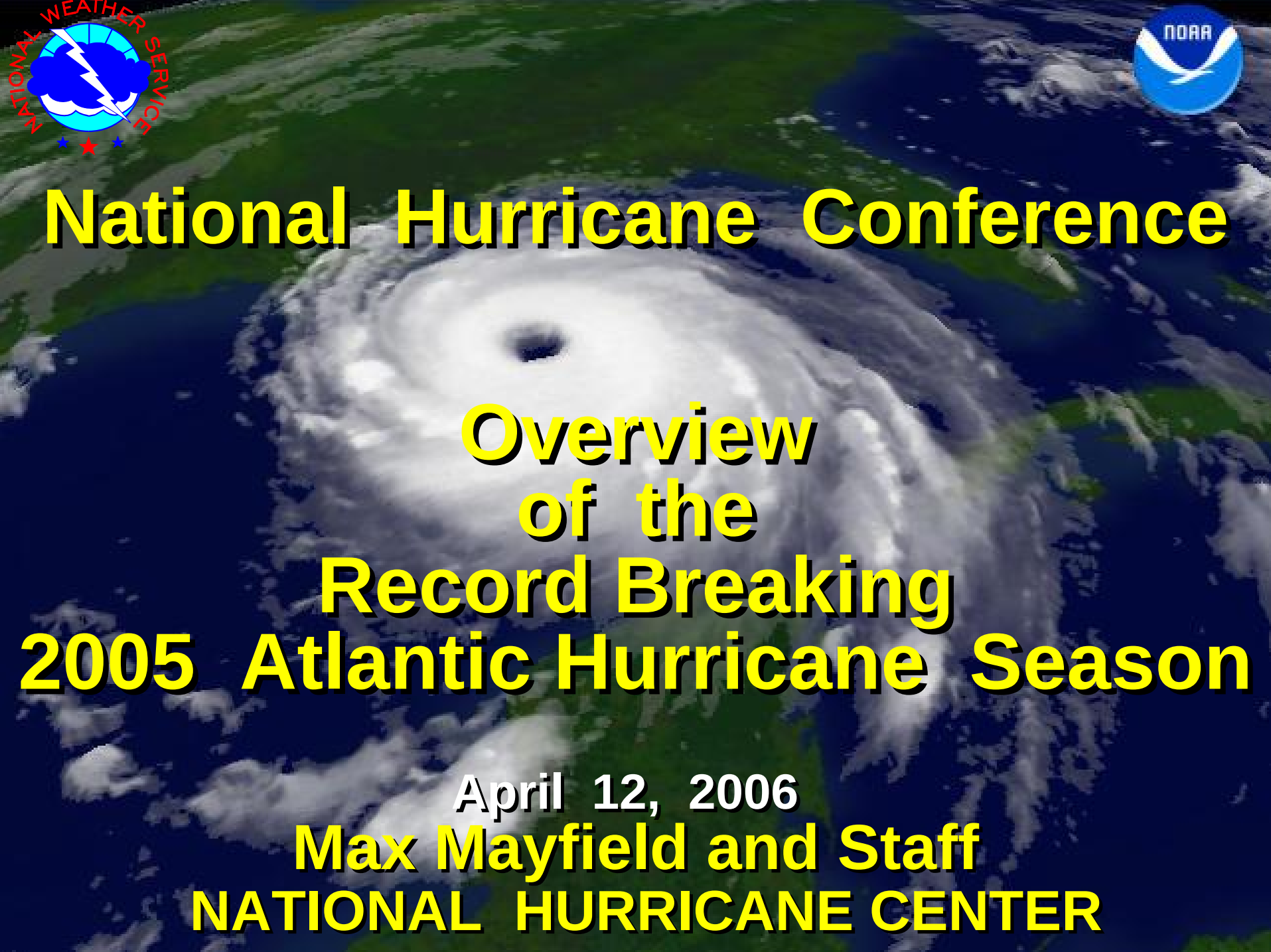
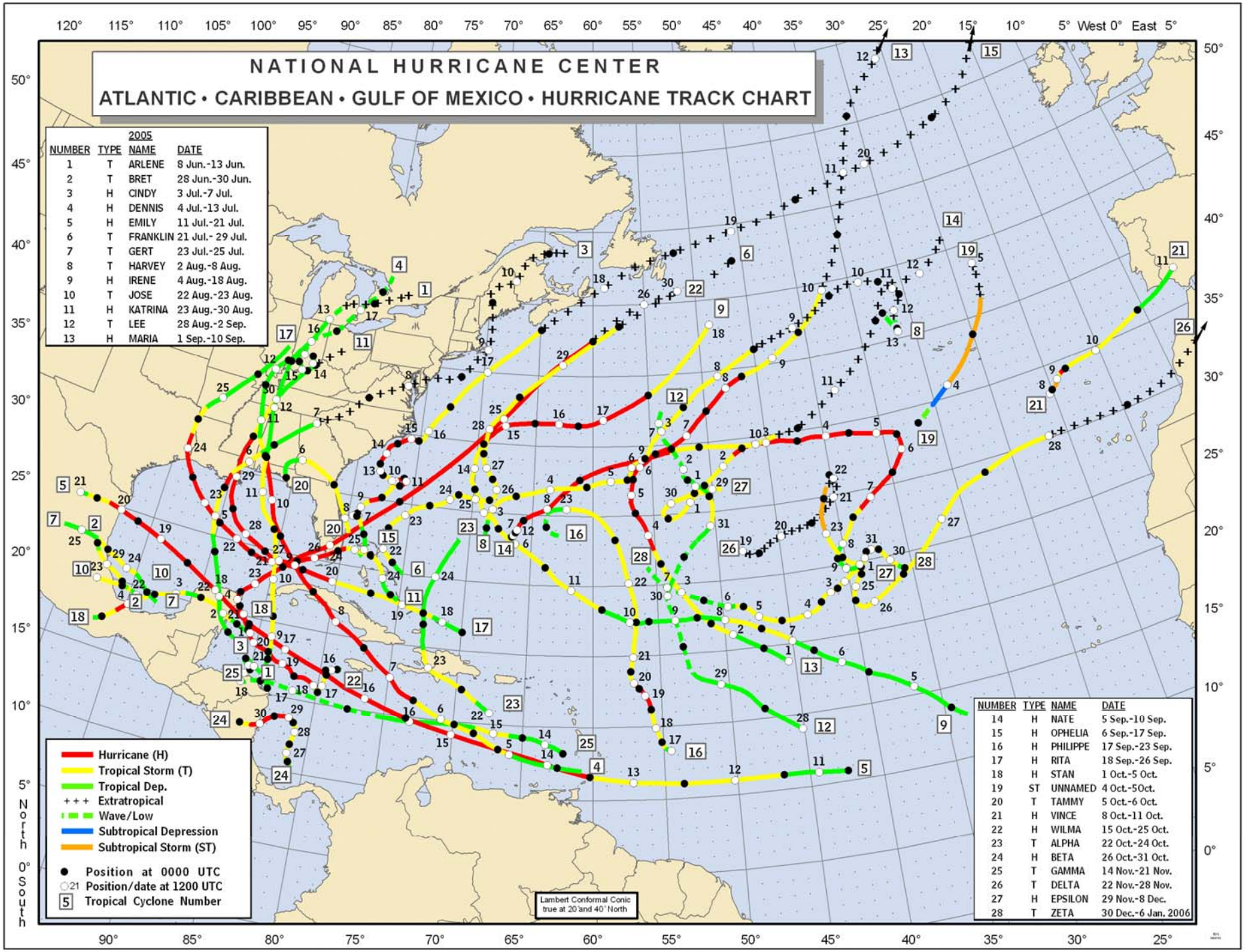


National Hurricane Conference

Overview of the Record Breaking 2005 Atlantic Hurricane Season

April 12, 2006

Max Mayfield and Staff
NATIONAL HURRICANE CENTER


NATIONAL HURRICANE CENTER
ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART
2005
NUMBER TYPE NAME DATE
1 T ARLENE 8 Jun.-13 Jun.
2 T BRET 28 Jun.-30 Jun.
3 H CINDY 3 Jul.-7 Jul.
4 H DENNIS 4 Jul.-13 Jul.
5 H EMILY 11 Jul.-21 Jul.
6 T FRANKLIN 21 Jul.- 29 Jul.
7 T GERT 23 Jul.-25 Jul.
8 T HARVEY 2 Aug.-8 Aug.
9 H IRENE 4 Aug.-18 Aug.
10 T JOSE 22 Aug.-23 Aug.
11 H KATRINA 23 Aug.-30 Aug.
12 T LEE 28 Aug.-2 Sep.
13 H MARIA 1 Sep.-10 Sep.
NUMBER TYPE NAME DATE
14 H NATE 5 Sep.-10 Sep.
15 H OPHELIA 6 Sep.-17 Sep.
16 H PHILIPPE 17 Sep.-23 Sep.
17 H RITA 18 Sep.-26 Sep.
18 H STAN 1 Oct.-5 Oct.
19 ST UNNAMED 4 Oct.-5Oct.
20 T TAMMY 5 Oct.-6 Oct.
21 H VINCE 8 Oct.-11 Oct.
22 H WILMA 15 Oct.-25 Oct.
23 T ALPHA 22 Oct.-24 Oct.
24 H BETA 26 Oct.-31 Oct.
25 T GAMMA 14 Nov.-21 Nov.
26 T DELTA 22 Nov.-28 Nov.
27 H EPSILON 29 Nov.-8 Dec.
28 T ZETA 30 Dec.-6 Jan. 2006
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Extratropical
Wave/Low
Subtropical Depression
Subtropical Storm (ST)
Position at 0000 UTC
21 Position/date at 1200 UTC
5 Tropical Cyclone Number
Lambert Conformal Conic
true at 20 and 40 North
120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65° 60° 55° 50° 45° 40° 35° 30° 25° 20° 15° 10° 5° West 0° East 5°
50° 45° 40° 35° 30° 25° 20° 15° 10° 5° North 0° South
90° 85° 80° 75° 70° 65° 60° 55° 50° 45° 40° 35° 30° 25°

