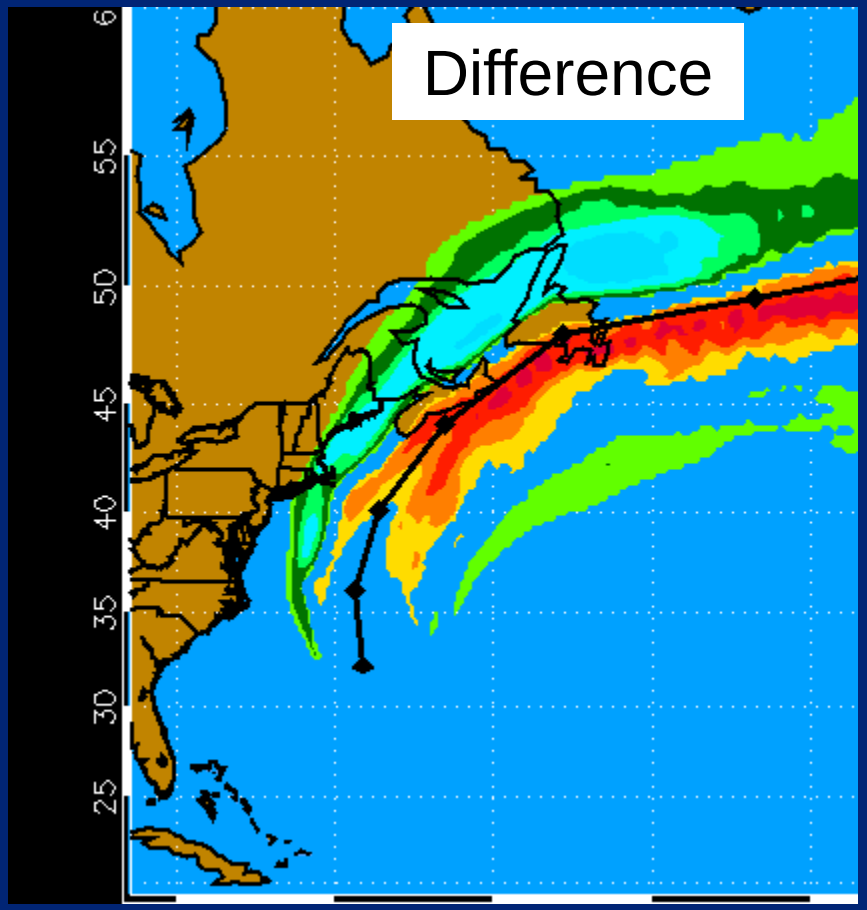


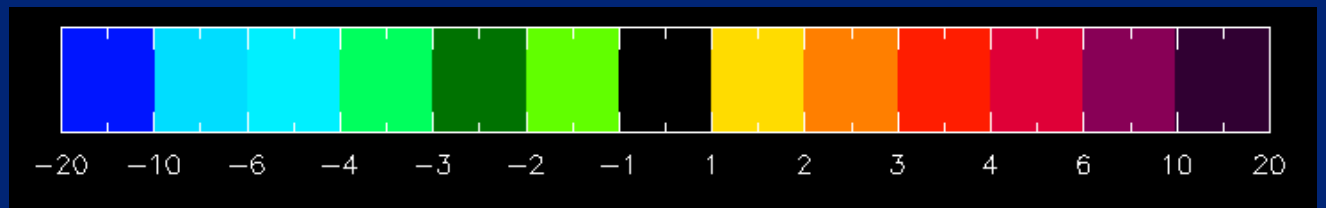


How would New Probabilities Look for Bill?

Advisory 28 – 5 am 22 Aug 2009

- Reduction in probability of TS winds of 3-6% along the western flank of the track of Bill
- Increase of probability by 3-6% along Bill's forecast track
- This case had "low" track model spread





Intensity Probability Table

- Small Probabilities Matter
- Probabilities lower (realistically) for strong storms when they are forecast to be near land
  - Example: Katrina's Louisiana landfall

Hurricane Ike Intensity Probability Table

Intensity (Maximum Wind Speed) Probability Table
Tropical Storm Ike Advisory Number 4
5:00 AM AST Sep 2 2008

Wind Range (mph)	Forecast Time						
	12 hour for 2 PM Tue	24 hour for 2 AM Wed	36 hour for 2 PM Wed	48 hour for 2 AM Thu	72 hour for 2 AM Fri	96 hour for 2 AM Sat	120 hour for 2 AM Sun
Dissipated	<1%	<1%	<1%	<1%	<1%	1%	2%
Tropical Depression (<39)	1%	2%	2%	1%	3%	2%	3%
Tropical Storm (39-73)	82%	58%	32%	26%	23%	20%	23%
Hurricane (all categories)	17%	40%	67%	72%	74%	77%	73%
-- Category 1 (74-95)	16%	36%	48%	42%	35%	31%	27%
-- Category 2 (96-110)	1%	3%	14%	19%	21%	22%	19%
-- Category 3 (111-130)	<1%	1%	4%	9%	14%	18%	17%
-- Category 4 (131-155)	<1%	1%	1%	2%	4%	6%	7%
-- Category 5 (>155)	<1%	<1%	<1%	<1%	1%	1%	1%
Forecast Maximum Wind	65 mph	70 mph	80 mph	85 mph	90 mph	100 mph	105 mph

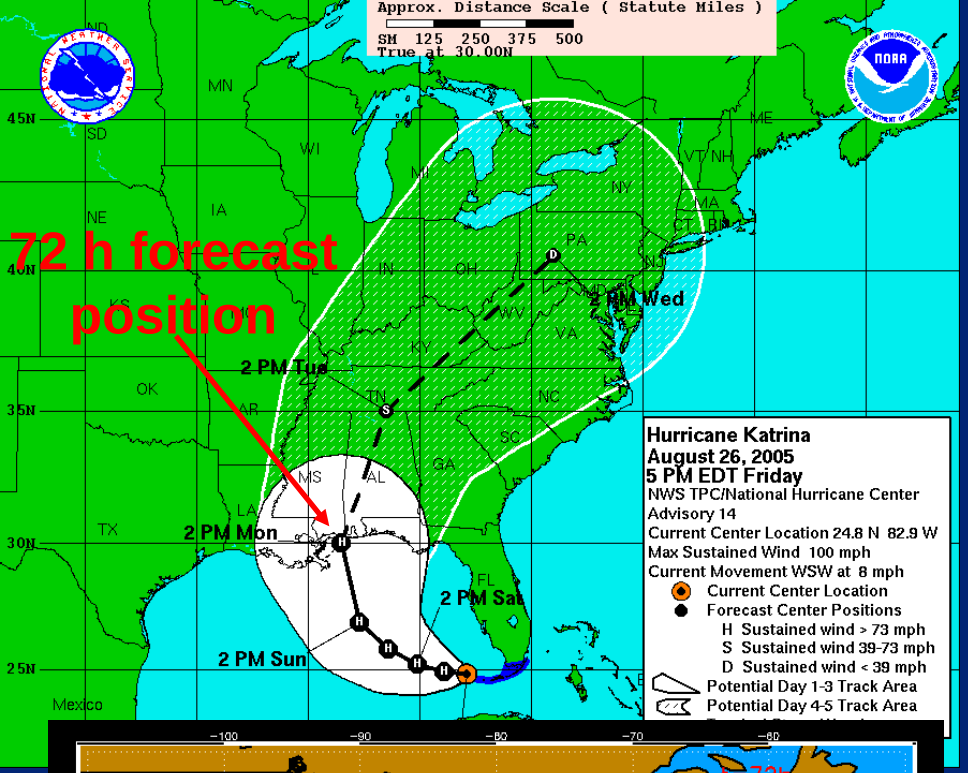
Small Probabilities of Category 4 Hurricane

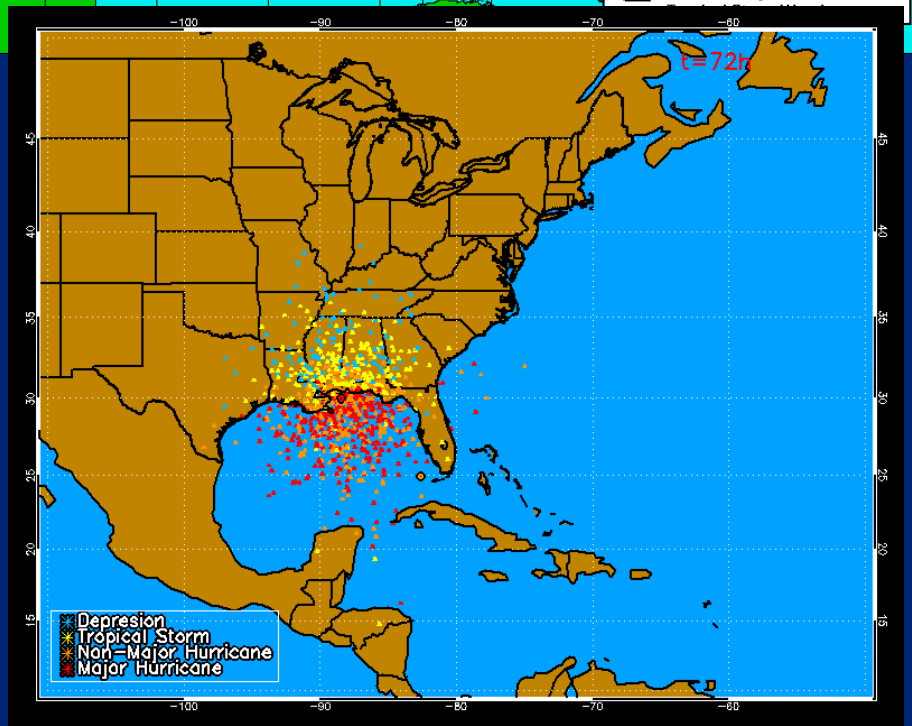
Intensity (Maximum Wind Speed) Probability Table
Tropical Storm Ike Advisory Number 4
5:00 AM AST Sep 2 2008

Wind Range (mph)	Forecast Time						
	12 hour for 2 PM Tue	24 hour for 2 AM Wed	36 hour for 2 PM Wed	48 hour for 2 AM Thu	72 hour for 2 AM Fri	96 hour for 2 AM Sat	120 hour for 2 AM Sun
Dissipated	<1%	<1%	<1%	<1%	<1%	1%	2%
Tropical Depression (<39)	1%	2%	2%	1%	3%	2%	3%
Tropical Storm (39-73)	82%	58%	32%	26%	23%	20%	23%
Hurricane (all categories)	17%	40%	67%	72%	74%	77%	73%
-- Category 1 (74-95)	16%	36%	48%	42%	35%	31%	27%
-- Category 2 (96-110)	1%	3%	14%	19%	21%	22%	19%
-- Category 3 (111-130)	<1%	1%	4%	9%	14%	18%	17%
-- Category 4 (131-155)	<1%	1%	1%	2%	4%	6%	7%
-- Category 5 (>155)	<1%	<1%	<1%	<1%	1%	1%	1%
Forecast Maximum Wind	65 mph	70 mph	80 mph	85 mph	90 mph	100 mph	105 mph

2% chance of category 4 hurricane verifies

Katrina Advisory 14





Official NHC Intensity Forecast
72 hour forecast- 135 mph (cat. 4)

Verifying Intensity
cat. 1

Katrina Landfall Intensity 130 mph cat. 3

Maximum Wind Speed (Intensity) Probability Table
From NHC Advisory 14
5 PM EDT Aug 26, 2005

Wind Range (mph)	Forecast Time: 12 hour for 2 PM Fri	24 hour for 2 AM Sat	36 hour for 2 PM Sat	48 hour for 2 AM Sun	72 hour for 2 AM Mon	96 hour for 2 AM Tue	120 hour for 2 AM Wed
Dissipated	<1%	<1%	<1%	<1%	8%	46%	58%
Tropical Depression (<39)	<1%	<1%	<1%	<1%	13%	26%	20%
Tropical Storm (39-73)	1%	3%	4%	5%	20%	13%	6%
Hurricane (74+)	99%	97%	96%	94%	58%	15%	17%
Category 1 (74-95)	26%	21%	19%	18%	14%	3%	2%
Category 2 (96-110)	60%	47%	34%	26%	12%	2%	4%
Category 3 (111-130)	13%	25%	34%	34%	19%	5%	5%
Category 4 (131-155)	1%	3%	7%	14%	12%	4%	4%
Category 5 (>155)	<1%	<1%	1%	2%	3%	1%	1%
NHC Forecast	**105**	**110**	**115**	**120**	**135**	**40**	**30**

Summary

- NHC probability products help you deal with the uncertainty inherent in forecasting tropical cyclones
- Provide additional information beyond what is available in deterministic forecasts and in Hurrevac for:
  - Timing of event onset
  - Likelihood of various wind speeds occurring at your location
  - Likelihood of tropical cyclone intensity
- “Low” probabilities of extreme events often warrant action!

Use of Probabilistic Information in WFO Products During Tropical Cyclone Events

"HURRICANE CONDITIONS EXPECTED."

Pablo Santos
NOAA/NWS Miami, FL

Contents of Presentation

- Review of Wind Speed Probability Products and how you can access this data

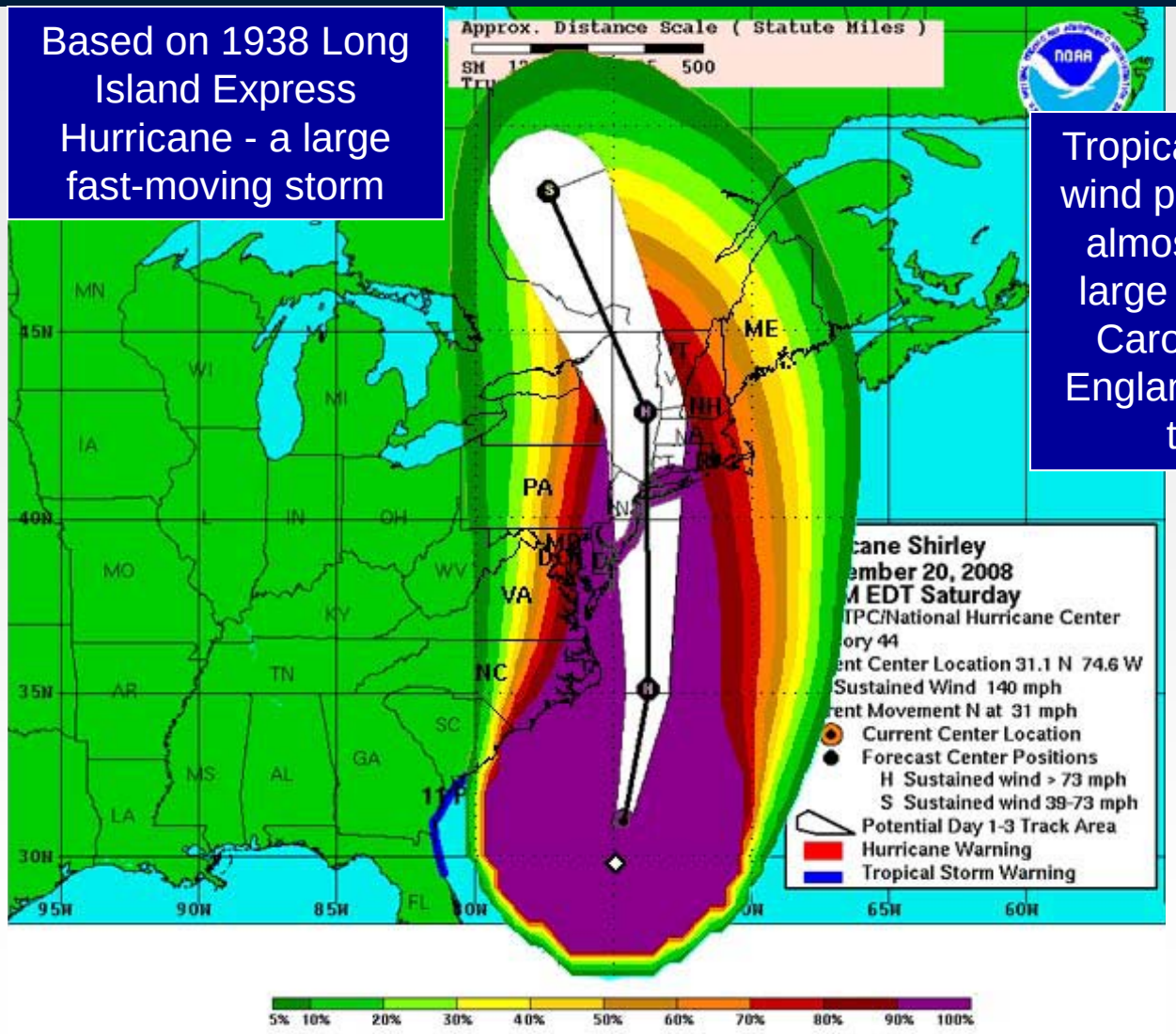
- Use of Probabilistic Information in WFO Forecast Products During Tropical Cyclones
  - Public Forecasts
  - Hurricane Local Statement (Text and Graphical)
    - Winds
    - Surge
    - Inland Flooding
    - Tornadoes

Wind Speed Probability Definitions

- **Cumulative** – The probability of sustained winds reaching or exceeding the specified wind speed threshold between the 00 hour forecast and a specified forecast hour.
  - Available in NHC's PWSAT# text product as well as in graphical form.
  - Also Available through the NDFD Website.
- **Individual (Interval)** – The probability of sustained winds reaching or exceeding the specified wind speed threshold beginning during an individual 12 hour forecast period ending at the specified forecast hour (e.g., period of onset).
  - Available in NHC's PWSAT# text product.
  - Available from the NDFD Website also.
- **Incremental** –The probability of sustained winds reaching or exceeding the specified threshold during the 12 hour forecast period ending at the specified forecast hour.
  - Available through the NDFD Website.

Impacts Can Be Felt Well Outside The Cone

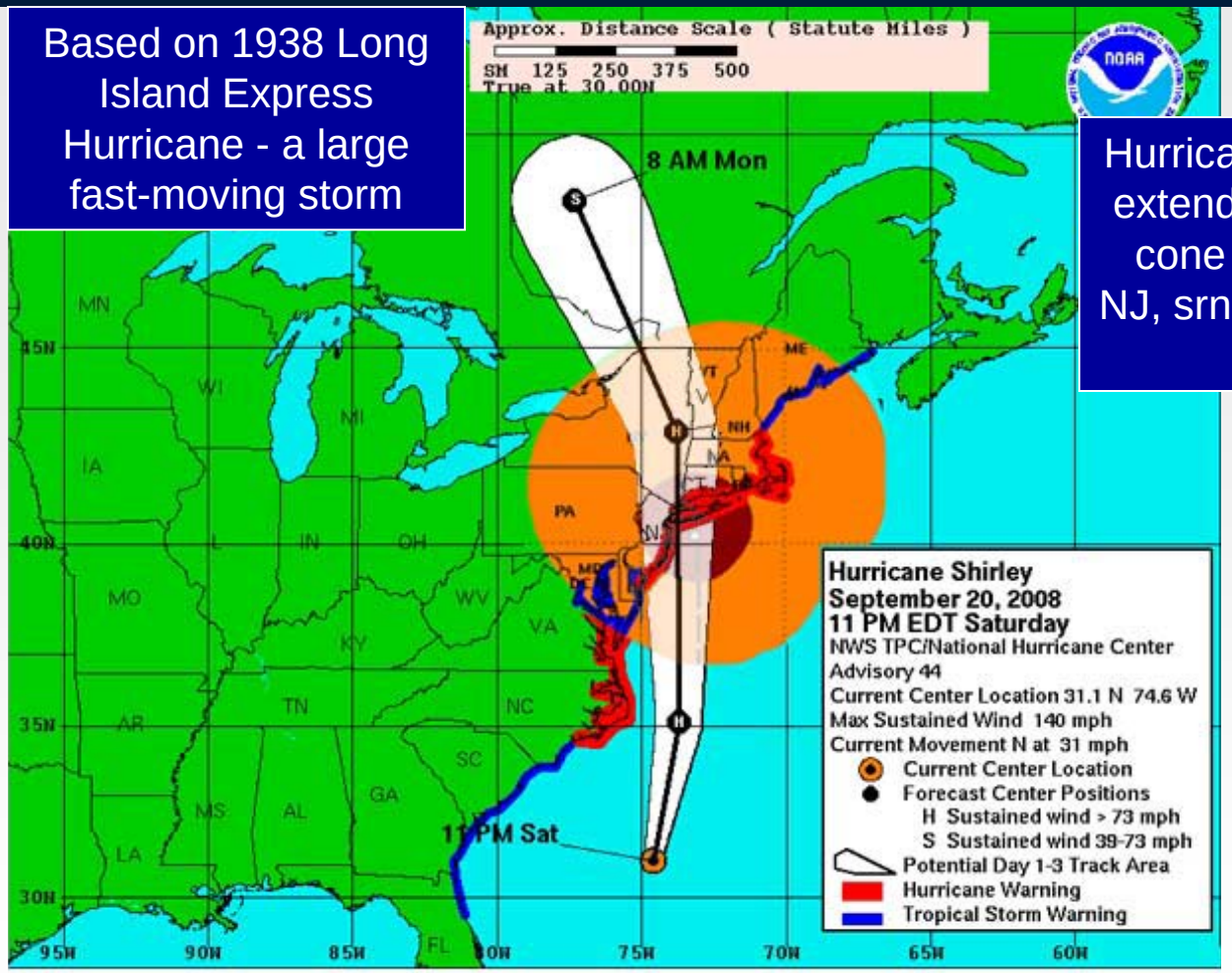
Based on 1938 Long Island Express Hurricane - a large fast-moving storm



Tropical Storm Force wind probabilities are almost certain in a large area from the Carolinas to New England well outside the cone!

Impacts Can Be Felt Well Outside The Cone

Based on 1938 Long Island Express Hurricane - a large fast-moving storm



Hurricane-force winds extended outside the cone over much of NJ, srn NY, LI, and CT

LOCATIONS SHOWN WHEN THEIR TOTAL CUMULATED 5 DAY
PROBABILITY IS AT LEAST 2.5 PERCENT

Z INDICATES UNIVERSAL COORDINATED TIME (GREENWICH)

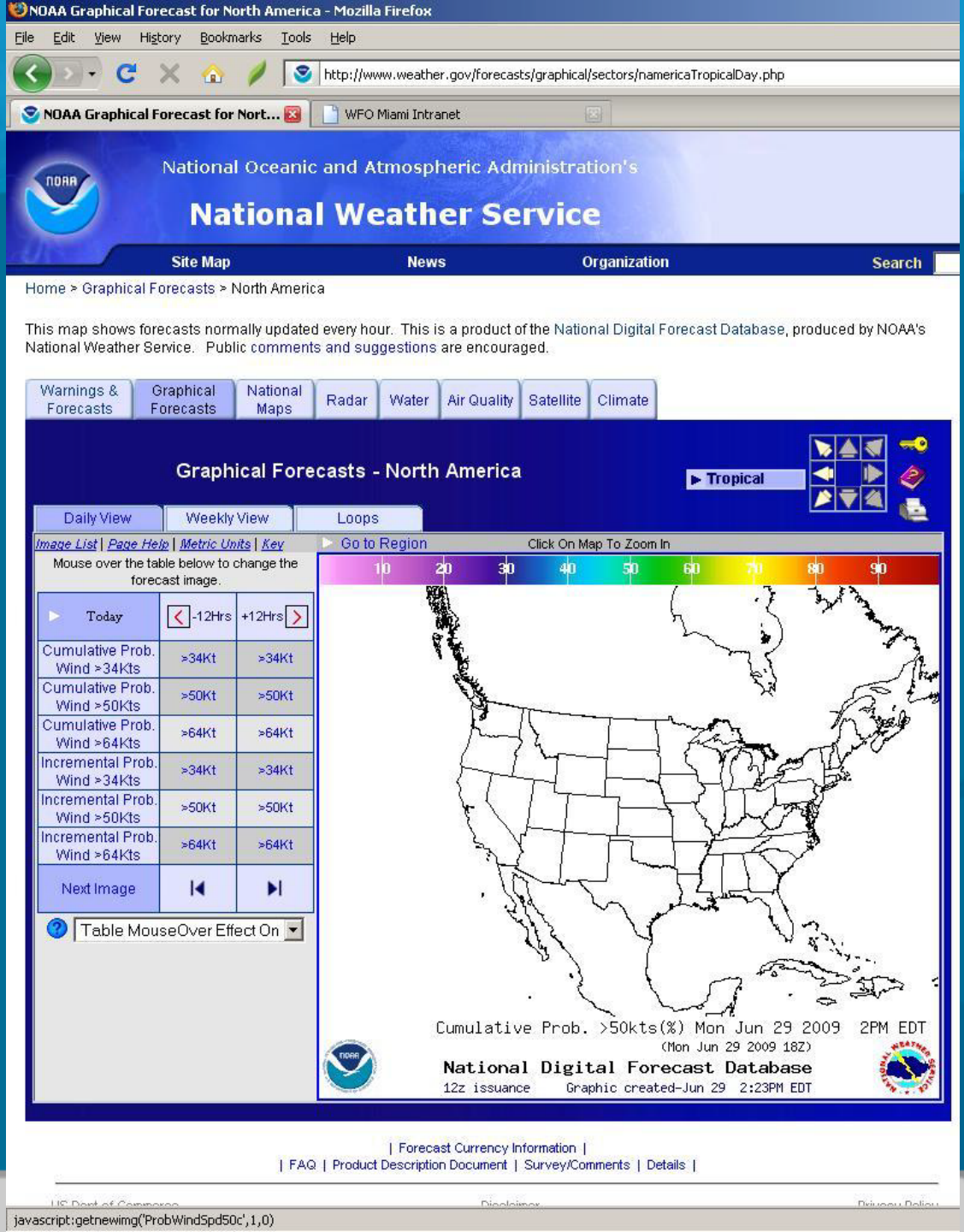
Individual Period Probabilities Cumulative Period Probabilities

- - - - WIND SPEED PROBABILITIES FOR SELECTED LOCATIONS - - - -

TIME PERIODS		FROM 06Z THU TO 18Z THU	FROM 18Z THU TO 06Z FRI	FROM 06Z FRI TO 18Z FRI	FROM 18Z FRI TO 06Z SAT	FROM 06Z SAT TO 06Z SUN	FROM 06Z SUN TO 06Z MON	FROM 06Z MON TO 06Z TUE
FORECAST HOUR		(12)	(24)	(36)	(48)	(72)	(96)	(120)
LOCATION	KT							
MIAMI FL	34	X	X(X)	X(X)	2(2)	16(18)	23(41)	5(46)
MIAMI FL	50	X	X(X)	X(X)	X(X)	6(6)	11(17)	3(20)
MIAMI FL	64	X	X(X)	X(X)	X(X)	2(2)	5(7)	1(8)
KEY WEST FL	34	X	X(X)	2(2)	7(9)	26(35)	18(53)	3(56)
KEY WEST FL	50	X	X(X)	X(X)	1(1)	14(15)	11(26)	1(27)
KEY WEST FL	64	X	X(X)	X(X)	X(X)	8(8)	5(13)	1(14)
MARCO ISLAND	34	X	X(X)	X(X)	5(5)	20(25)	23(48)	4(52)
MARCO ISLAND	50	X	X(X)	X(X)	1(1)	10(11)	12(23)	2(25)

Note:

- Go to weather.gov
- Click on Graphical Forecasts
- Scroll to the Bottom
- Click on Tropical
- Notice both Cumulative and Incremental Probabilities are available here
- Notice the Resolution
- What About Interval or Individual Probabilities?



How Can I get the grids from the NDFD

- **Download DeGrib (NDFD GRIB2 Decoder from):**
  - **http://www.weather.gov/mdl/NDFD_GRIB2Decoder/register.php**

- **Then go to this site and read on how turn the NDFD gridded data into GIS Files (Creating GIS files from the downloaded NDFD grids):**
  - **http://www.weather.gov/ndfd/gis/ndfd_GIS_tutorial.html**

How Do We Use This Probabilistic Data in WFO Forecast Products?