2005 ATLANTIC HURRICANE SEASON STATISTICS

NAME	DATES	MIN. PRESS (MB)	MAX. WINDS (MPH)	DIRECT DEATHS	U.S. DAMAGE ($ million)
TS ARLENE	8 - 13 JUN	989	70	1	minor
TS BRET	28 - 30 JUN	1002	40	1	
H CINDY	3 - 7 JUL	991	75	1	320
H DENNIS	4 - 13 JUL	930	150 (4)	42	2230
H EMILY	11 - 21 JUL	929	160 (5)	6	minor
TS FRANKLIN	21 - 29 JUL	997	70		
TS GERT	23 - 25 JUL	1005	45		
TS HARVEY	2 - 8 AUG	994	65		
H IRENE	4 - 18 AUG	970	105 (2)		
TS JOSE	22 - 23 AUG	998	60	6	
H KATRINA	23 - 30 AUG	902	175 (5)	1200	75000
TS LEE	28 AUG - 2 SEP	1006	40		
H MARIA	1 - 10 SEP	962	115 (3)		
H NATE	5 - 10 SEP	979	90 (1)		

2005 ATLANTIC HURRICANE SEASON STATISTICS

NAME	DATES	MIN. PRESS (MB)	MAX. WINDS (MPH)	DIRECT DEATHS	U.S. DAMAGE ($ million)
H OPHELIA	6 - 17 SEP	976	85 (1)	1	70
H PHILIPPE	17 - 24 SEP	985	80 (1)		
H RITA	18 - 26 SEP	895	180 (5)	7	10000
H STAN	1 - 5 OCT	977	80 (1)	80	
ST UNNAMED	4 - 5 OCT	997	50		
TS TAMMY	5 - 6 OCT	1001	50		minor
H VINCE	8 - 11 OCT	988	75 (1)		
H WILMA	15 - 25 OCT	882	185 (5)	22	16800
TS ALPHA	22 - 24 OCT	998	50	26	
H BETA	26 - 31 OCT	962	115 (3)		
TS GAMMA	14 - 21 NOV	1002	50	37	
TS DELTA	22 - 28 NOV	980	70		
H EPSILON	29 NOV - 8 DEC	981	85		
TS ZETA	30 DEC - 6 JAN	994	65		

SEASON HIGHLIGHTS

- Most active Atlantic hurricane season of record - 28 storms developed including 27 named tropical storms and one subtropical storm. This breaks the old record of 21 set in 1933.

- Fifteen tropical storms became hurricanes, breaking the record of 12 set in 1969.

- Seven of the hurricanes became major hurricanes. This included the first time that four Category 5 hurricanes had been observed in a single Atlantic season and the first time that four major hurricanes hit the United States in one season.

- Hurricane Wilma had the lowest minimum central pressure ever observed in an Atlantic hurricane - 882 mb. The central pressure of Wilma fell 88 mb in 12 hours.

- The "Accumulated Cyclone Energy" (ACE) for the season was 285% of median – the highest value of record for an Atlantic hurricane season.

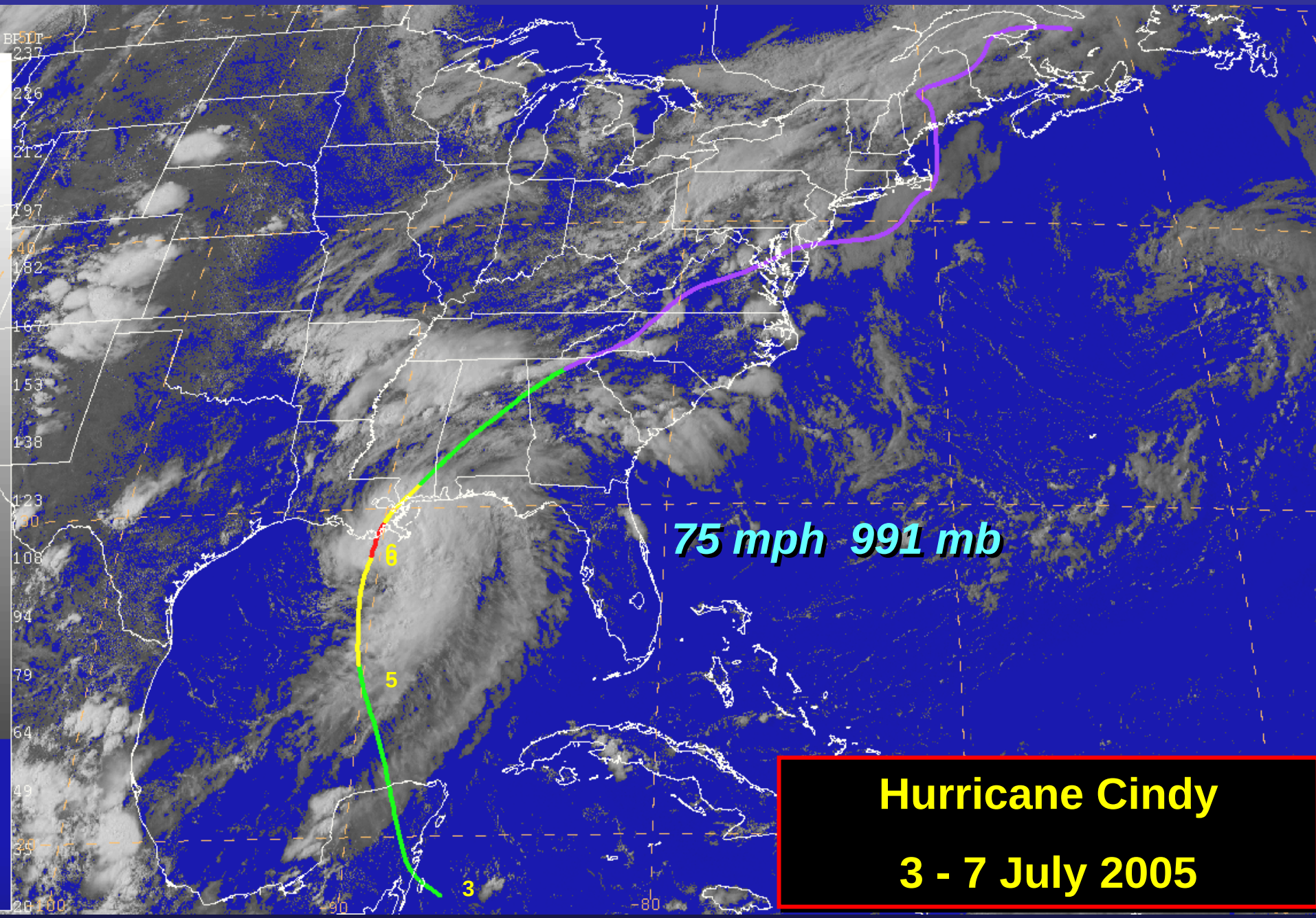
SEASON HIGHLIGHTS

- Seven landfalls in the United States, including Hurricane Cindy, Dennis, Katrina, Rita, and Wilma along with Tropical Storms Arlene and Tammy. Hurricane Ophelia also struck the North Carolina coast, although the center stayed just offshore.

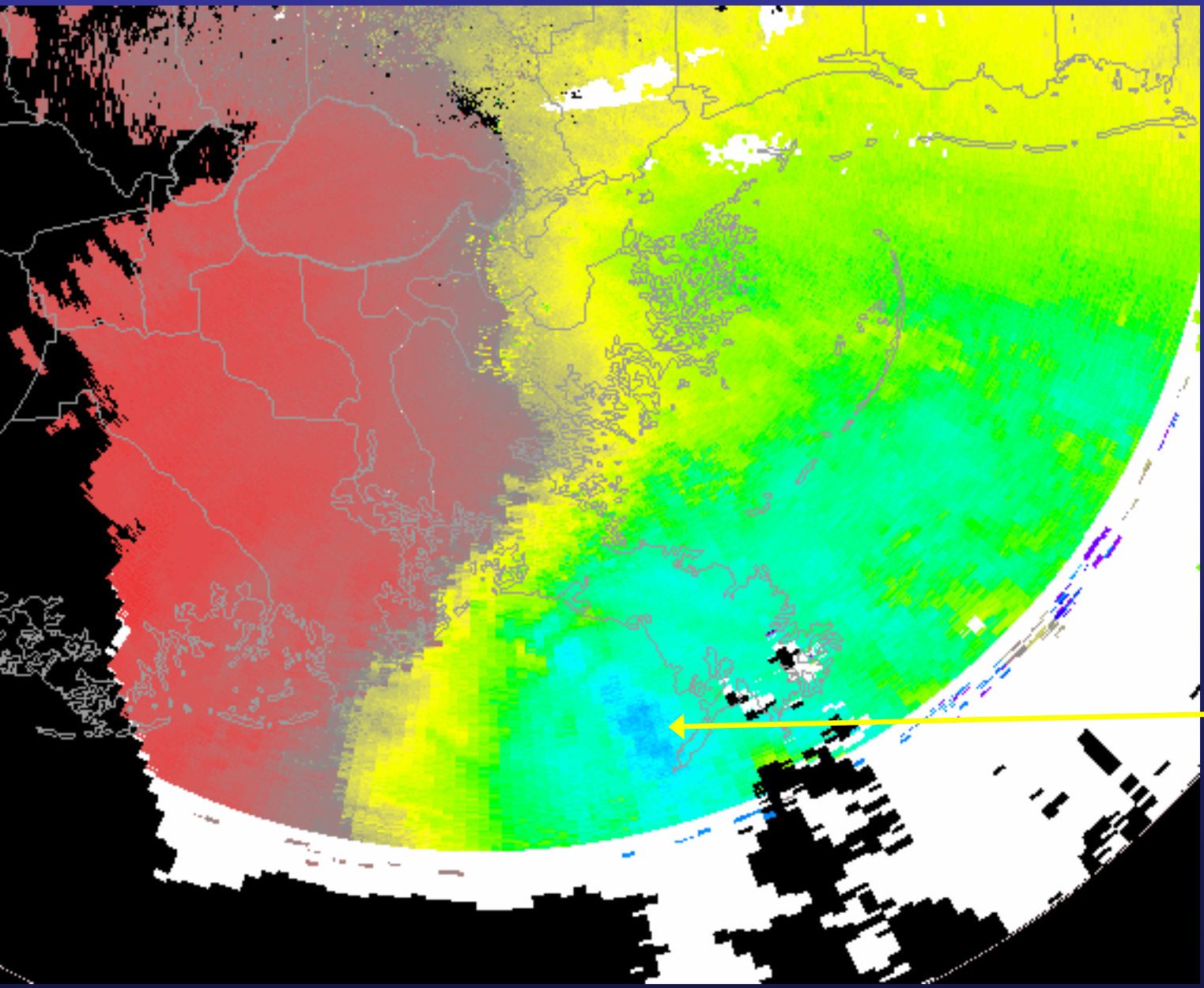
- Death toll near 1400, including around 1200 from Katrina in the United States - the deadliest U. S. hurricane since the Palm Beach-Lake Okeechobee hurricane of 1928. Additionally, a large area of disturbed weather affecting Central America at the time of Hurricane Stan may have caused 1000-2000 deaths.