- Public Forecasts
  - 7 Days
  - Sky, Weather, Wind, MaxT, MinT, and PoP or Probability of Precipitation
  - Versions:
    - Zone (ZFP product)
    - Click Point (interactive web)
  - Application of Incremental Wind Speed Probabilities
- Hurricane Local Statement
  - Text - emphasis on likely or even expected conditions based on latest forecast and ensuing impacts.
  - App. Of Cumulative and Individual Wind Speed Probabilities.
  - App. Of Probabilistic Surge, Rainfall Probabilities, and Tornado Probabilities.
  - Graphical - emphasis on depiction of the POTENTIAL impact relative to the uncertainty of the forecast conditions.

Public Forecasts
(Point and Click Versus Zone Version)

Friday: A 20 percent chance of showers and thunderstorms. Partly cloudy, with a high near 85. Breezy, with a east wind between 13 and 16 mph, with gusts as high as 21 mph.

Friday Night: A 30 percent chance of showers and thunderstorms after 2am. Mostly cloudy, with a low around 75. Breezy, with a east wind between 15 and 17 mph, with gusts as high as 23 mph.

Saturday: A 40 percent chance of showers and thunderstorms. Mostly cloudy, with a high near 85. Windy, with a east wind between 18 and 22 mph, with gusts as high as 29 mph.

Saturday Night: A 30 percent chance of showers and thunderstorms. Mostly cloudy, with a low around 74. Windy, with a east wind between 13 and 21 mph, with gusts as high as 26 mph.

Sunday: A 40 percent chance of showers and thunderstorms. Mostly cloudy, with a high near 84. East wind around 13 mph.

Sunday Night: A 30 percent chance of showers and thunderstorms. Mostly cloudy, with a low around 73. Southeast wind around 10 mph.

Monday: A 30 percent chance of showers and thunderstorms. Mostly cloudy, with a high near 86. South wind between 10 and 14 mph, with gusts as high as 18 mph.

Monday Night: A slight chance of showers. Mostly cloudy, with a low around 72. Chance of precipitation is 20%.

Tuesday: A 20 percent chance of showers and thunderstorms. Mostly cloudy, with a high near 84.

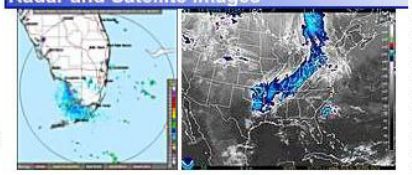
Tuesday Night: A 20 percent chance of showers and thunderstorms. Mostly cloudy, with a low around 72.

Wednesday: A 30 percent chance of showers and thunderstorms. Mostly cloudy, with a high near 85.

(28 °C)

Heat Index:	85 °F (29 °C)
Visibility:	10.00 mi.
More Local Wx:	3 Day History:

Radar and Satellite Images



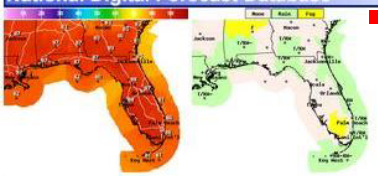
Detailed Point Forecast [Move Up]

Click Map for Forecast Disclaimer

Requested Location Forecast Area

Lat/Lon: 26.15°N 80.17°W **Elevation:** 0 ft

National Digital Forecast Database



Additional Forecasts & Information

Zone Area Forecast for Coastal Broward County, FL

Forecast Discussion	Air Quality Forecasts
Printable Forecast	Text Only Forecast
Hourly Weather Graph	Tabular Forecast
International System of Units	About Point Forecasts
South Florida Weather Alerts	Marine Forecast
Tropics / Hurricanes	Climate / Past Weather
Day 1 Hazards Graphics	

Webmaster
National Weather Service:
Miami - South Florida

Back to Previous Page

www.weather.gov
Privacy Policy
Disclaimer

Done

Your **National Weather Service** *forecast*

Coastal Broward County, FL

Enter Your "City, ST" or zip code Go

Mobile Weather Information

NWS Miami - South Florida

Zone Forecast: Coastal Broward County

Last Update: 432 AM EDT THU MAY 14 2009

Detailed 7-day Forecast

Hazardous weather condition(s):

Hazardous Weather Outlook

Today...Partly sunny with a 20 percent chance of showers and thunderstorms. Highs in the upper 80s. East winds 10 to 15 mph.

Tonight...Partly cloudy. A 20 percent chance of showers and thunderstorms. Lows in the mid 70s. East winds 10 to 15 mph.

Friday...Partly sunny with a 20 percent chance of showers and thunderstorms. Breezy. Highs in the mid 80s. East winds 10 to 15 mph becoming 15 to 20 mph in the afternoon.

Friday Night...Partly cloudy. A 30 percent chance of showers and thunderstorms. Breezy. Lows in the mid 70s. East winds 15 to 20 mph.

Saturday...Partly sunny with a 40 percent chance of showers and thunderstorms. Windy. Highs in the mid 80s. East winds 15 to 20 mph becoming 20 to 25 mph in the afternoon.

Saturday Night...Partly cloudy with a 30 percent chance of showers and thunderstorms. Windy. Lows in the mid 70s.

Sunday...Partly sunny with a 40 percent chance of showers and thunderstorms. Highs in the mid 80s.

Sunday Night...Partly cloudy with a 30 percent chance of showers and thunderstorms. Lows in the mid 70s.

Monday...Partly sunny with a 30 percent chance of showers and thunderstorms. Highs in the mid 80s.

Monday Night...Partly cloudy with a 20 percent chance of showers. Lows in the lower 70s.

Tuesday...Partly sunny with a 20 percent chance of showers and thunderstorms. Highs in the mid 80s.

Tuesday Night...Partly cloudy. Slight chance of showers and thunderstorms in the evening...then slight chance of showers. Lows in the lower 70s. Chance of rain 20 percent.

Wednesday...Partly sunny with a 30 percent chance of

Current Conditions [Move Down]

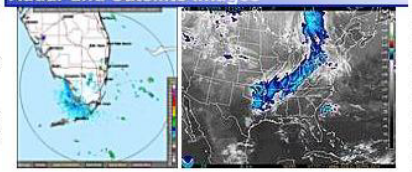
Fort Lauderdale Executive Airport
Lat: 26.2 Lon: -80.17 Elev: 13
Last Update on May 14, 8:53 am EDT

Partly Cloudy

82 °F
(28 °C)

Humidity:	63 %
Wind Speed:	E 15 MPH
Barometer:	30.11" (1019.7 mb)
Dewpoint:	68 °F (20 °C)
Heat Index:	85 °F (29 °C)
Visibility:	10.00 mi.
More Local Wx:	3 Day History:

Radar and Satellite Images



Detailed Point Forecast [Move Up]

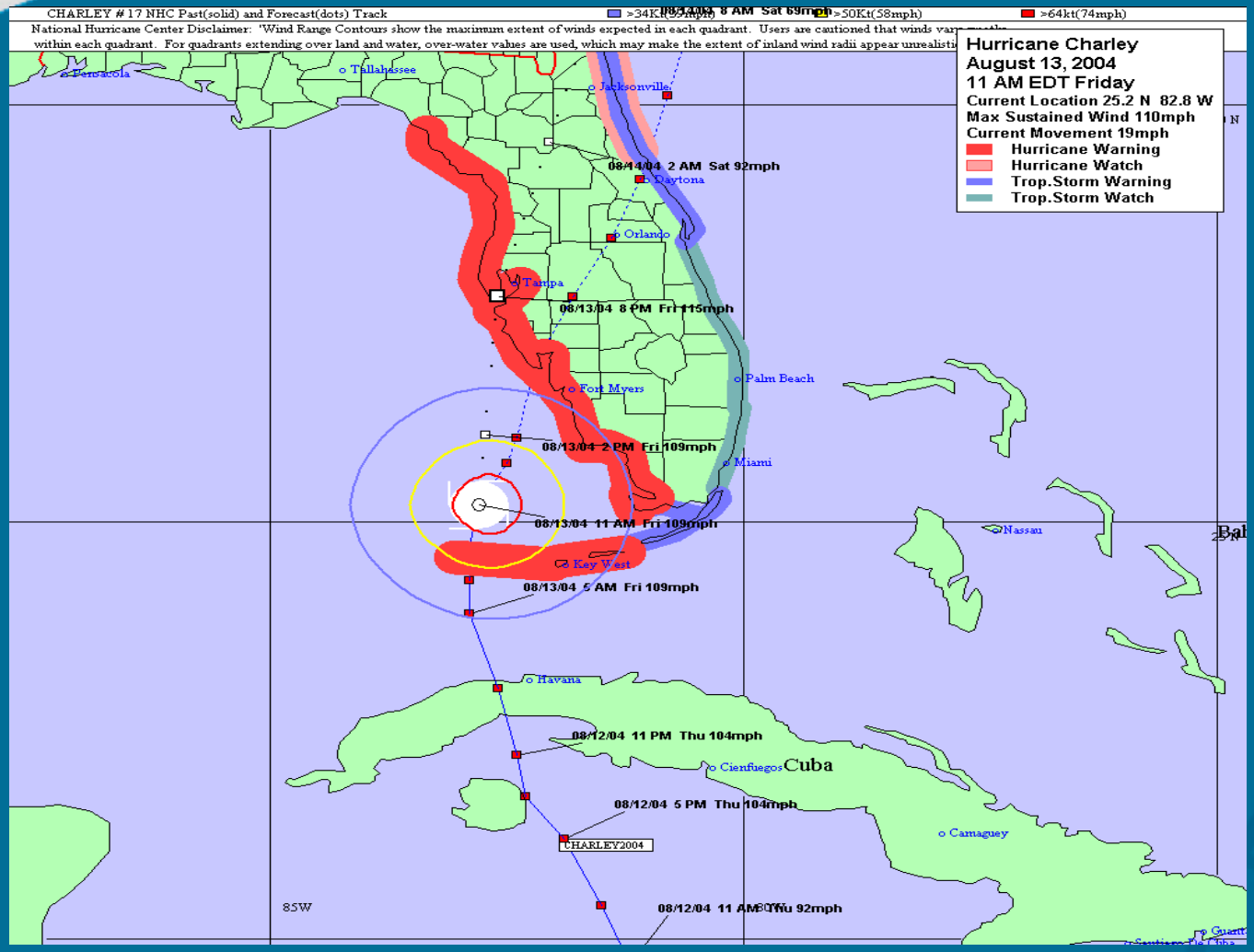
Click for Point Specific Forecast Disclaimer

Forecast Area

Done

Period	Tropical Storm Incremental Wind Speed Probability Thresholds	Hurricane Incremental Wind Speed Probability Thresholds
1	55	30
2	45	25
3	40	20
4	35	15
5	30	10
6	25	7
7	20	6
8	15	5
9	12.5	4
10	10	3

Tropical Cyclone Situations
(Going Back To Hurricane Charley Example)

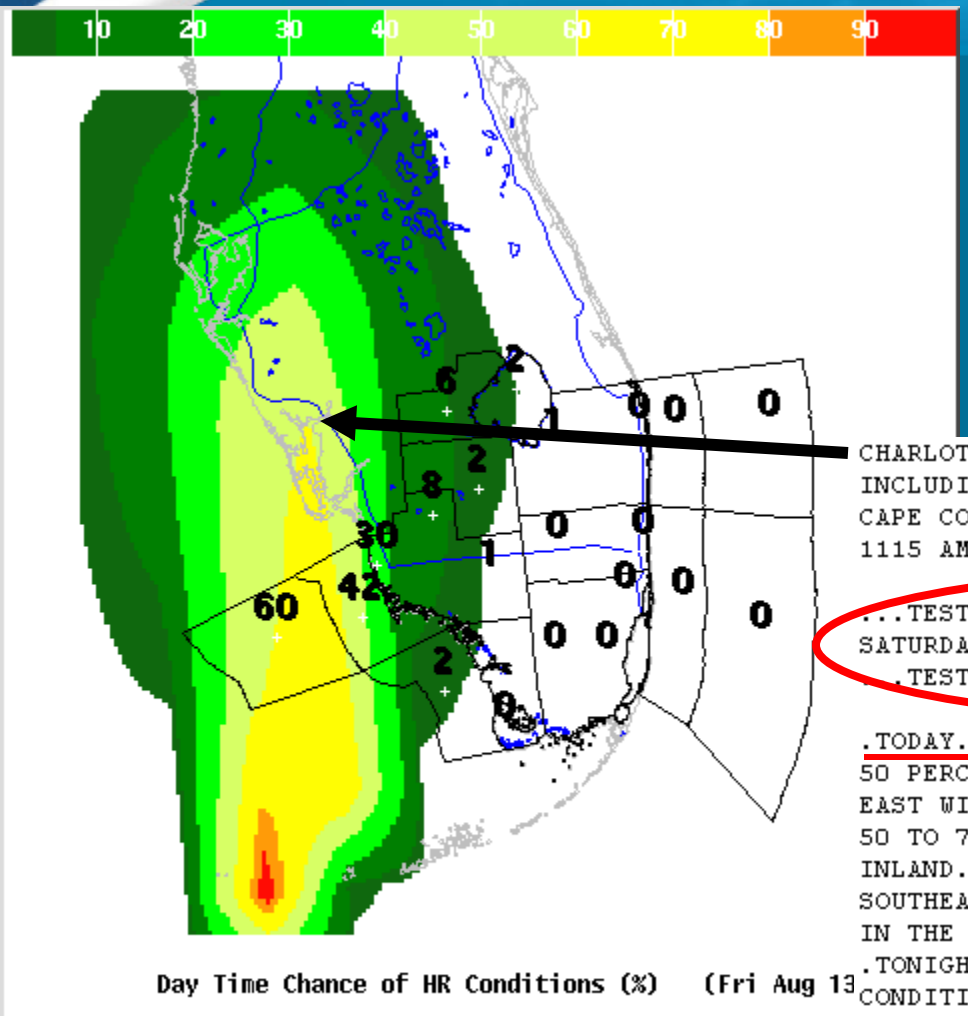


A **Hurricane Warning** means the sustained wind is expected to be 64 knots or greater *somewhere* in the warned area within 24 hours…*but not everywhere*.

However, the NHC wind forecast (e.g., radii) is a main driver for the local Public and Marine wind forecasts during tropical cyclones situations.