- Total damage to property in the United States estimated near $104 billion - the costliest U. S. hurricane season of record. Katrina caused estimated damage of $75 billion, making it the costliest single hurricane in U. S. history.

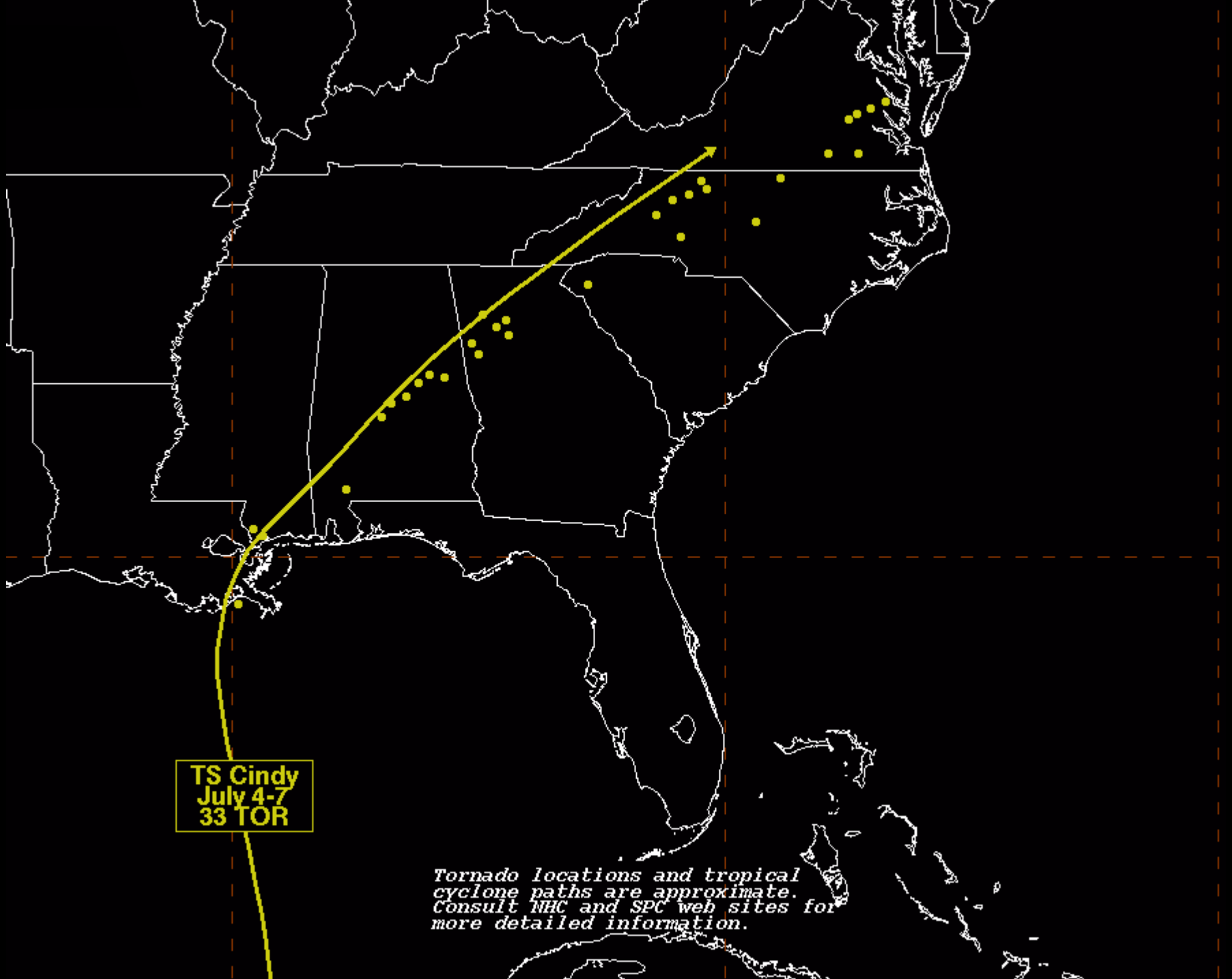
- Track forecast verification indicates that the average forecast errors for 12-72 hr were near record low levels.


75 mph 991 mb
6
5
3
Hurricane Cindy
3 - 7 July 2005

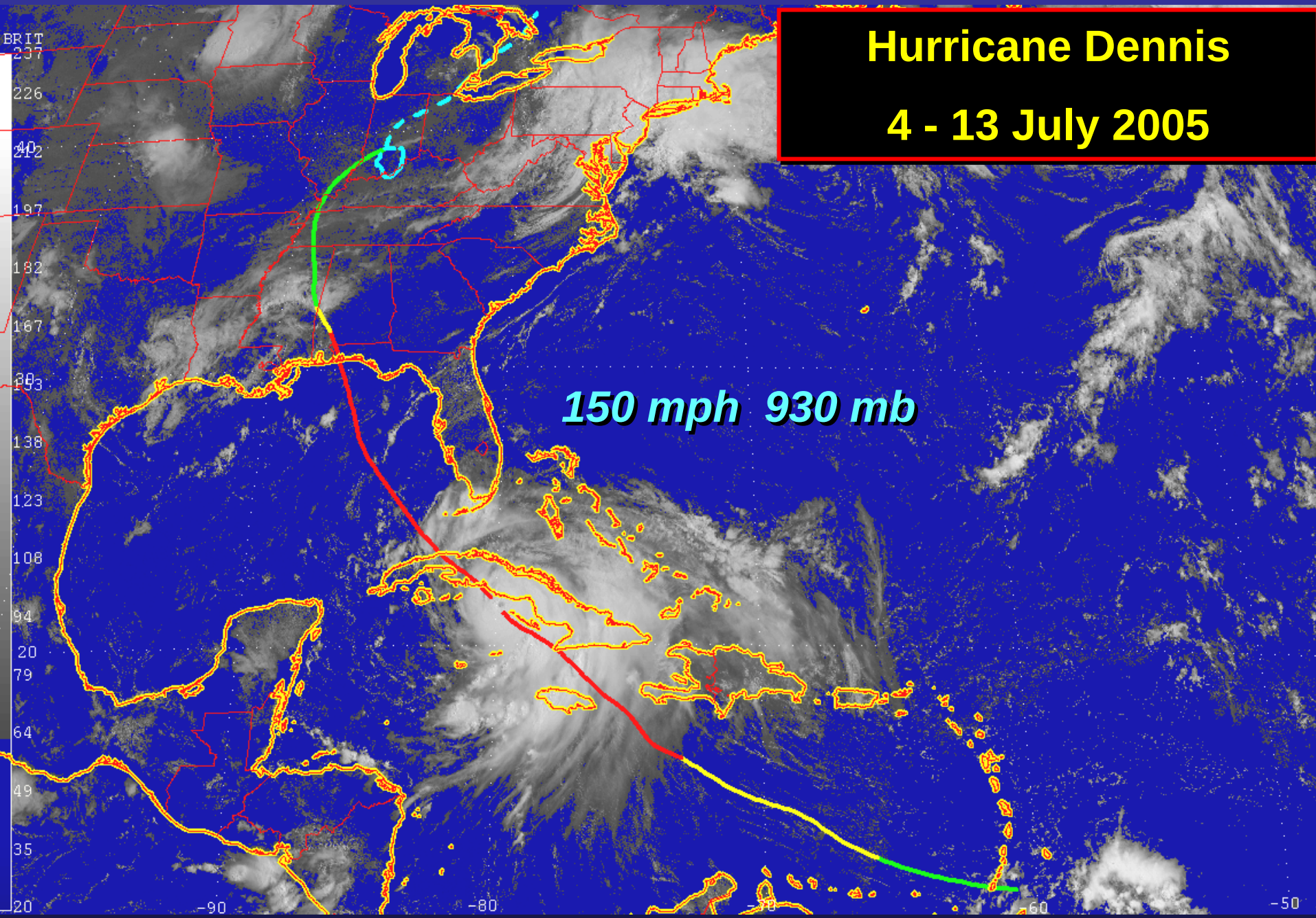
WSR-88D Shows Cindy Was A Hurricane Near Landfall