Hurricane Charley (2004)

Example...00-12 Hours, First Period



CHARLEY (ZFP)

CHARLOTTE-LEE-
INCLUDING THE CITIES OF...PORT CHARLOTTE...PUNTA GORDA...
CAPE CORAL...FORT MYERS
1115 AM EDT FRI AUG 13 2004

...TEST INLAND HURRICANE WARNING IN EFFECT UNTIL 10 AM EDT SATURDAY TEST...
..TEST HURRICANE WARNING IN EFFECT TEST...

.TODAY...HURRICANE CONDITIONS EXPECTED. MOSTLY CLOUDY WITH A 50 PERCENT CHANCE OF RAIN. HIGHS IN THE MID 80S. NEAR THE COAST... EAST WINDS 40 TO 45 MPH WITH GUSTS UP TO 60 MPH BECOMING SOUTH 50 TO 70 MPH WITH GUSTS UP TO 90 MPH IN THE AFTERNOON. INLAND...EAST WINDS 35 TO 40 MPH WITH GUSTS UP TO 55 MPH BECOMING SOUTHEAST AND BECOMING 45 TO 55 MPH WITH GUSTS UP TO 65 MPH IN THE AFTERNOON.
.TONIGHT...TROPICAL STORM CONDITIONS EXPECTED WITH HURRICANE CONDITIONS POSSIBLE. CLOUDY WITH A 50 PERCENT CHANCE OF RAIN. LOWS AROUND 60. SOUTH WINDS 45 TO 55 MPH WITH GUSTS UP TO 65 MPH BECOMING EAST AND DECREASING TO AROUND 25 MPH WITH GUSTS UP TO 30 MPH AFTER MIDNIGHT.
.SATURDAY...CLOUDY WITH A 50 PERCENT CHANCE OF RAIN. BREEZY. HIGHS IN THE MID 80S. EAST WINDS AROUND 25 MPH WITH GUSTS UP TO 30 MPH.

Advisory Time: 20040813_1500 (0-12 Hours – First Period)

Example

Advisory Time: 20040902_1500 (25-36 Hours – Third Period)

FRANCES (ZFP)

FLZ168-030130-
COASTAL PALM BEACH-
INCLUDING THE CITIES OF...JUPITER...PALM BEACH...BOCA RATON
1128 AM EDT THU SEP 2 2004

...HURRICANE WARNING IN EFFECT...

.REST OF TODAY...WINDY. PARTLY SUNNY. SCATTERED SHOWERS AND THUNDERSTORMS. HIGHS IN THE MID 80S. NORTH WINDS 25 MPH WITH GUSTS UP TO 35 MPH. CHANCE OF RAIN 50 PERCENT.
.TONIGHT...WINDY. PARTLY CLOUDY. SCATTERED SHOWERS AND THUNDERSTORMS. LOWS IN THE MID 70S. NORTH WINDS 25 MPH WITH GUSTS UP TO 35 MPH. CHANCE OF RAIN 50 PERCENT.
.FRIDAY...TROPICAL STORM CONDITIONS EXPECTED WITH HURRICANE CONDITIONS POSSIBLE. PARTLY SUNNY. SCATTERED SHOWERS AND THUNDERSTORMS. HIGHS IN THE MID 80S. NORTH WINDS 25 MPH WITH GUSTS UP TO 35 MPH BECOMING 35 TO 45 MPH WITH GUSTS UP TO 65 MPH IN THE AFTERNOON. CHANCE OF RAIN 50 PERCENT.
.FRIDAY NIGHT...HURRICANE CONDITIONS EXPECTED. PARTLY CLOUDY. SCATTERED SHOWERS AND THUNDERSTORMS. LOWS IN THE MID 70S. NORTH WINDS 45 TO 60 MPH WITH GUSTS UP TO 75 MPH BECOMING NORTHWEST AND BECOMING 60 TO 80 MPH WITH GUSTS UP TO 95 MPH AFTER MIDNIGHT. CHANCE OF RAIN 50 PERCENT.
.SATURDAY...HURRICANE CONDITIONS POSSIBLE. PARTLY SUNNY. SCATTERED SHOWERS AND THUNDERSTORMS. HIGHS IN THE MID 80S. WEST WINDS 80 TO 100 MPH WITH GUSTS UP TO 125 MPH BECOMING SOUTHWEST AND DECREASING TO 65 TO 85 MPH WITH GUSTS UP TO 105 MPH IN THE AFTERNOON. CHANCE OF RAIN 50 PERCENT.
.SATURDAY NIGHT...HURRICANE CONDITIONS POSSIBLE. PARTLY CLOUDY WITH SCATTERED SHOWERS AND THUNDERSTORMS. LOWS IN THE MID 70S. CHANCE OF RAIN 50 PERCENT.
.SUNDAY...TROPICAL STORM CONDITIONS POSSIBLE. PARTLY SUNNY WITH SCATTERED SHOWERS AND THUNDERSTORMS. HIGHS IN THE MID 80S. CHANCE OF RAIN 50 PERCENT.
.SUNDAY NIGHT...WINDY. PARTLY CLOUDY WITH SCATTERED SHOWERS AND THUNDERSTORMS. LOWS IN THE MID 70S. CHANCE OF RAIN 50 PERCENT.

FRANCES (Click Point)

26.85N -80.08W **Forecast Valid:** 11am EDT Sep 2, 2004-6pm EDT Sep 8, 2004

Forecast at a Glance

Today	Tonight	Labor Day	Friday Night	Saturday	Saturday Night	Sunday	Sunday Night	Monday
50% Chance Tstms Hi 85°F	50% Chance Tstms Lo 75°F	Trop. Storm Conditions Expected Hi 85°F	Hurricane Conditions Expected Lo 75°F	Hurricane Conditions Possible Hi 85°F	Hurricane Conditions Possible Lo 75°F	Trop. Storm Conditions Possible Hi 85°F	50% Chance Tstms Lo 75°F	50% Chance Tstms Hi 85°F

Detailed 7-day Forecast

Today: Scattered showers and thunderstorms. Partly cloudy, with a high near 85. Windy, with a north wind around 23 mph, with gusts as high as 32 mph. Chance of precipitation is 50%.

Tonight: Scattered showers and thunderstorms. Partly cloudy, with a low around 75. Windy, with a north wind around 23 mph, with gusts as high as 32 mph. Chance of precipitation is 50%.

Labor Day: Tropical storm conditions expected, with hurricane conditions possible. Scattered showers and thunderstorms. Partly cloudy, with a high near 85. North wind 25 to 30 mph, with gusts as high as 41 mph. Chance of precipitation is 50%.

Friday Night: Hurricane conditions expected. Scattered showers and thunderstorms. Partly cloudy, with a low around 75. North wind 45 to 55 mph increasing to between 40 and 60 mph. Winds could gust as high as 80 mph. Chance of precipitation is 50%.

Saturday: Hurricane conditions possible. Scattered showers and thunderstorms. Partly cloudy, with a high near 85. Chance of precipitation is 50%.

Saturday Night: Hurricane conditions possible. Scattered showers and thunderstorms. Partly cloudy, with a low around 75. Chance of precipitation is 50%.

Sunday: Tropical storm conditions possible. Scattered showers and thunderstorms. Partly cloudy, with a high near 85. Chance of precipitation is 50%.

Sunday Night: Scattered showers and thunderstorms. Partly cloudy, with a low around 75. Windy, with a north wind around 23 mph, with gusts as high as 32 mph. Chance of precipitation is 50%.

Monday: Scattered showers and thunderstorms. Partly cloudy, with a high near 85. Windy, with a north wind around 23 mph, with gusts as high as 32 mph. Chance of precipitation is 50%.

Current Conditions [Move Down]

West Palm Beach, Palm Beach International Airport
Lat: 26.68 Lon: -80.12 Elev:

Not a Current Observation

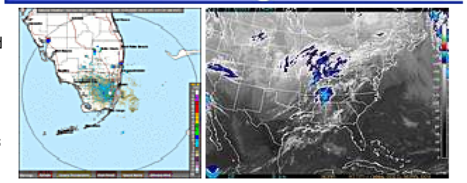
NULL

NULL

Humidity:	NULL
Wind Speed:	NULL
Barometer:	NULL
Dewpoint:	
Visibility:	NULL

More Local Wx: 3 Day History:

Radar and Satellite Images



Detailed Point Forecast [Move Up]

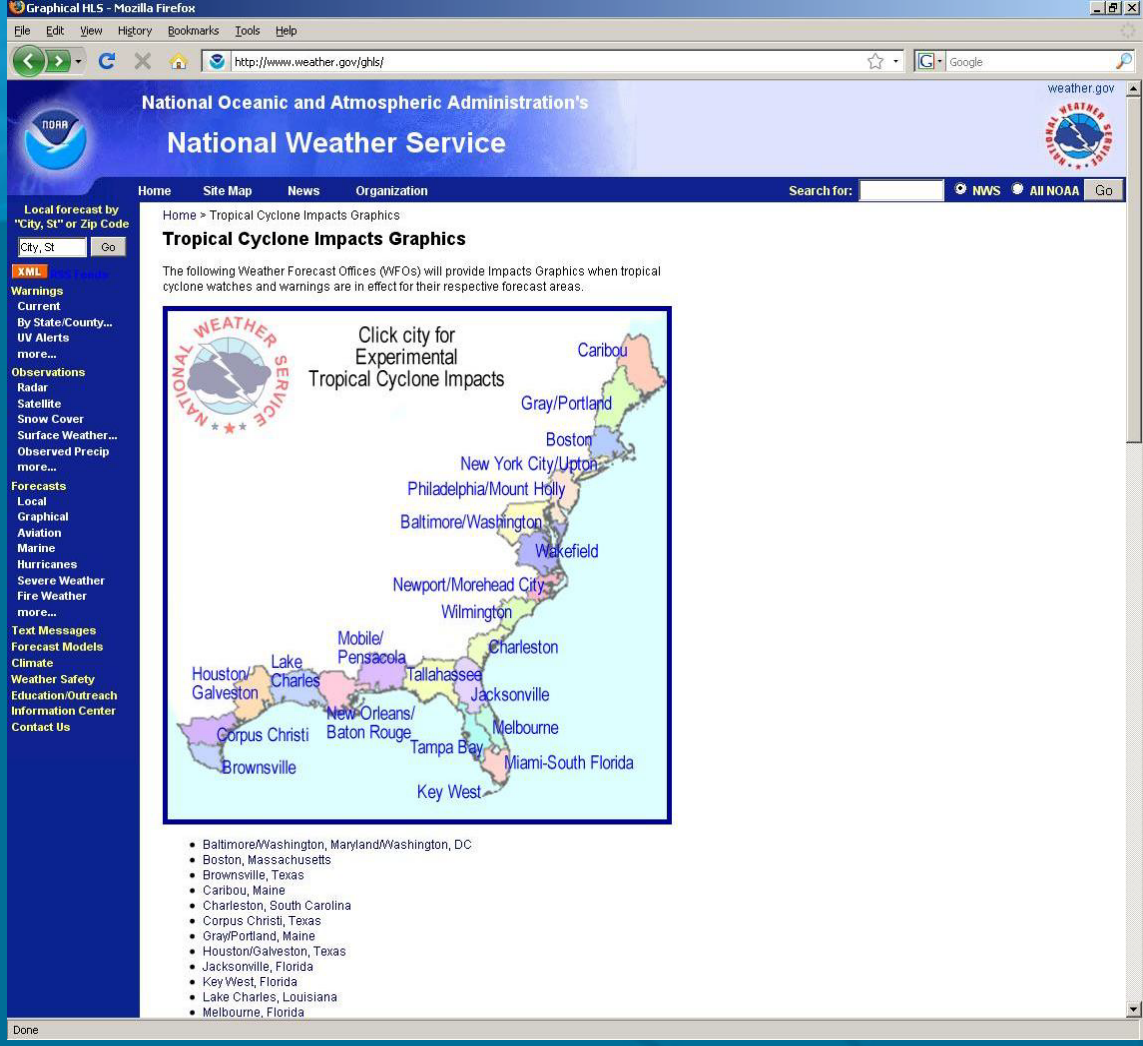
Click Map for Forecast

Done

Hurricane Local Statement Background Information

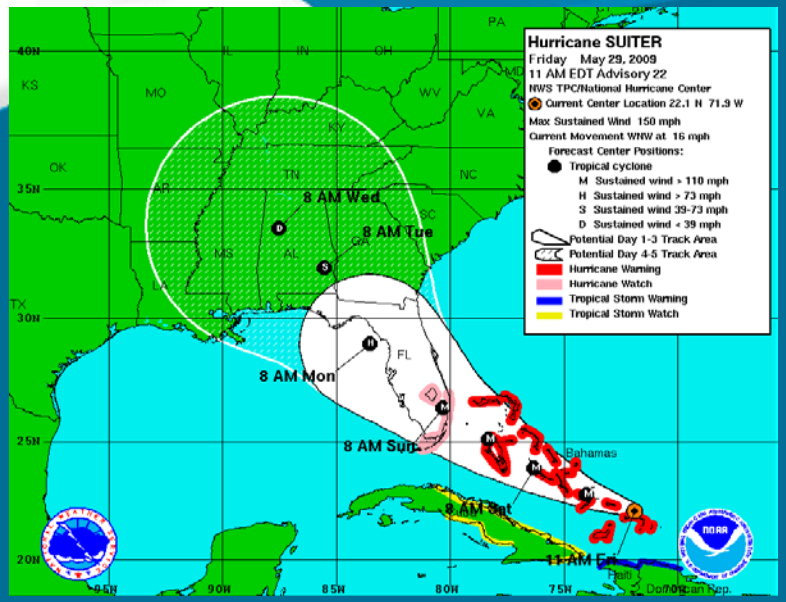
- Text (Show Suiter Example)
  - Segmented Preceded by an Overview
  - Overview contains information that is applicable to the County Warning Area
  - Segments contain information specific to a subset of zones within the County Warning Area
  - In the segments, Hazard specific Information according to latest forecast is provided for at least the following Hazards: Wind, Surge, Inland Flooding, and Tornadoes. Some offices include Marine.
- Graphical
  - Tropical Impact Graphics
  - Created for all Hazards addressed in the Text HLS and accounting for uncertainty.
  - They are based on a Threat Assessment of meteorological conditions and presented via the web as a Potential Impact Graphic in color codes.
  - Graphics dynamically linked to Text sections of the HLS for a given zone.