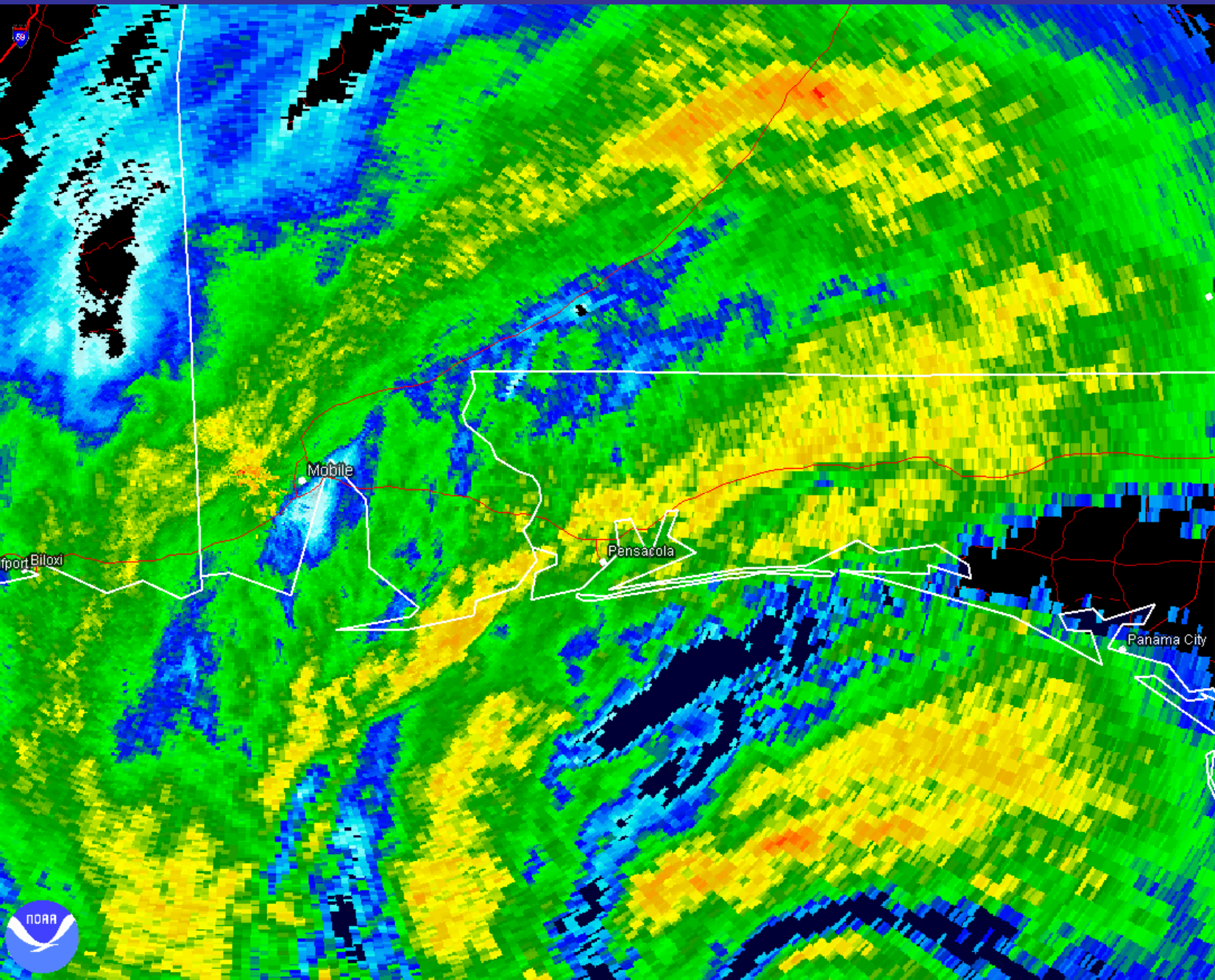
70-74 kt winds at 8000 ft suggests 65 kt at the surface


TS Cindy
July 4-7
33 TOR
Tornado locations and tropical cyclone paths are approximate. Consult NHC and SPC web sites for more detailed information.


EEDWA


Hurricane Dennis
4 - 13 July 2005
150 mph 930 mb
BRIT
237
226
212
197
182
167
153
138
123
108
94
79
64
49
35
20
-90
-80
-60
-50

Hurricane Dennis Landfall



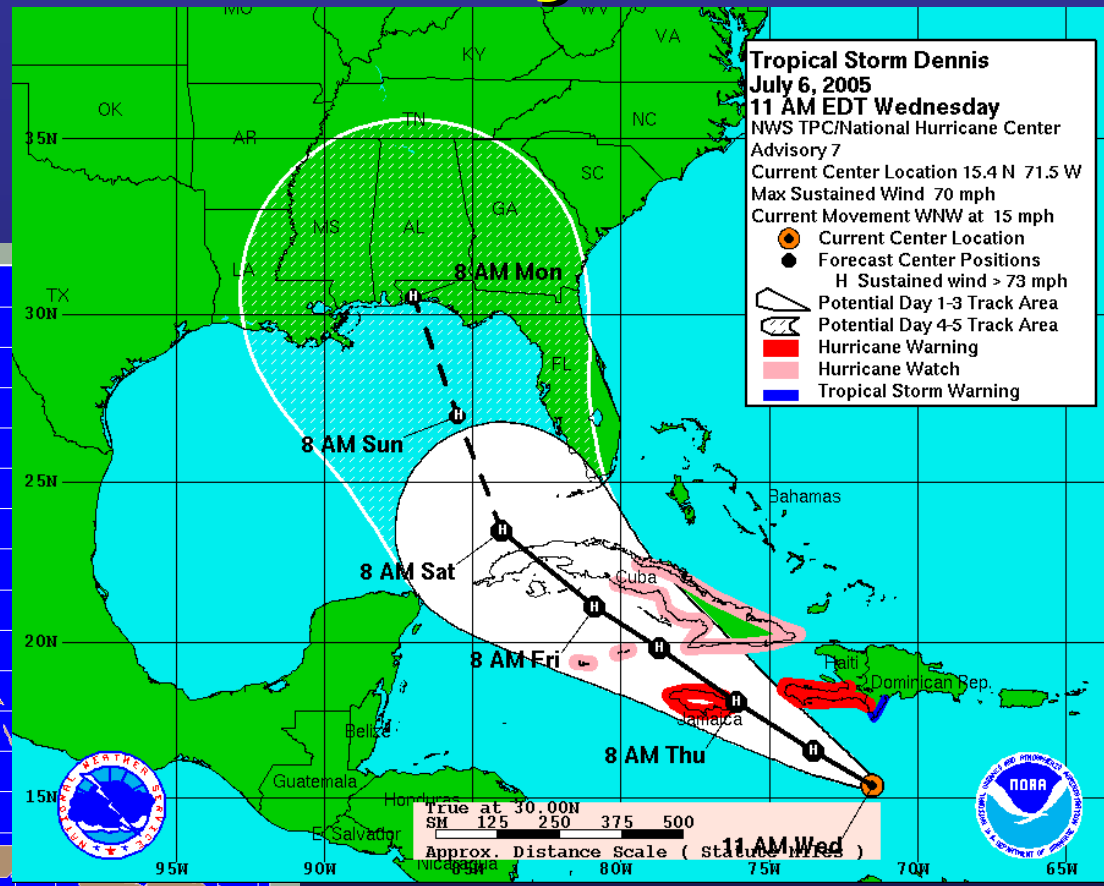
NEXRAD LEVEL-II
KMOB - MOBILE, AL
07/10/2005 13:58:24 GMT
LAT: 30/40/44 N
LON: 88/14/23 W
ELEV: 208.0 FT
VCP: 121

REFLECTIVITY
ELEV ANGLE: 0.40
SCAN TIME: 13:57:54

Legend: (Category) dBZ

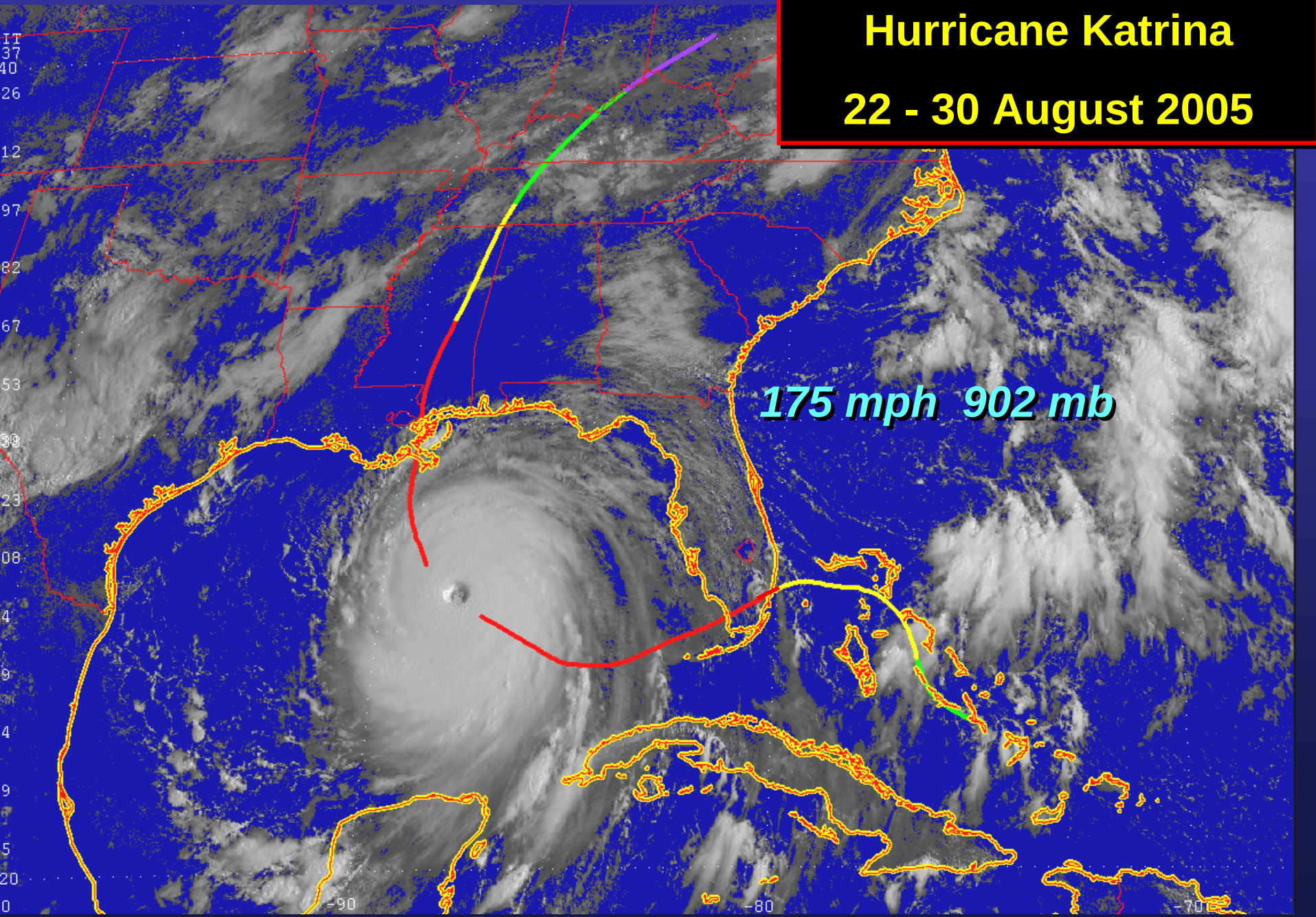
>= + 75
+ 70
+ 65
+ 60
+ 55
+ 50
+ 45
+ 40
+ 35
+ 30
+ 25
+ 20
+ 15
+ 10
+ 5
0
- 5
- 10
- 15
<= - 20

Dennis Track Forecasts
1200 UTC 6 July

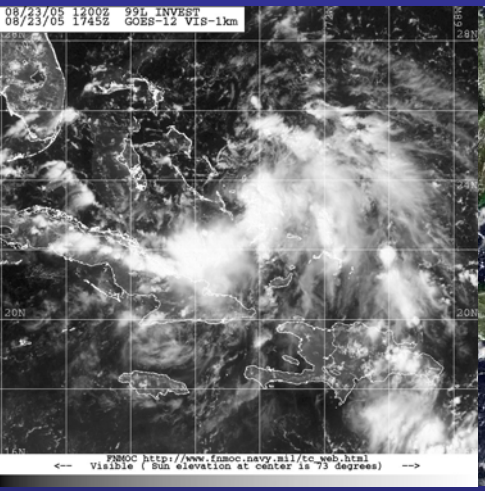


Dennis's Damage


Jennifer Petrandis


Hurricane Katrina
22 - 30 August 2005
175 mph 902 mb
-90
-80
-70

Images of Katrina



August 23

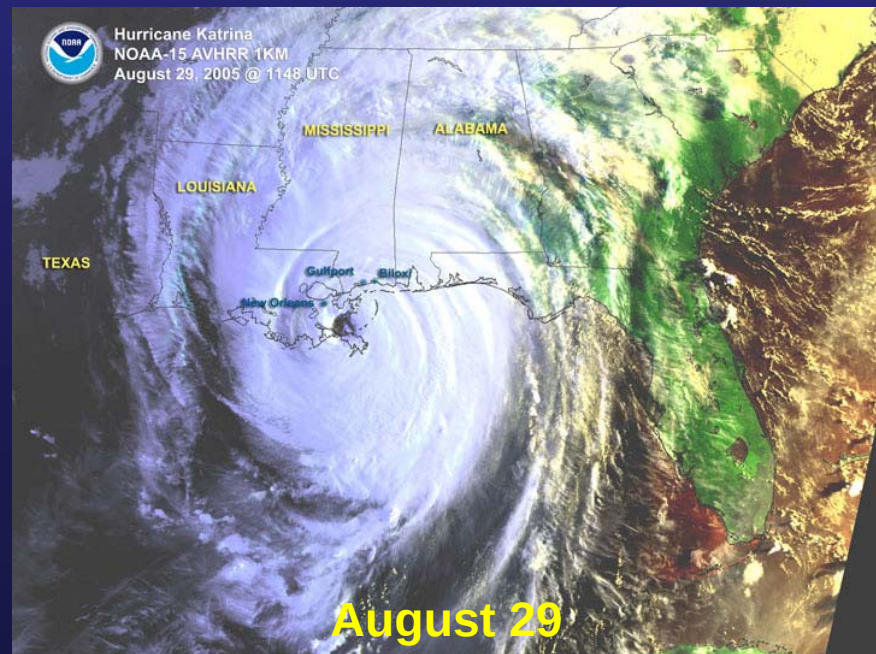
August 24

August 25

August 26

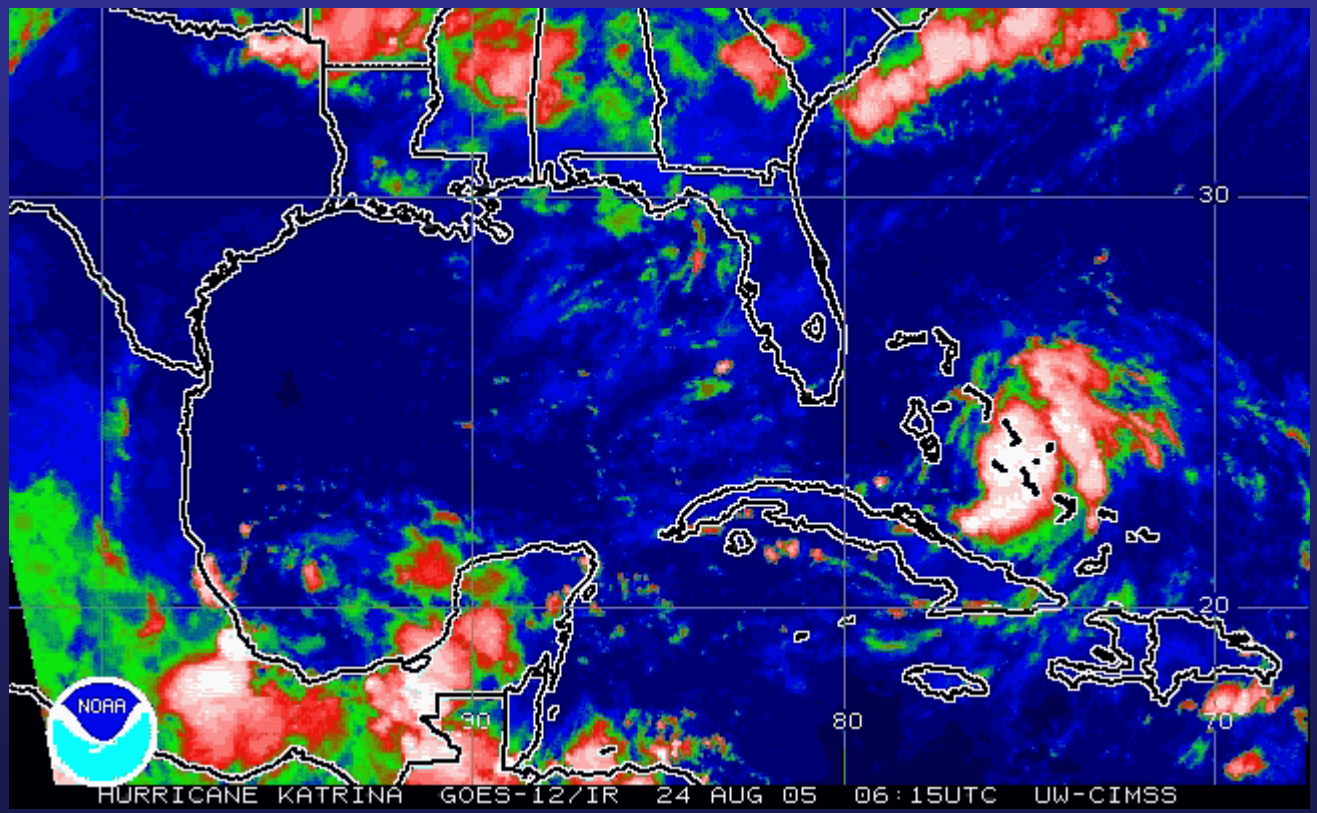
August 27

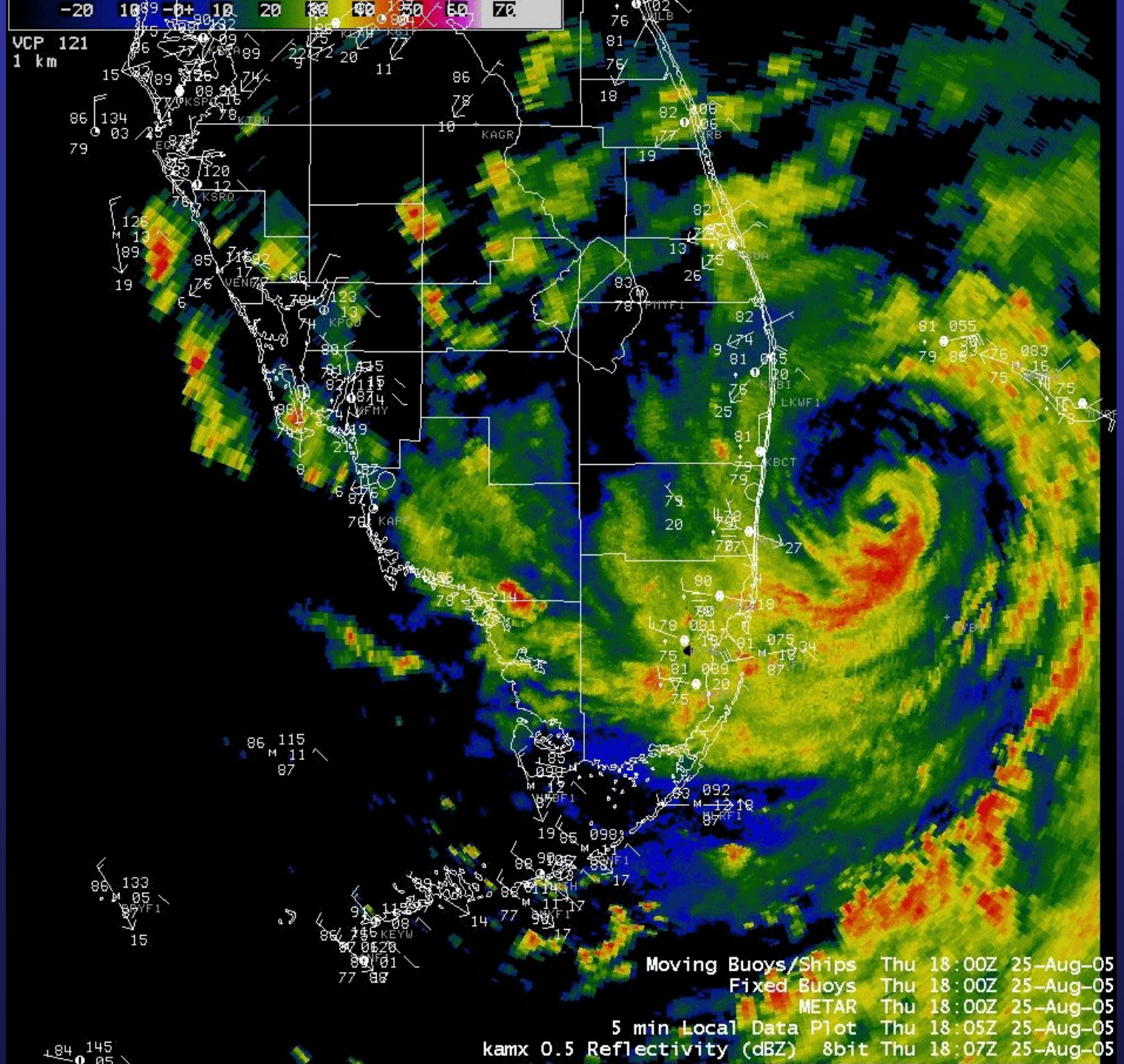
August 28

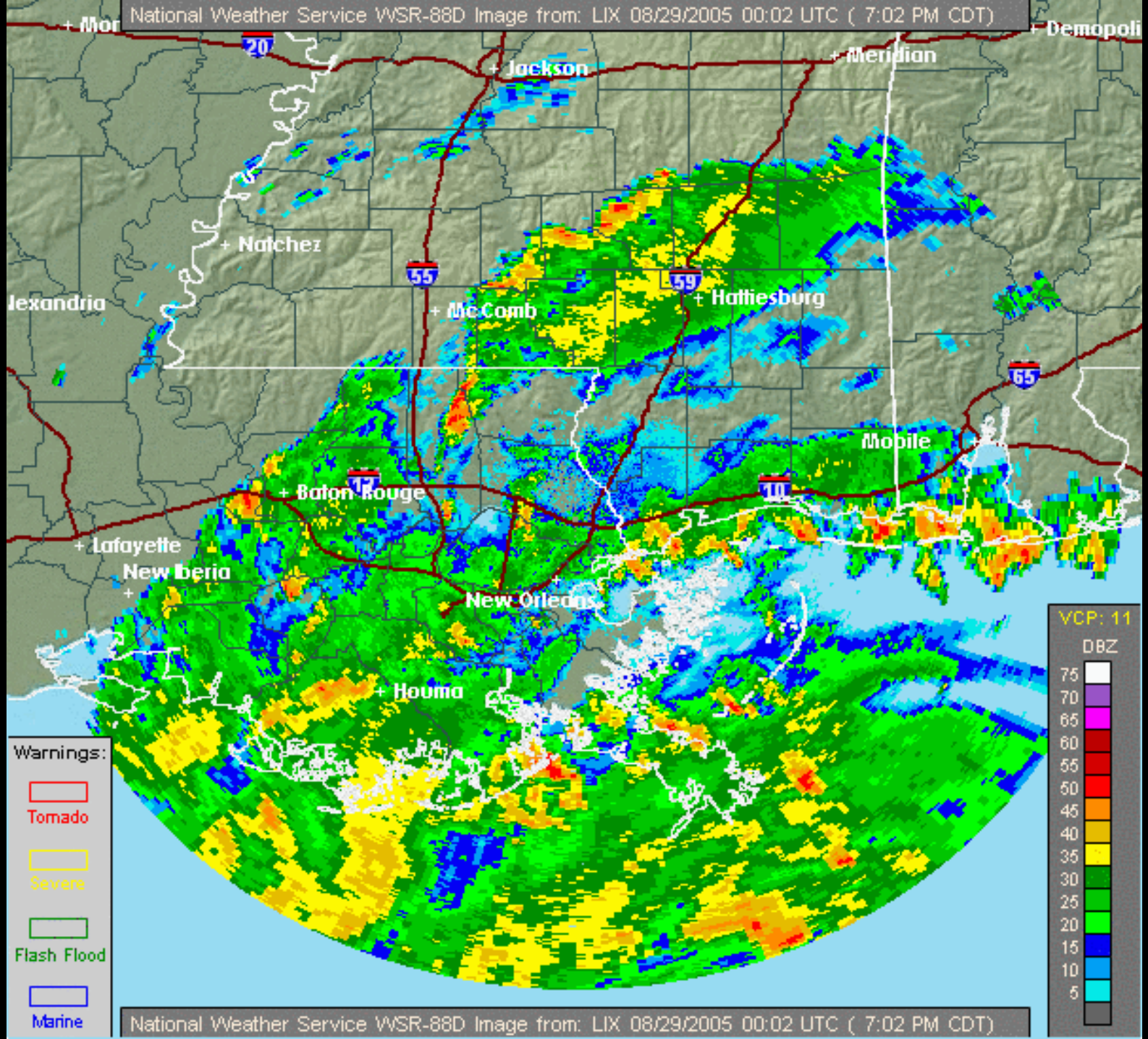


August 29

Satellite Life Cycle of Katrina




-20 10 -0+ 10 20 30 40 50 60 70
VCP 121
1 km
Moving Buoys/Ships Thu 18:00Z 25-Aug-05
Fixed Buoys Thu 18:00Z 25-Aug-05
METAR Thu 18:00Z 25-Aug-05
5 min Local Data Plot Thu 18:05Z 25-Aug-05
kamx 0.5 Reflectivity (dBZ) 8bit Thu 18:07Z 25-Aug-05


National Weather Service WSR-88D Image from: LIX 08/29/2005 00:02 UTC (7:02 PM CDT)
Jackson
Meridian
Natchez
McComb
Hattiesburg
Mobile
Baton Rouge
Lafayette
New Iberia
New Orleans
Houma
Warnings:
Tornado
Severe
Flash Flood
Marine
VCP: 11
DBZ
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
National Weather Service WSR-88D Image from: LIX 08/29/2005 00:02 UTC (7:02 PM CDT)