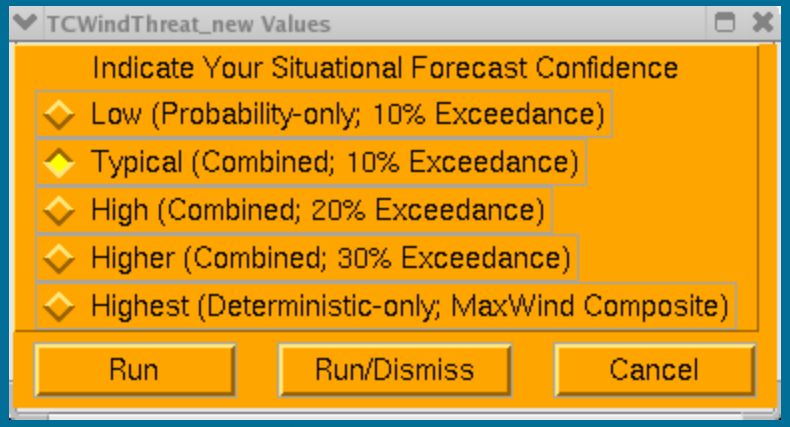
Graphical Hurricane Local Statement/Tropical Impact Graphics Web Links

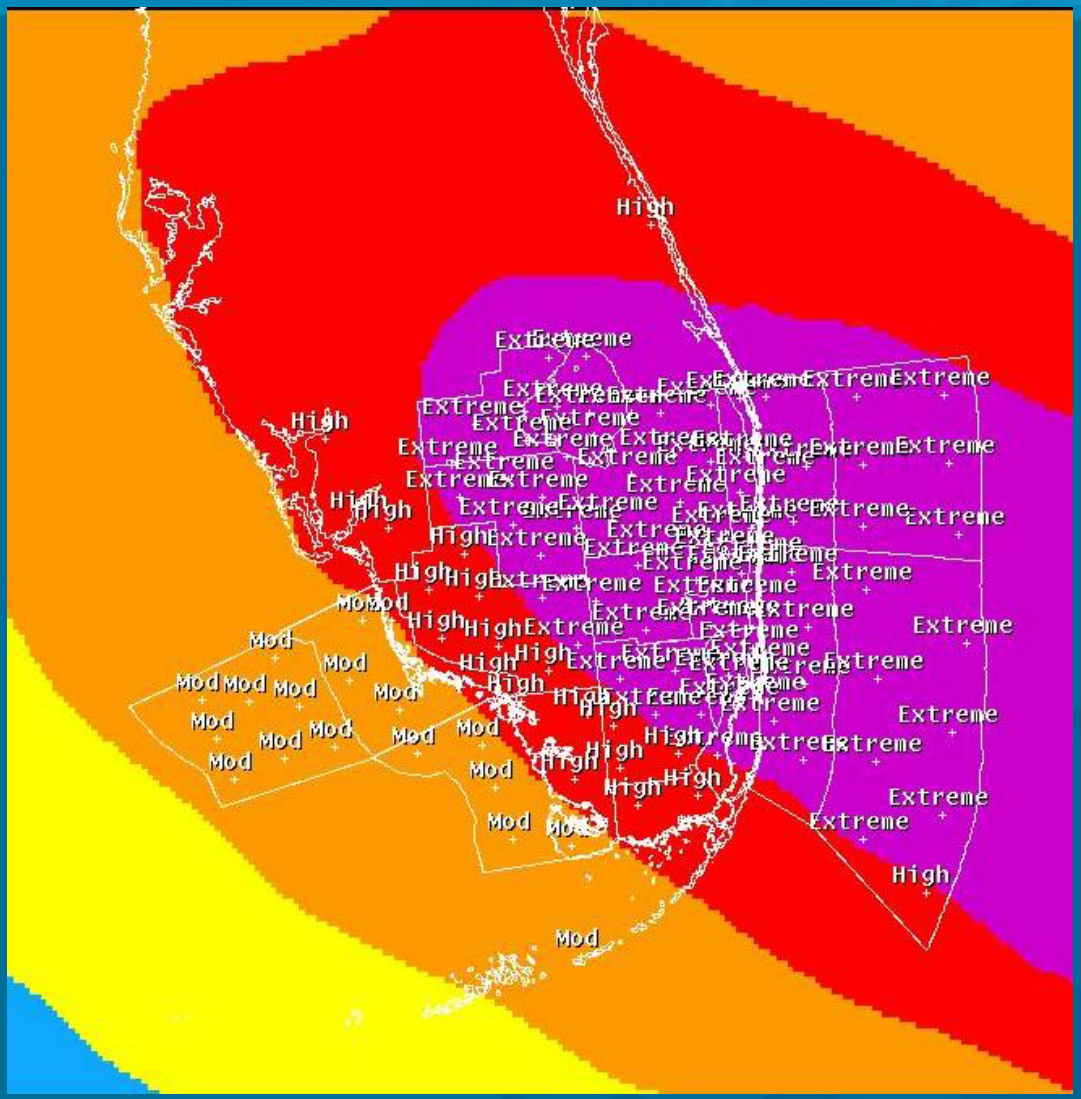


- http://weather.gov/ghls/
- Feedback/Survey: http://www.weather.gov/survey/nws-survey.php?code=TCIG
- How do we create the Impact Graphics that go into this product?