New Orleans

Interstate 10

17th Street Levee Breach

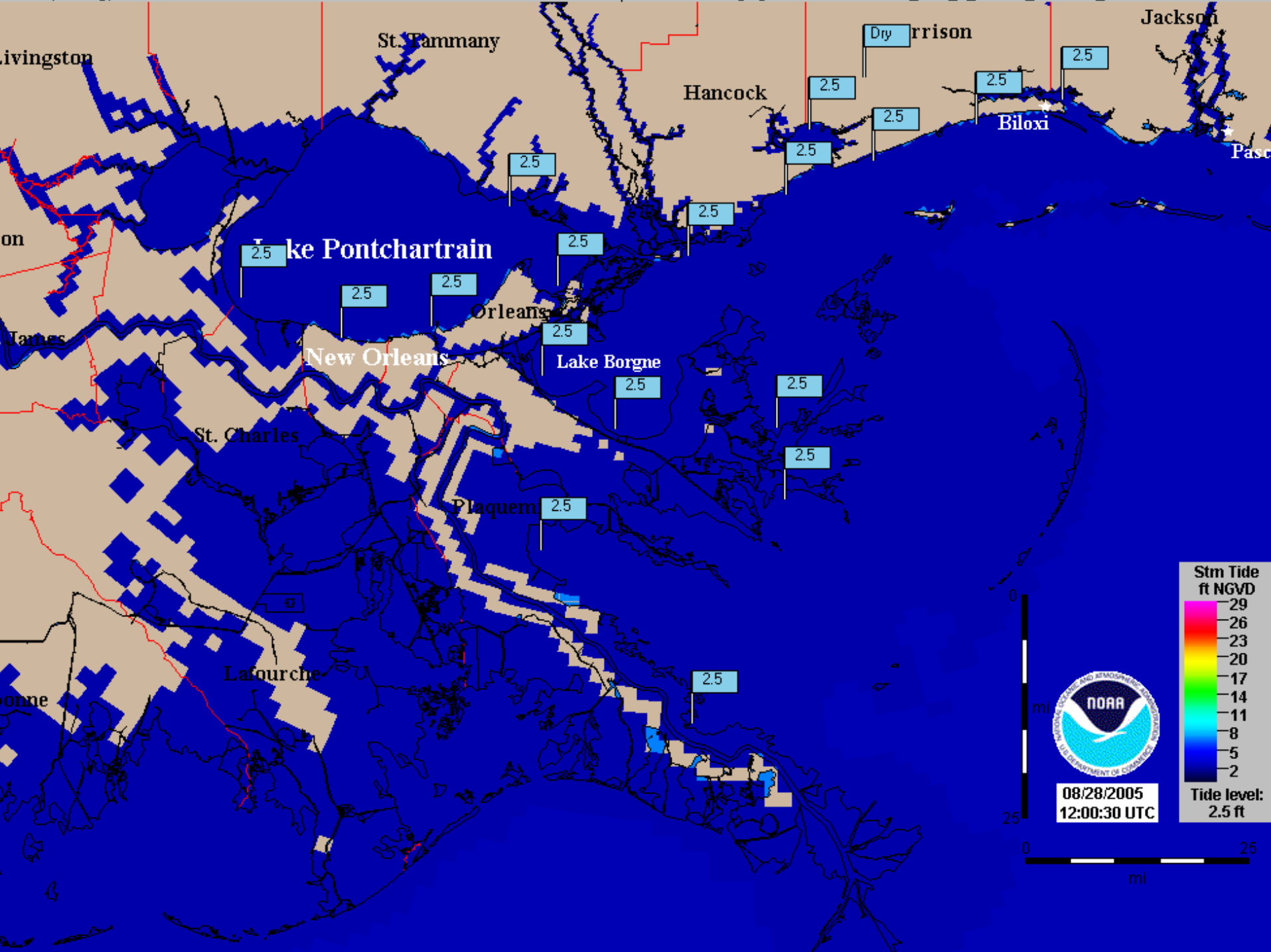
Lakeview

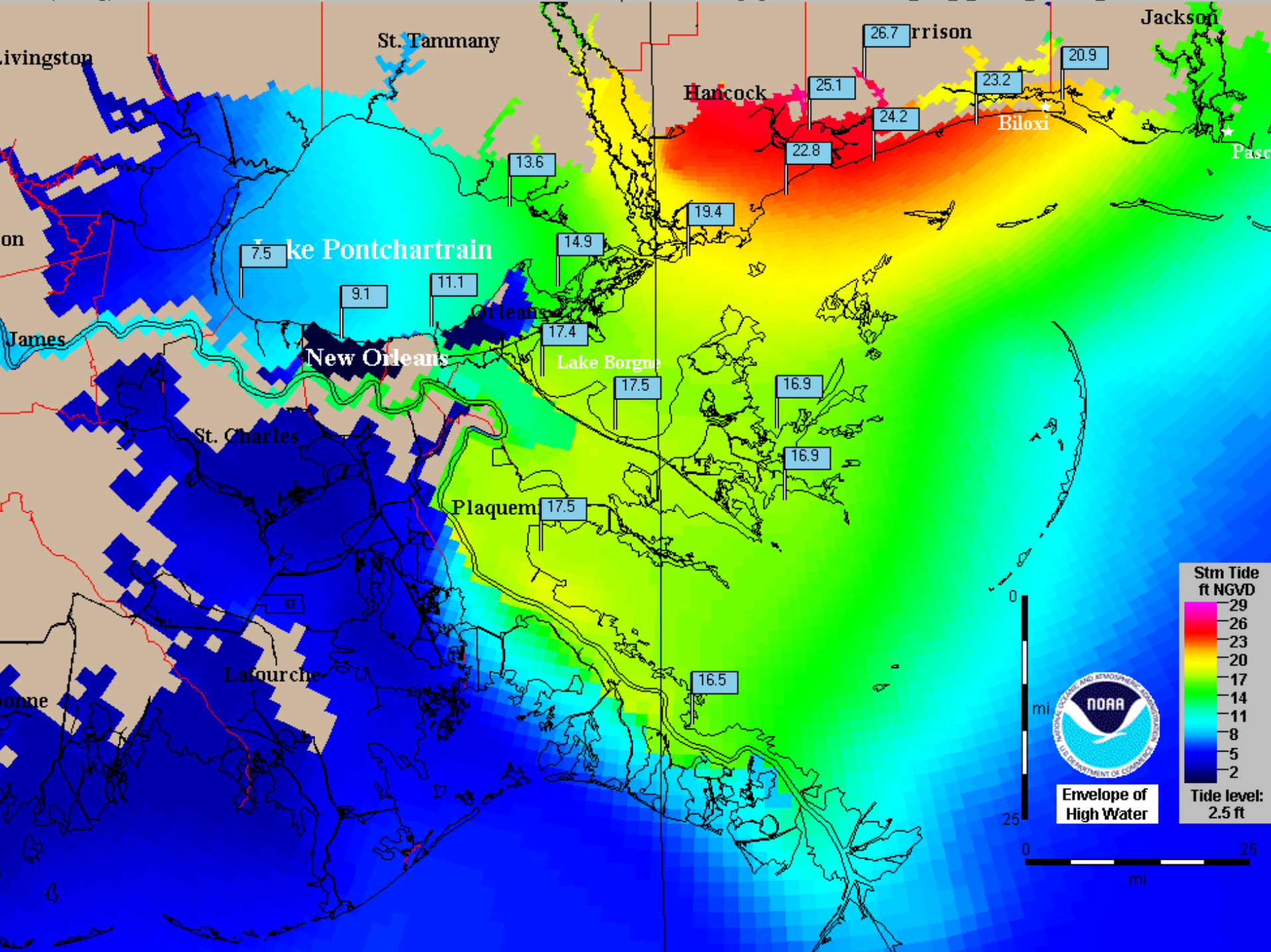
Orleans Parish

Orleans Parish

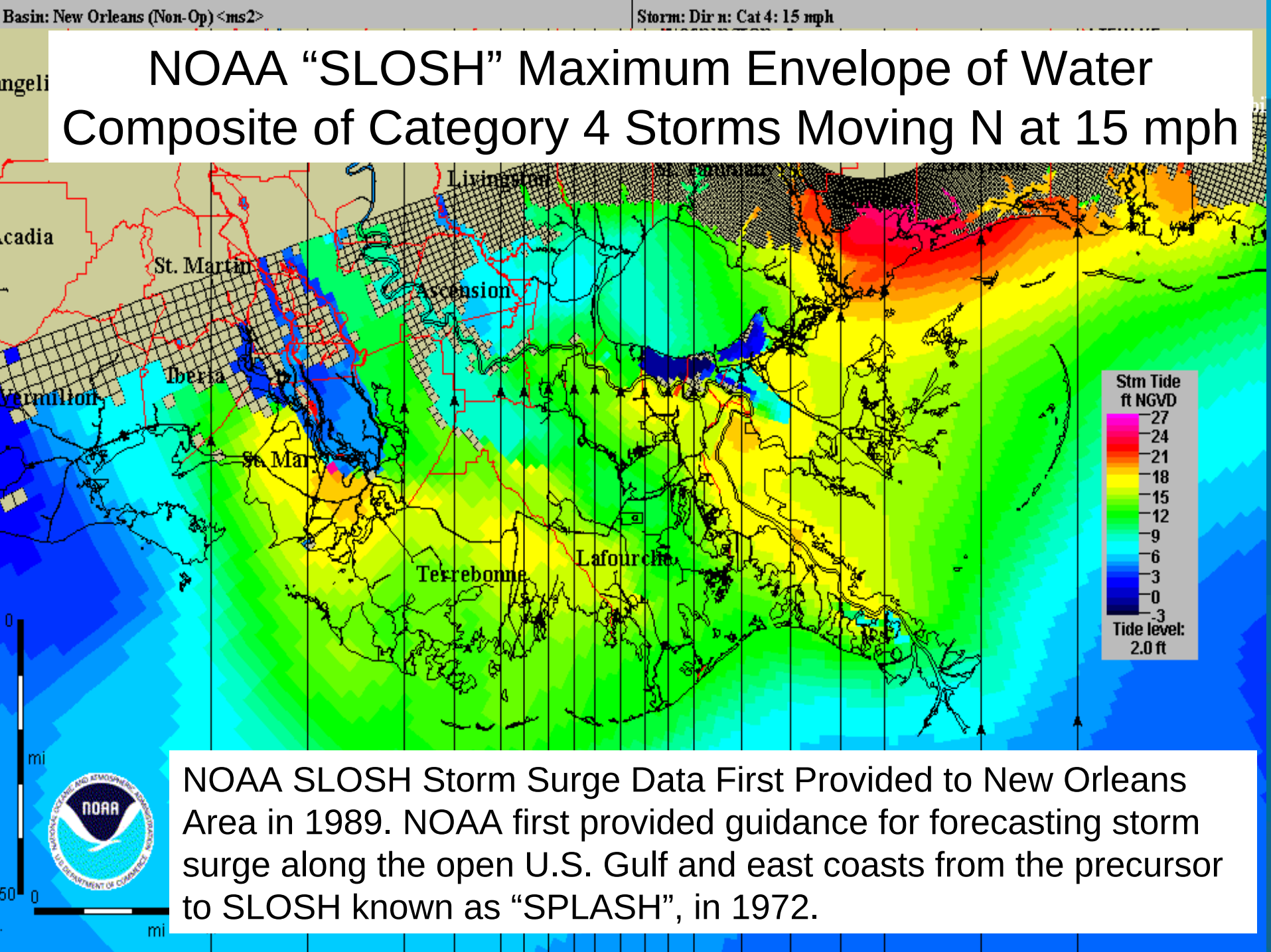
Orleans Parish

St Rita's Nursing Home, St Bernard Parish


St. Tammany
Hancock
Dry
rrison
Jackson
Biloxi
Lake Pontchartrain
Orleans
New Orleans
Lake Borgne
St. Charles
Plaquem
Lafourche
2.5
Stm Tide
ft NGVD
29
26
23
20
17
14
11
8
5
2
Tide level:
2.5 ft
08/28/2005
12:00:30 UTC
NOAA
0
25
mi


St. Tammany
Hancock
Jackson
Biloxi
Lake Pontchartrain
New Orleans
Orleans
Lake Borgne
St. Charles
Plaquemines
Lafourche
26.7
25.1
23.2
20.9
24.2
22.8
13.6
19.4
14.9
7.5
11.1
9.1
17.4
17.5
16.9
16.9
17.5
16.5
Stm Tide ft NGVD
29
26
23
20
17
14
11
8
5
2
Tide level: 2.5 ft
Envelope of High Water
0
25
mi
NOAA

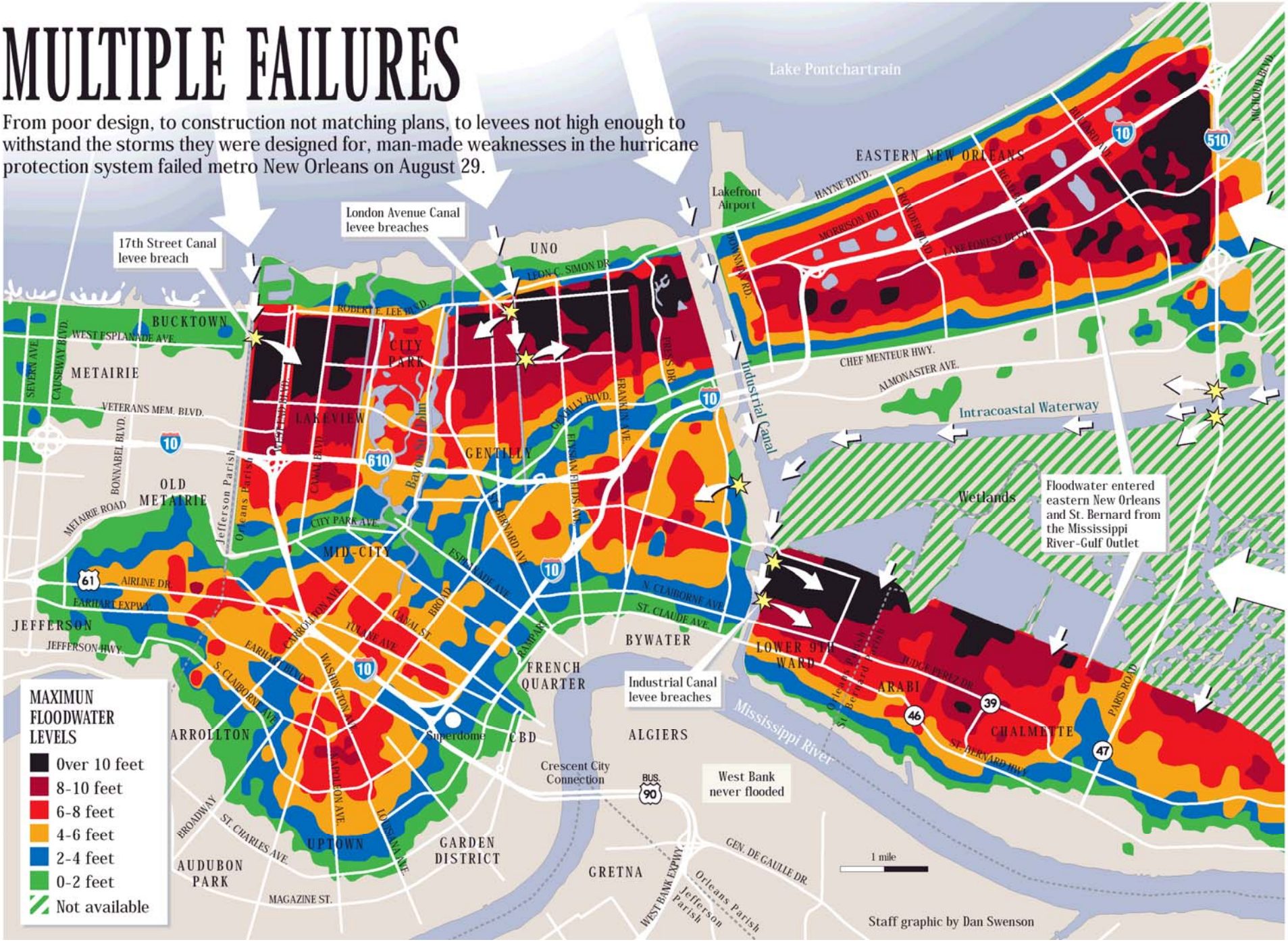
NOAA “SLOSH” Maximum Envelope of Water
Composite of Category 4 Storms Moving N at 15 mph