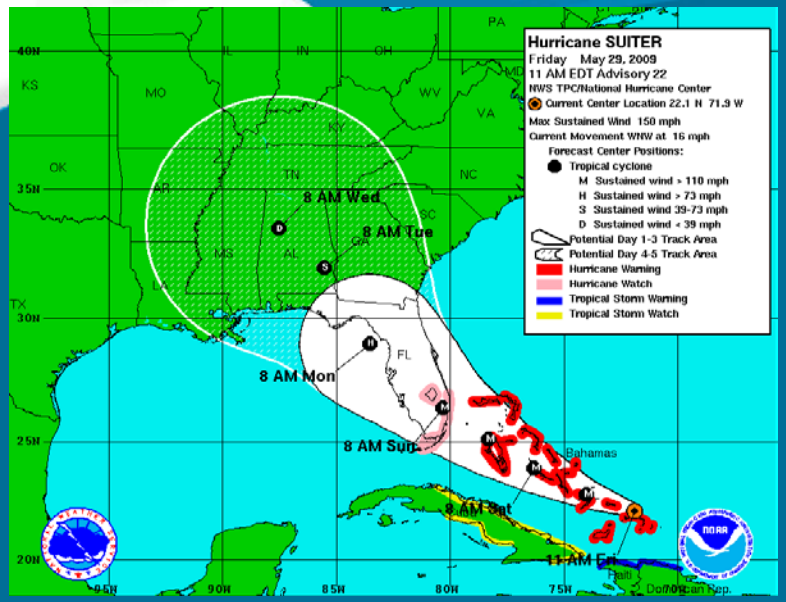
Typical Confidence Wind Threat Scenario

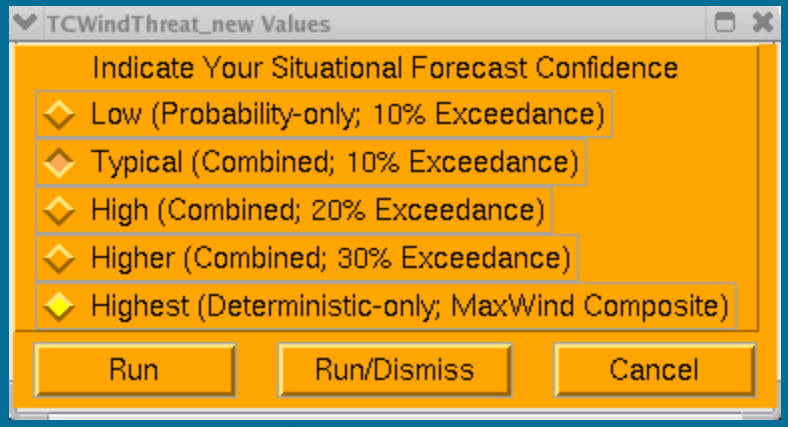


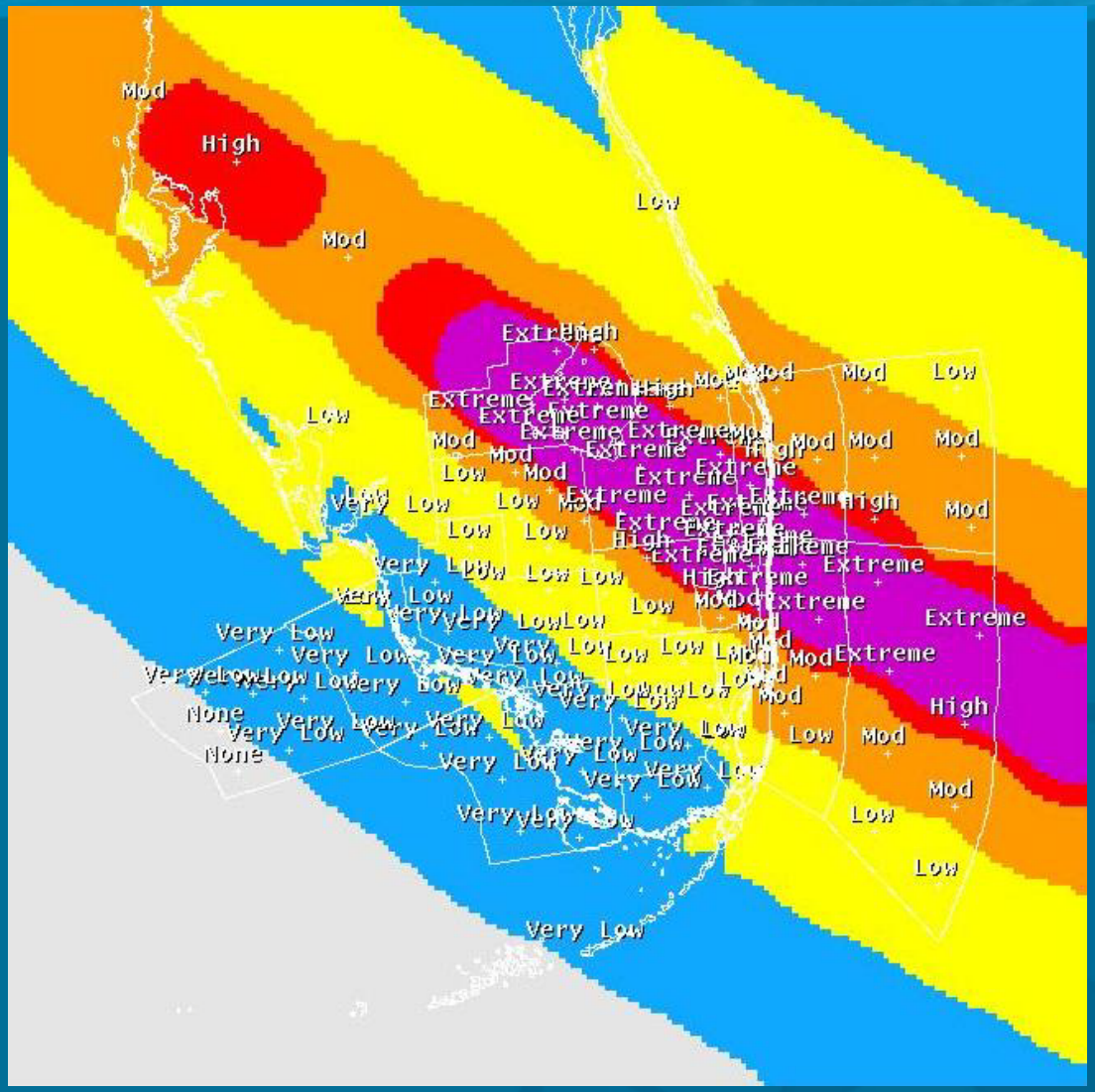




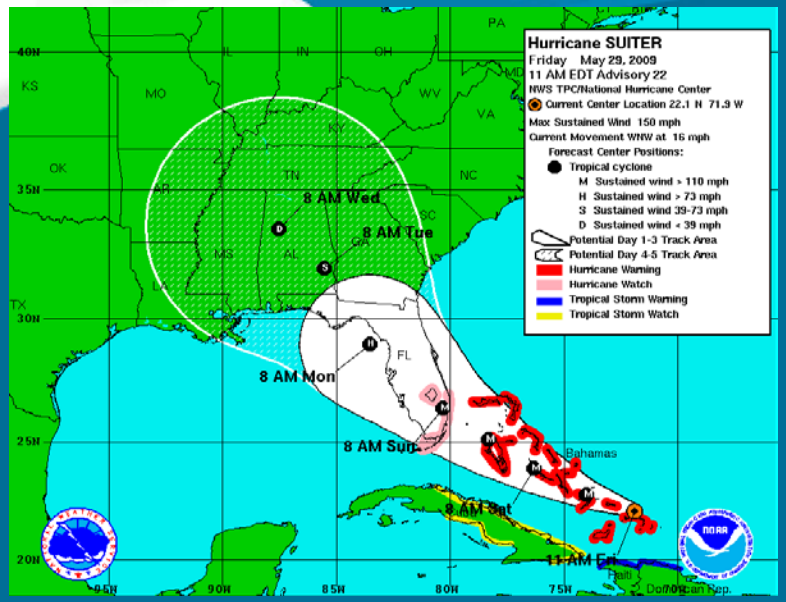
Higher Confidence Wind Threat Scenario

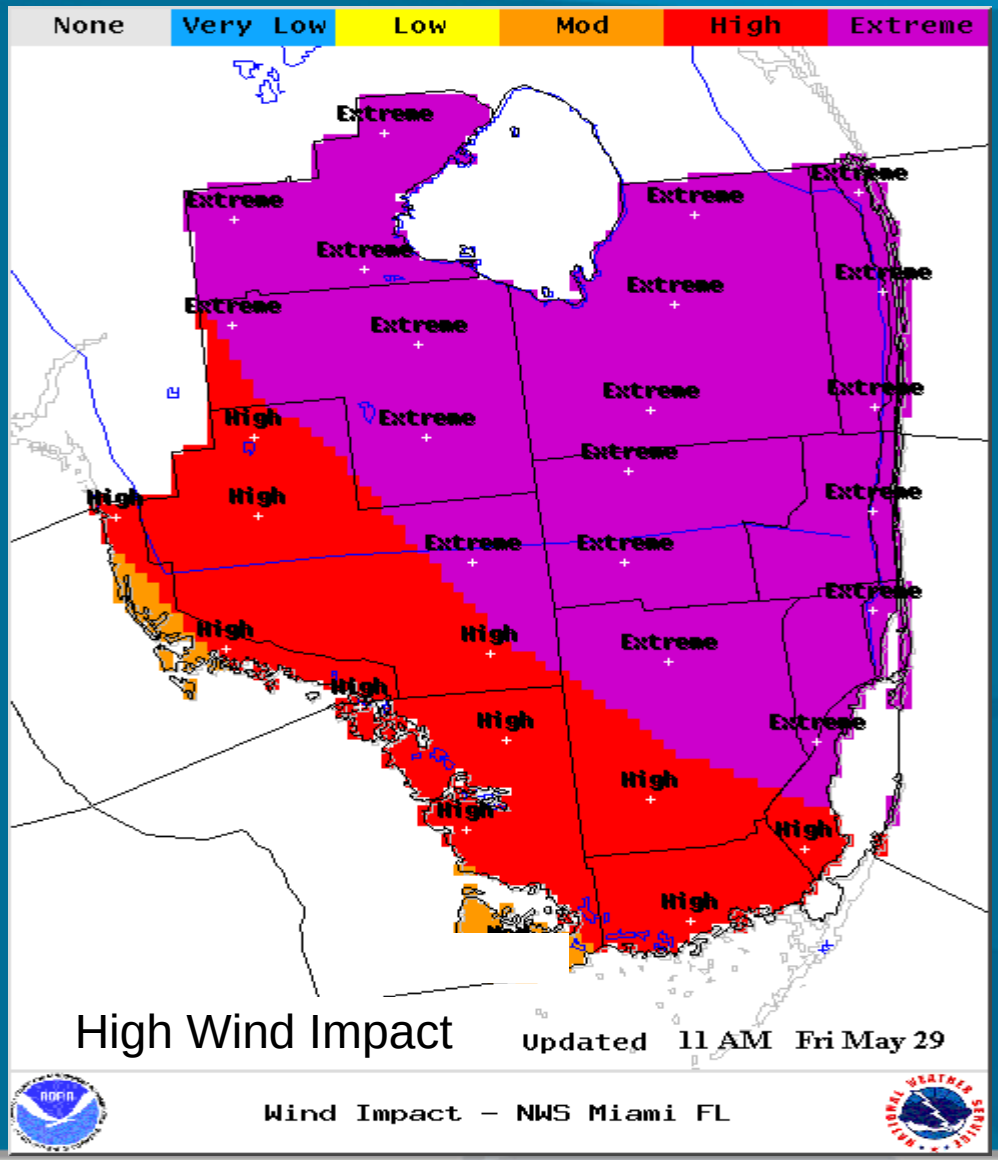






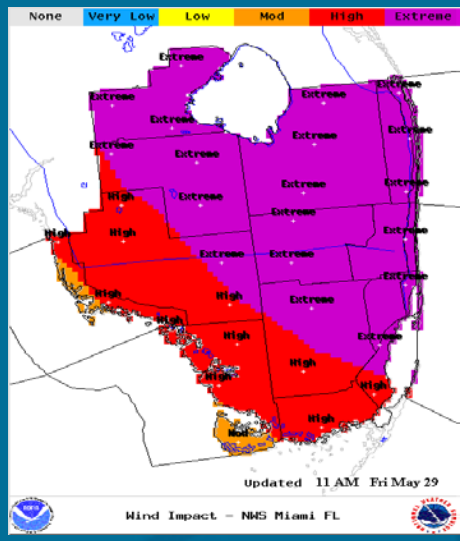
Potential Wind Impact Graphic





Impact Level Definitions

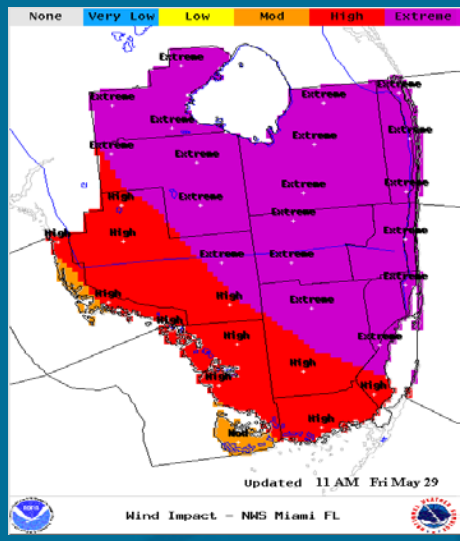
Impact Levels	Description
Extreme	• **Threat** - An extreme threat to life and property; the likelihood for major hurricane-force winds (greater than 110 mph) of Category 3, 4, or 5 intensity. • **Minimum Action** - Prepare for the likelihood of extreme to catastrophic wind damage. • **Potential Impact –** An extreme impact to communities within the specified area. Winds capable of causing structural damage to buildings, some with complete wall and roof failures. Complete destruction of mobile homes. Numerous large signs and trees blown down. Many roads impassible due to large debris. Widespread power outages. Damage is consistent with that realized by winds of Category 3, 4, or 5 strength on the Saffir-Simpson Scale.
High	• **Threat** - A critical threat to life and property; the likelihood for strong hurricane-force winds (96 to 110 mph) of Category 2 intensity. • **Minimum Action** - Prepare for the likelihood of major wind damage. • **Potential Impact –** A high impact to communities within the specified area. Winds capable of causing significant damage to roofing material, doors, fences, and windows of buildings, but with some occurrences of structural damage. Considerable damage to mobile homes. Many large signs and trees blown down with further damage to standing trees. Some roads impassible due to large debris. Widespread power outages. Damage is consistent with that realized by winds of Category 2 strength on the Saffir-Simpson Scale.
Moderate	• **Threat** - A significant threat to life and property; the likelihood for hurricane-force winds (74 to 95 mph) of Category 1 intensity. • **Minimum Action** - Prepare for the likelihood of moderate wind damage. • **Potential Impact –** A moderate impact to communities within the specified area. Winds capable of causing significant damage to mobile homes, especially if unanchored. Some damage to roofing material, doors, fences, and windows of buildings. Several large signs and trees blown down, especially shallow-rooted and diseased trees. A few roads impassible due to large debris. Scattered power outages, but widespread in areas with above ground lines. Damage is consistent with that realized by winds of Category 1 strength on the Saffir-Simpson Scale.



High Wind Impact

Impact Level Definitions

Low	• **Threat** - An elevated threat to life and property; the likelihood for strong tropical storm-force winds (58 to 73 mph). • **Minimum Action** - Prepare for the likelihood of minor to locally moderate wind damage. • **Potential Impact –** A low impact to communities in the specified area. Winds capable of causing damage to unanchored mobile homes, porches, carports, awnings, pool enclosures and with some shingles blown from roofs. Large branches break off trees, but several shallow-rooted and diseased trees blown down. Loose objects are easily blown about and become dangerous projectiles. Winds dangerous on bridges and causeways, especially for high profile vehicles. Scattered power outages, especially in areas with above ground lines.
Very Low	• **Threat** - A limited threat to life and property; the likelihood for tropical storm-force winds (39 to 57 mph). • **Minimum Action** - Prepare for the likelihood of minor wind damage. • **Potential Impact –** A very low impact to communities within the specified area. Winds capable of causing damage to carports, awnings, and pool enclosures. Some damage to unanchored mobile homes. Small branches break off trees and loose objects are blown about. Winds becoming dangerous on bridges and causeways, especially for high profile vehicles. Isolated to widely scattered power outages, especially in areas with above ground lines.
None	• **Threat** - No discernable threat to life and property; winds to remain below tropical storm-force, but windy conditions may still be present. • **Minimum Action** - Evaluate personal and community disaster plans and ensure seasonal preparedness activities are complete. • **Potential Impact –** Wind damage is not expected; impact should be negligible.

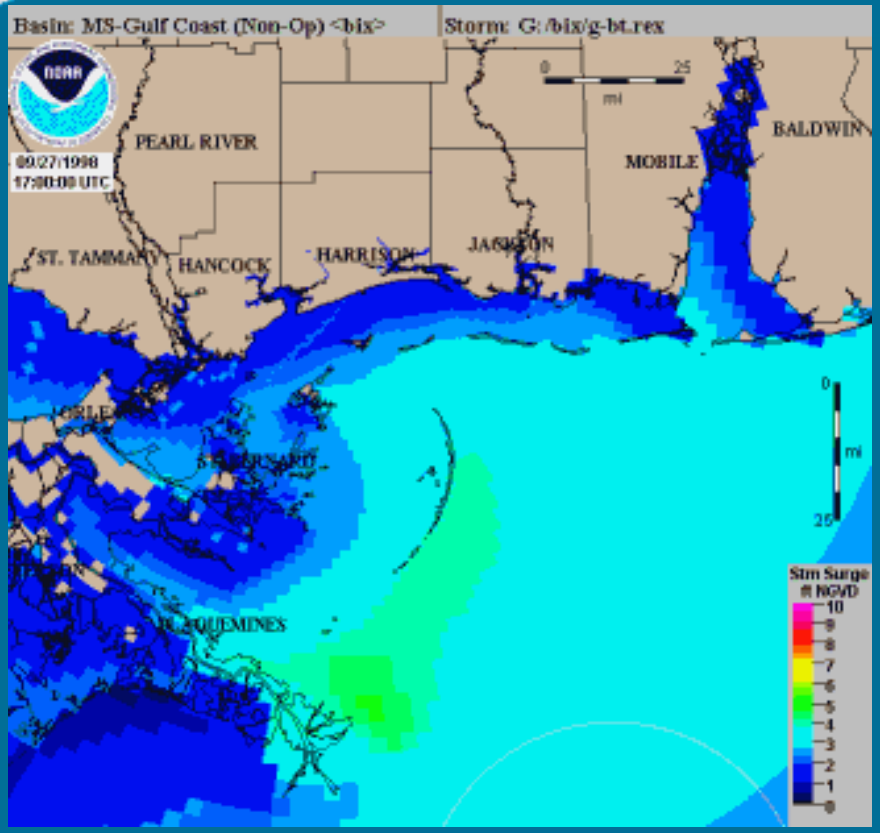


High Wind Impact

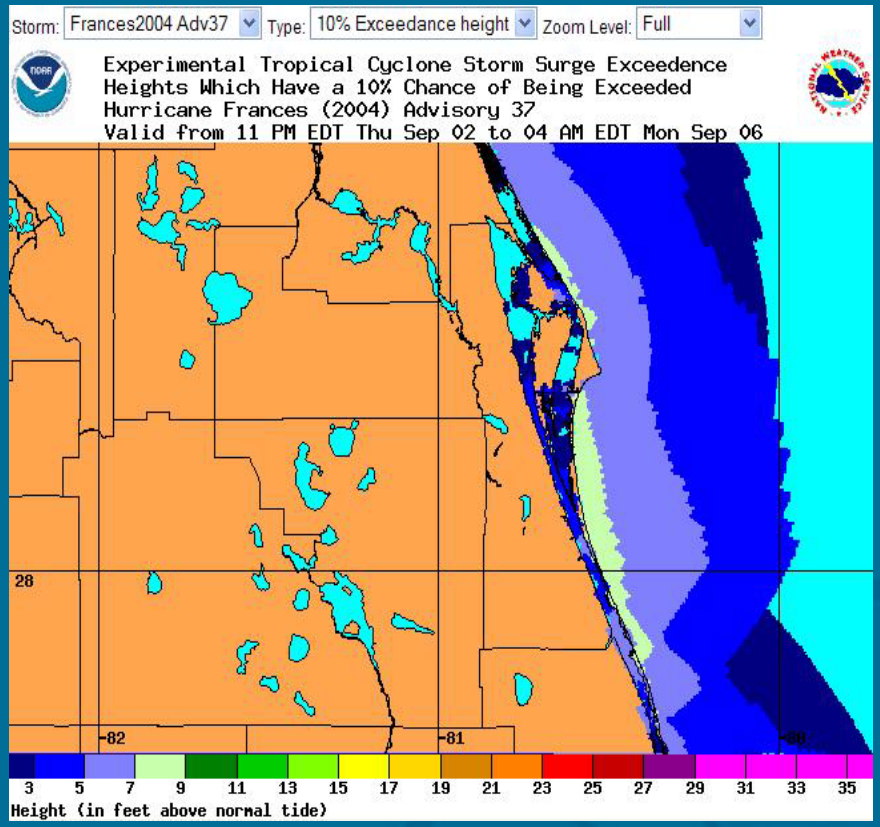
Note: During 2007, the color for 'Very Low' was changed from light yellow to blue.

Coastal Flooding/Surge – Tool Inputs

SLOSH



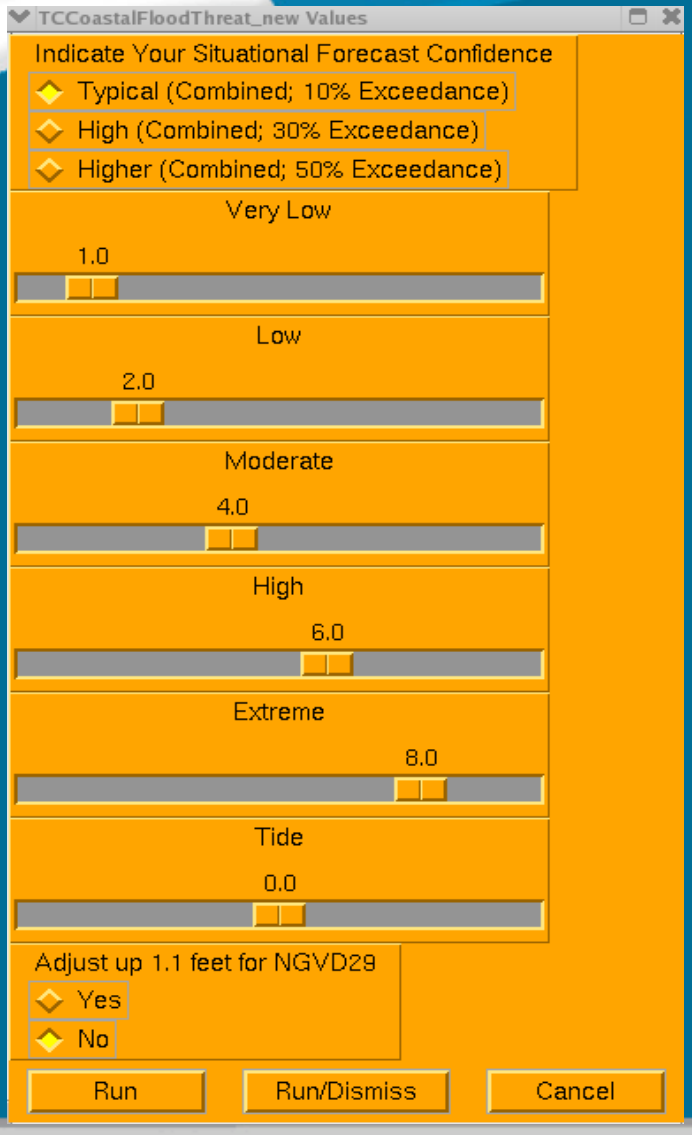
PSURGE

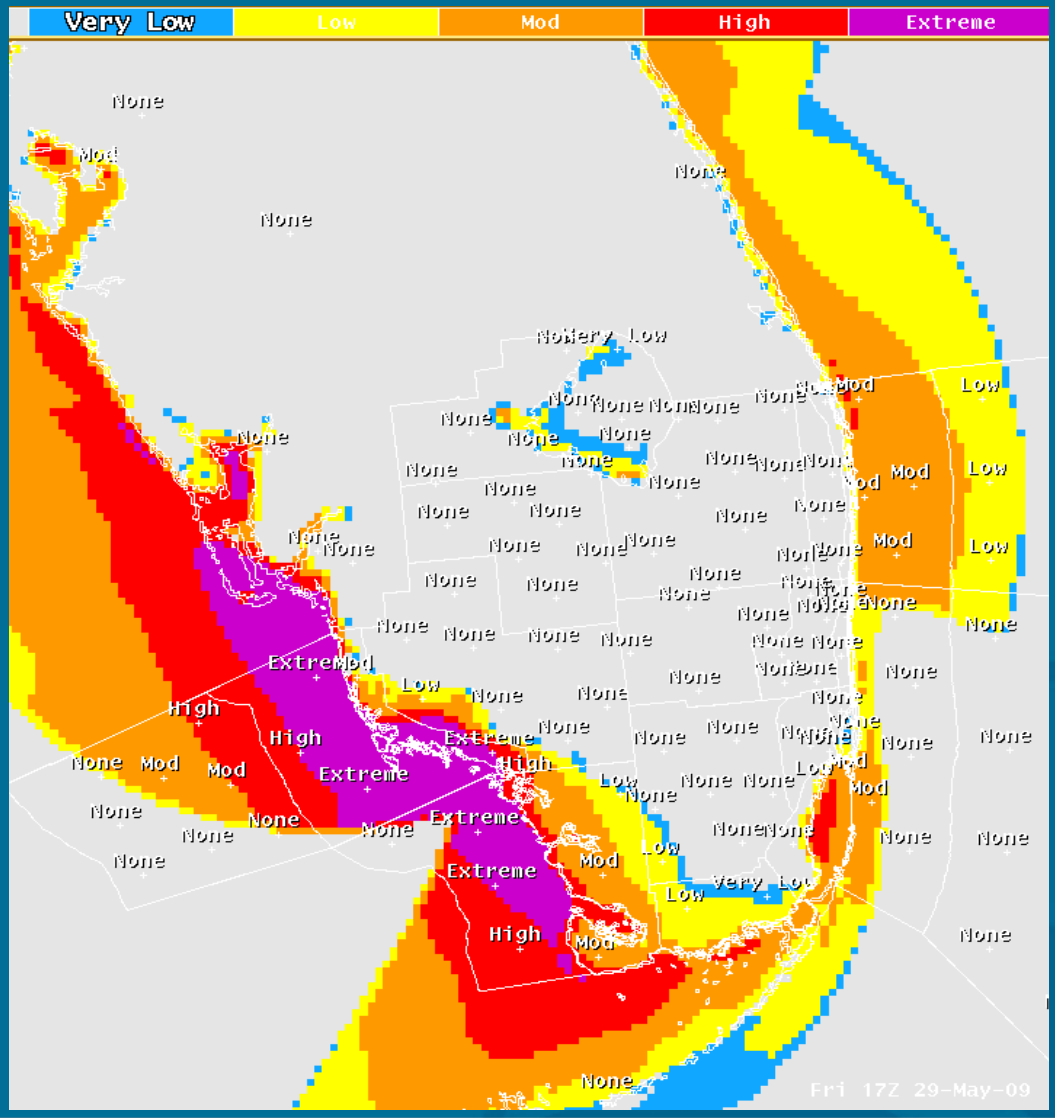


http://www.weather.gov/mdl/psurge/

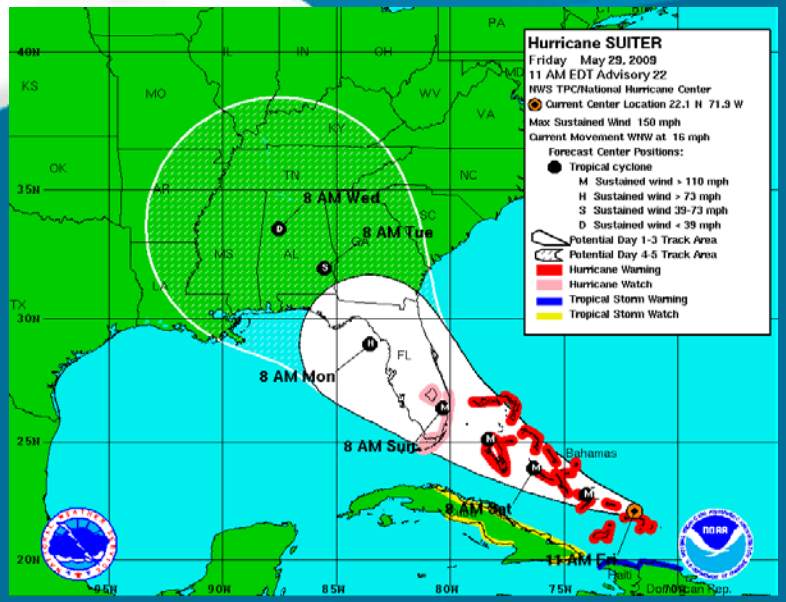
http://www.nhc.noaa.gov/HAW2/english/surge/slosh.shtml

Typical Confidence Storm Threat or Potential Impact Depiction

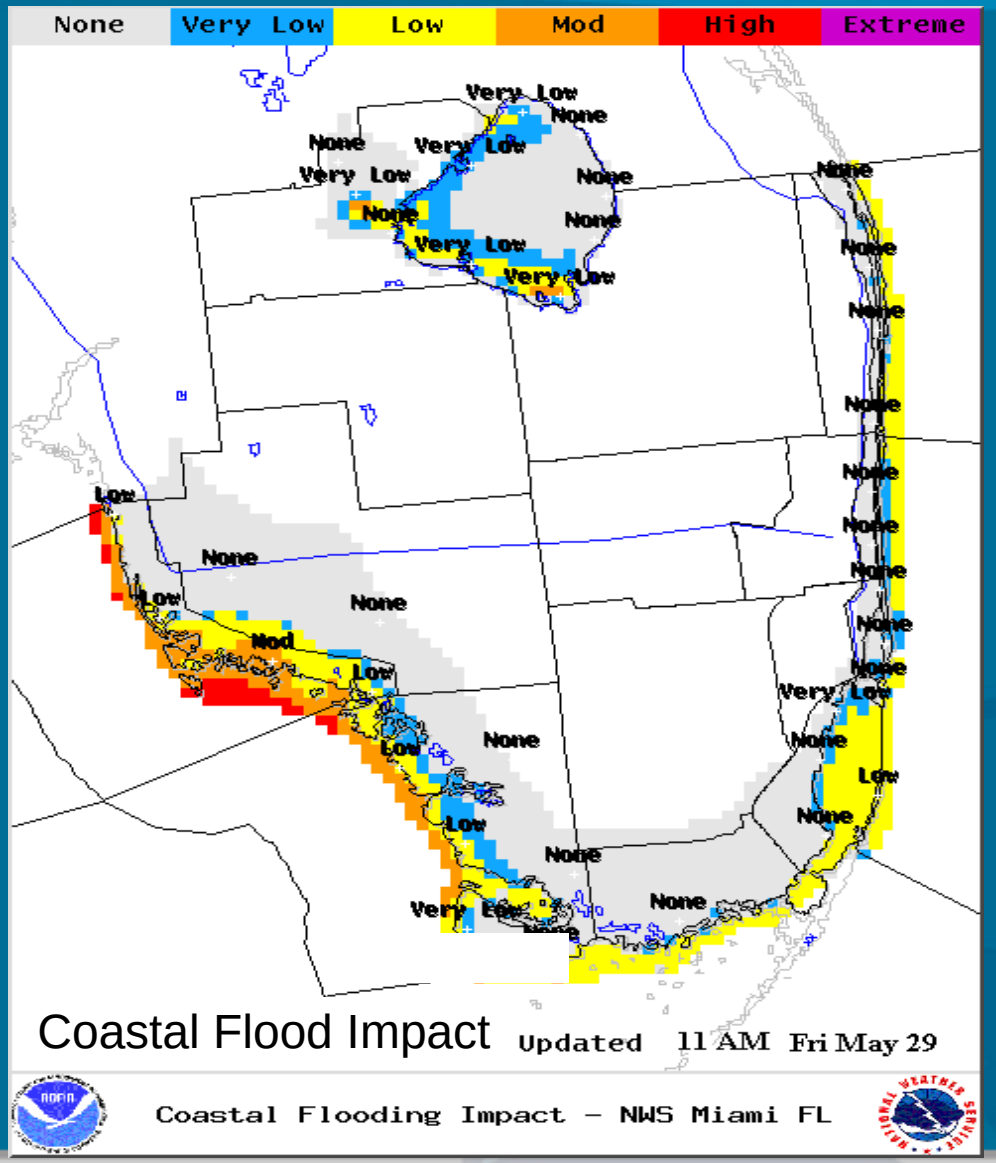




Potential Coastal Flood Impact Graphic



HIGH Confidence



Impact Level Definitions - Florida

(Traditional)

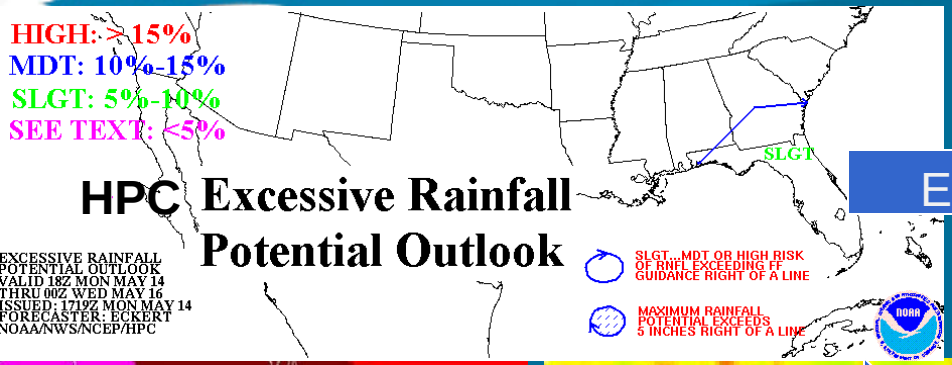
Impact Levels	Description
Extreme	• **Threat:** An extreme threat to life and property; the likelihood for combined storm surge and astronomical tide resulting in sea water inundation of 8 feet or higher. • **Minimum Action:** Prepare for the likelihood of extreme to catastrophic coastal flood damage. • **Potential Impact:** An extreme impact to communities in the specified area. Coastal flooding capable of causing widespread inundation of the surge zone by sea water, possibly reaching several miles inland for low-lying areas. Extreme beach erosion with several new inland cuts likely created. Many large sections of near-shore roads washed out and/or low-lying escape routes flooded. Powerful scouring surge waters and intense battering wind waves breaching dunes and seawalls in widespread locations to result in structural damage to numerous shoreline buildings, with several washing into the sea. Damage accentuated from considerable floating debris. Extensive damage to marinas, docks, and piers. Numerous small craft broken away from moorings.
High	• **Threat:** A critical threat to life and property; the likelihood for combined storm surge and astronomical tide resulting in sea water inundation of 6 to 8 feet. • **Minimum Action:** Prepare for the likelihood of major coastal flood damage. • **Potential Impact**: A high impact to communities in the specified area. Coastal flood waters capable of causing partial inundation of the surge zone by sea water, especially for low-lying areas. Severe beach erosion. Several sections of near-shore roads washed out and/or low-lying escape routes flooded. Scouring surge waters and battering wind waves breaching dunes and seawalls in scattered locations to result in structural damage to several shoreline buildings, with a few washing into the sea. Damage accentuated by floating debris. Damage to marinas, docks, and piers. Several small craft broken away from moorings, especially in unprotected anchorages.

Impact Level Definitions - Florida

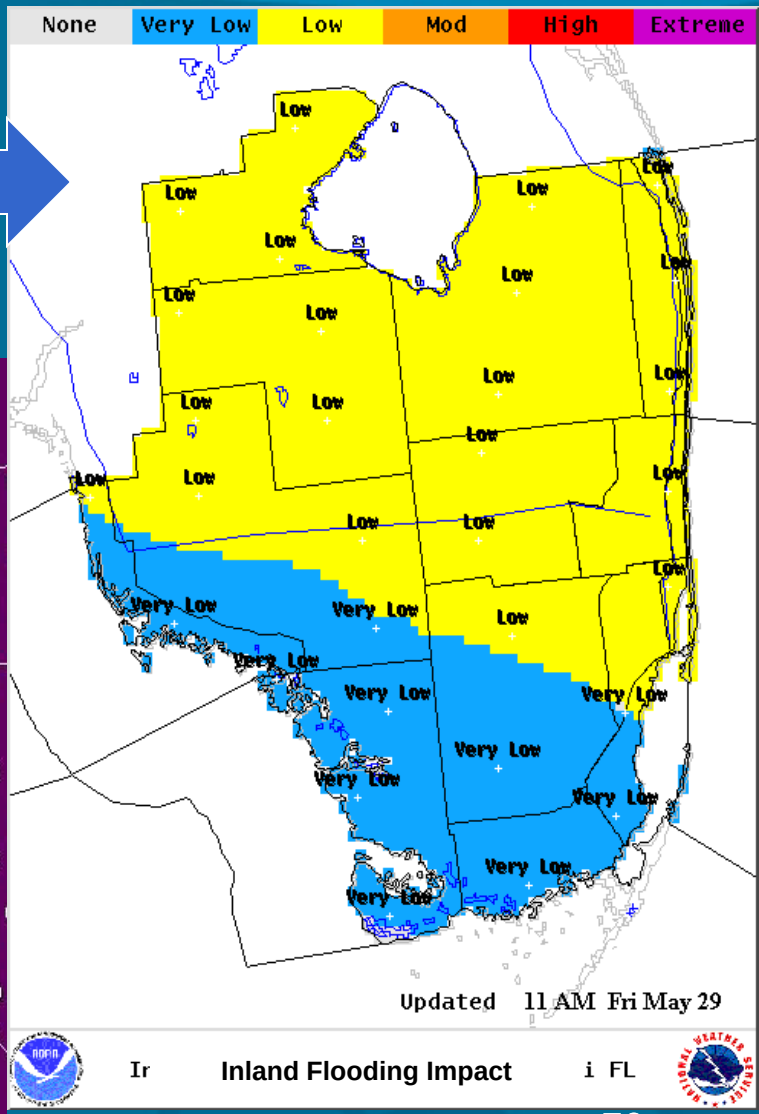
(Traditional)

Moderate	• **Threat:** A significant threat to life and property; the likelihood for combined storm surge and astronomical tide resulting in sea water inundation of 4 to 6 feet. • **Minimum Action:** Prepare for the likelihood of moderate coastal flood damage. • **Potential Impact**: A moderate impact to communities in the specified area. Coastal flood waters capable of causing major beach erosion. A few sections of near-shore escape roads weakened or washed out, especially in historically vulnerable low spots. Surge waters and wind waves breaching dunes and seawalls in scattered locations to result in structural damage to a few shoreline buildings, mainly in historically vulnerable spots. Minor damage to marinas, docks, and piers. A few small craft broken away from moorings, especially in unprotected anchorages.
Low	• **Threat:** An elevated threat to life and property; the likelihood for combined storm surge and astronomical tide resulting in sea water inundation of 2 to 4 feet. • **Minimum Action:** Prepare for the likelihood of minor to locally moderate coastal flood damage. • **Potential Impact**: A low impact to communities in the specified area. Coastal flood waters capable of causing moderate to locally major beach erosion. Very heavy surf breaching dunes in isolated locations, mainly in historically vulnerable spots.
Very Low	• **Threat:** A limited threat to life and property; the likelihood for combined storm surge and astronomical tide resulting in sea water inundation of 1 to 2 feet. • **Minimum Action:** Prepare for the likelihood of minor coastal flood damage. • **Potential Impact**: A very low impact to communities in the specified area. Coastal flood waters capable of causing heavy surf and moderate beach erosion.
None	• **Threat:** No discernable threat to life and property; no surge waters expected. • **Minimum Action:** Evaluate personal and community disaster plans and ensure seasonal preparedness activities are complete. • **Potential Impact:** Coastal flooding is not expected; impact should be negligible. Surf conditions may still be rough with minor beach erosion.

Inland Flood – Tool Inputs/Potential Impact Depiction



ERP Grid



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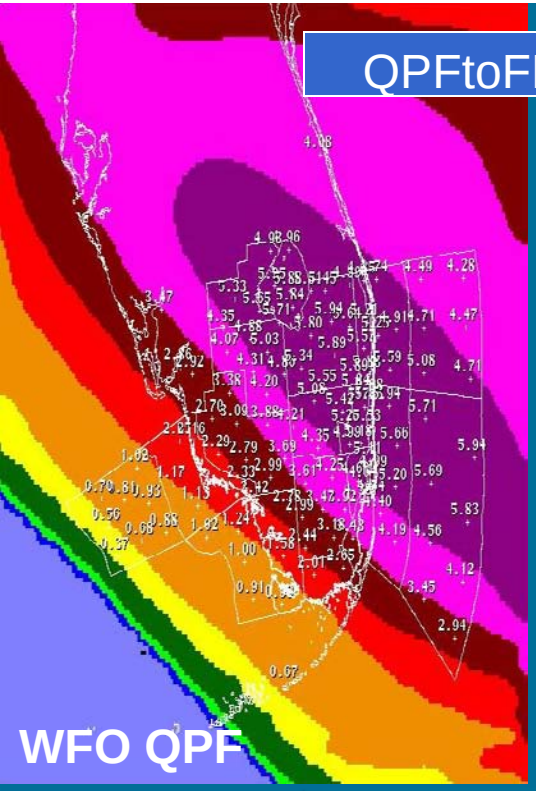
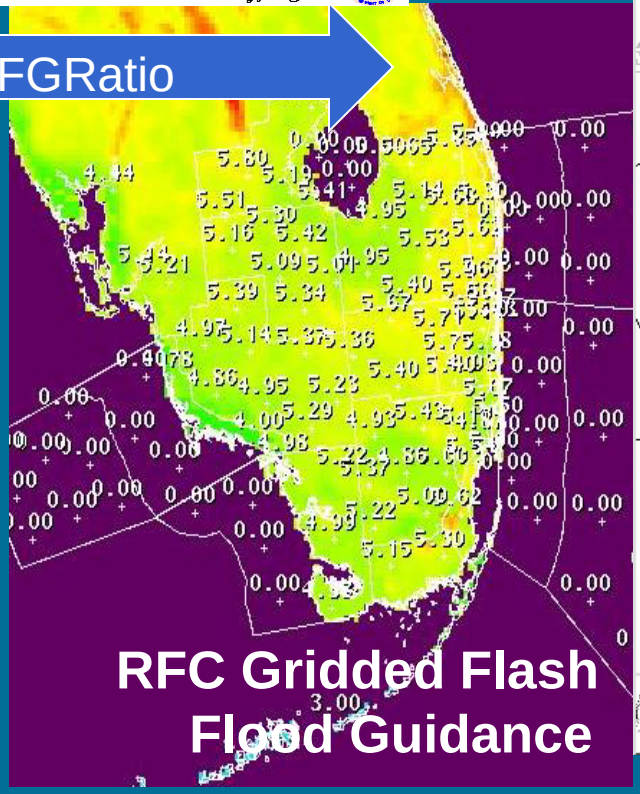


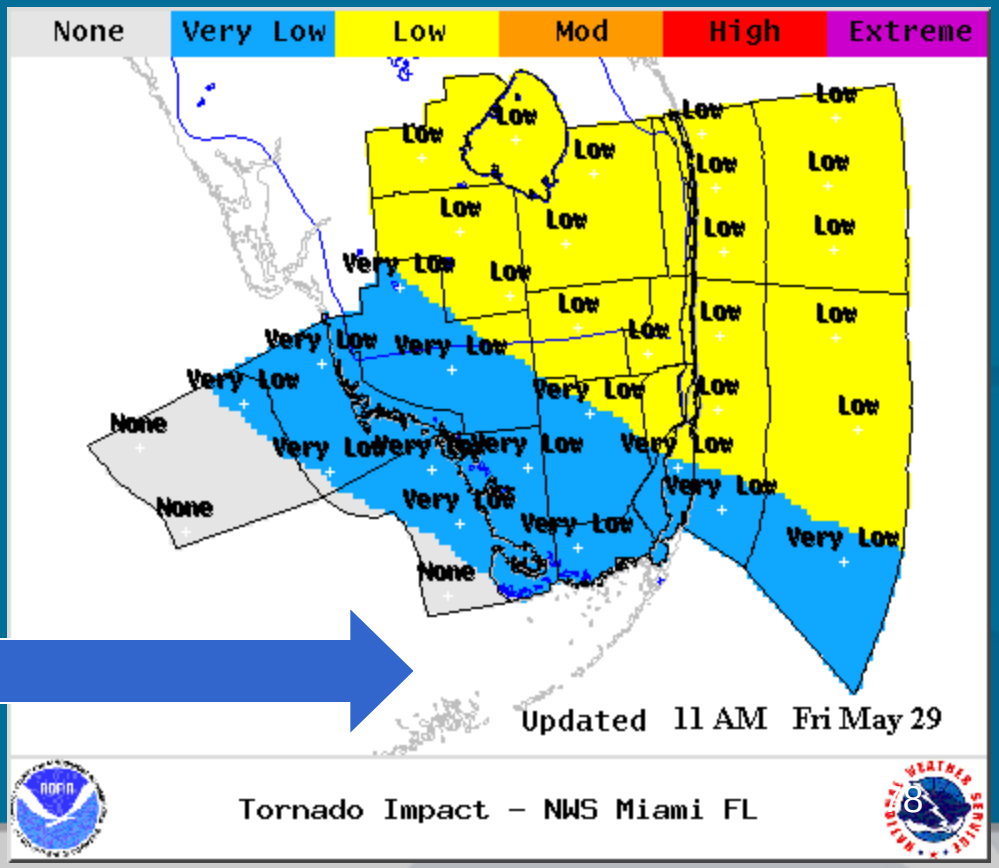


Inland Flooding Impact Level Definitions - Florida

Impact Levels	Description
Extreme	• **Threat:** An extreme threat to life and property; the likelihood for higher rain totals to greatly exceed flash flood guidance. • **Minimum Action:** Prepare for the likelihood of damage consistent with very major inland flooding. • **Potential Impact:** An extreme impact to communities within the specified area. Scattered locations may experience major inland flooding, among many locations of minor to moderate inland flooding.
High	• **Threat:** A critical threat to life and property; the likelihood for higher rain totals to well exceed flash flood guidance. • **Minimum Action:** Prepare for the likelihood of damage consistent with major inland flooding. • **Potential Impact:** A high impact to communities within the specified area. Isolated locations may experience major inland flooding, among scattered locations of minor to moderate inland flooding.
Moderate	• **Threat:** A significant threat to life and property; the likelihood for higher rain totals to exceed flash flood guidance. • **Minimum Action:** Prepare for the likelihood of damage consistent with moderate inland flooding. • **Potential Impact:** A moderate impact to communities within the specified area. Isolated locations may experience moderate inland flooding, among scattered locations of minor flooding.
Low	• **Threat:** An elevated threat to life and property; the likelihood for higher rain totals to be around flash flood guidance. • **Minimum Action:** Prepare for the likelihood of damage consistent with minor inland flooding. • **Potential Impact:** A low impact to communities within the specified area. Isolated to scattered locations may experience minor inland flooding.
Very Low	• **Threat:** A limited threat to life and property; the likelihood for higher rain totals to approach flash flood guidance. • **Minimum Action:** Prepare for the likelihood of damage consistent with very minor inland flooding. • **Potential Impact:** A very low impact to communities within the specified area. Isolated locations may experience minor inland flooding.
None	• **Threat:** No discernible threat to life and property; the likelihood for higher rain totals to remain below flash flood guidance. • **Minimum Action:** Listen for forecast changes; review flooding safety rules. • **Potential Impact:** None expected; heavy rain may still occur.

Tornado - Inputs

Use the SPC tornado probabilities with local enhancements, with consideration for strongest potential tornado (category). Cyclone forecast uncertainty must also be factored in for event duration.



Tornado Impact Level Definitions

Impact Levels	Description
Extreme	• **Threat:** An extreme threat to life and property; the occurrence of tornadoes is very likely. • **Minimum Action:** Prepare for the likelihood of many tornadoes (even families) with scattered significant tornadoes. • **Potential Impact:** An extreme impact to communities within the specified area. Scattered locations may experience major to catastrophic tornado damage, among many locations of minor to moderate tornado damage. Some tornadoes may have longer damage tracks
High	• **Threat:** A critical threat to life and property; the occurrence of tornadoes is likely. • **Minimum Action:** Prepare for the likelihood of scattered tornadoes (even families) with isolated significant tornadoes. • **Potential Impact:** A high impact to communities within the specified area. Isolated locations may experience major to catastrophic tornado damage, among scattered locations of minor to moderate tornado damage. Some tornadoes may have longer damage tracks.
Moderate	• **Threat:** A significant threat to life and property; the occurrence of tornadoes is possible, and more likely than not. • **Minimum Action:** Prepare for the likelihood of scattered tornadoes. • **Potential Impact:** A moderate impact to communities within the specified area. Scattered locations may experience minor to moderate tornado damage. A few tornadoes may have longer damage tracks.
Low	• **Threat:** An elevated threat to life and property; the occurrence of tornadoes is possible, but less likely than so. • **Minimum Action:** Prepare for the likelihood of isolated to scattered tornadoes. • **Potential Impact:** A low impact to communities within the specified area. Isolated to scattered locations may experience minor to moderate tornado damage.
Very Low	• **Threat:** A limited threat to life and property; the occurrence of tornadoes is unlikely, but cannot be ruled out altogether. • **Minimum Action:** Prepare for the likelihood of isolated tornadoes. • **Potential Impact:** A very low impact to communities within the specified area. Isolated locations may experience minor to moderate tornado damage.
None	• **Threat:** No discernible threat to life and property; the occurrence of tornadoes is very unlikely. • **Minimum Action:** Listen for forecast changes; review tornado safety rules. • **Potential Impact:** None expected; strong wind gusts may still occur.

Thank You

Comments or Questions?

Feedback/Survey: http://www.weather.gov/survey/nws-survey.php?code=TCIG

Also Email: Robert.Molleda@noaa.gov, Pablo.Santos@noaa.gov