NOAA SLOSH Storm Surge Data First Provided to New Orleans Area in 1989. NOAA first provided guidance for forecasting storm surge along the open U.S. Gulf and east coasts from the precursor to SLOSH known as “SPLASH”, in 1972.

MULTIPLE FAILURES

From poor design, to construction not matching plans, to levees not high enough to withstand the storms they were designed for, man-made weaknesses in the hurricane protection system failed metro New Orleans on August 29.



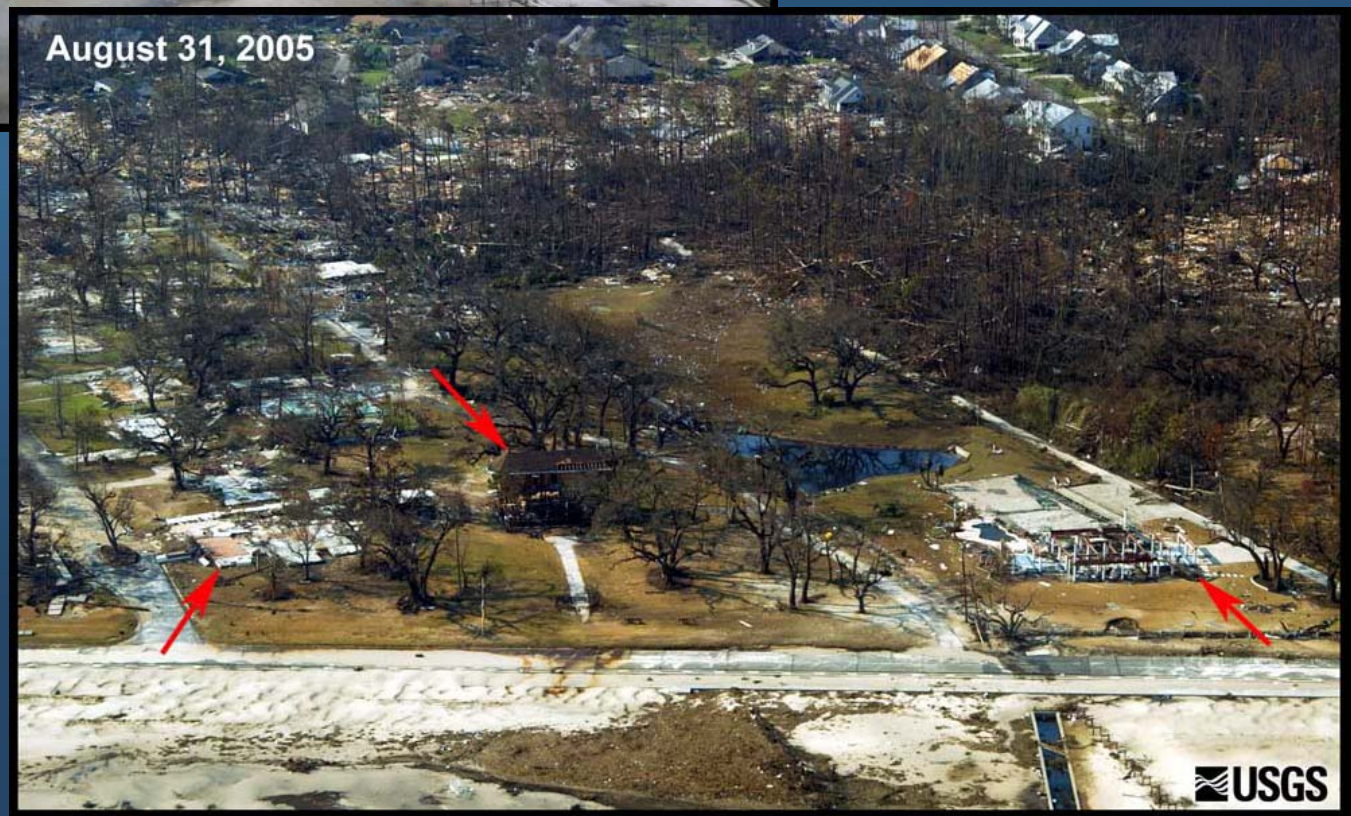
Staff graphic by Dan Swenson

Levee overtopping in Katrina

Picture by Don McCrosky, Entergy's Michoud Power Plant Manager

Pre
Katrina

Post
Katrina



Mainland Mississippi

USGS

Pre
Katrina

Post
Katrina

USGS

The Hancock County EOC was flooded with 2 feet of Katrina's storm surge.

Interstate 10 & SR 603, Waveland

Waveland

Gulfport

Biloxi

Before and After Katrina: Mississippi Coast

Before and After Katrina: Mississippi Coast

The PSS Chemul, a 13,000-ton semi-submersible accommodation/ maintenance vessel owned by PEMEX that broke loose during Hurricane Katrina is wedged under the Cochrane Bridge in Mobile, Alabama. (AFP/Stan Honda)

Dauphin Island, AL

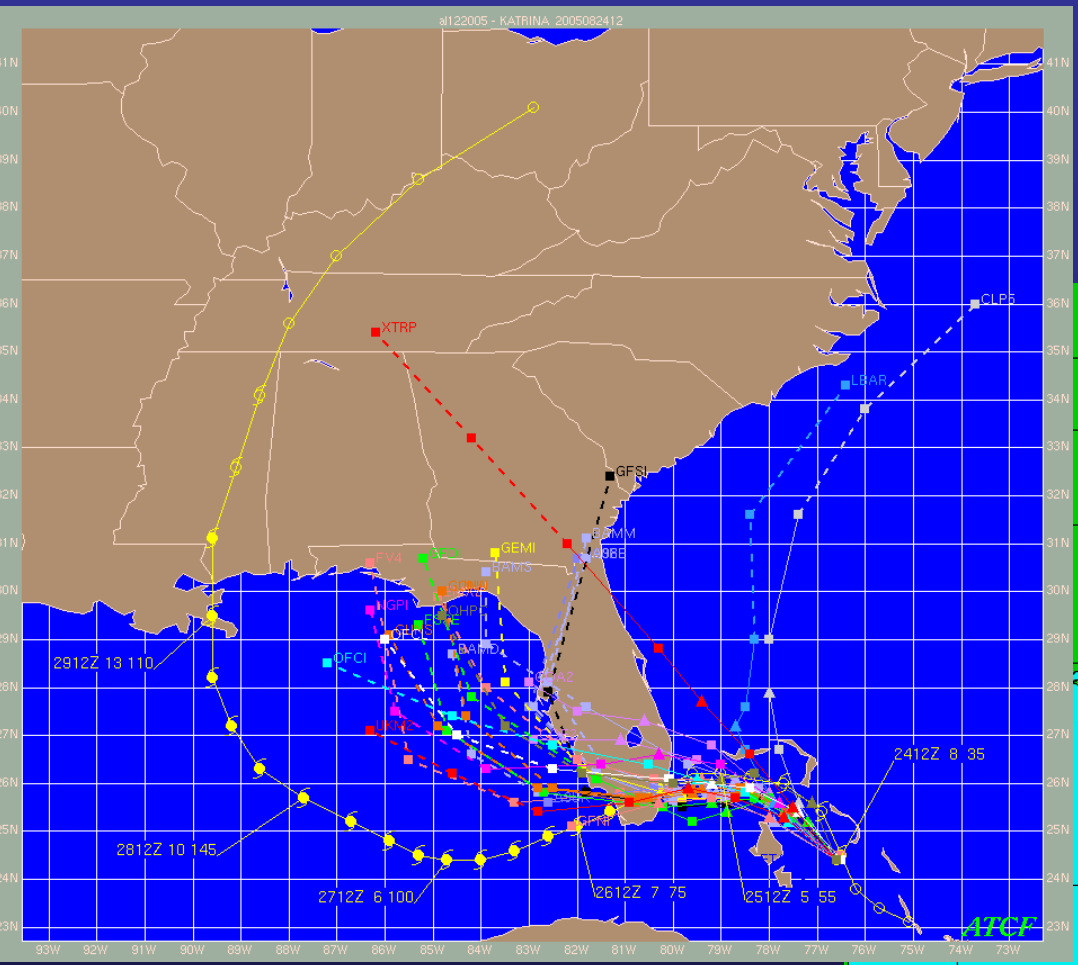
Pre Ivan

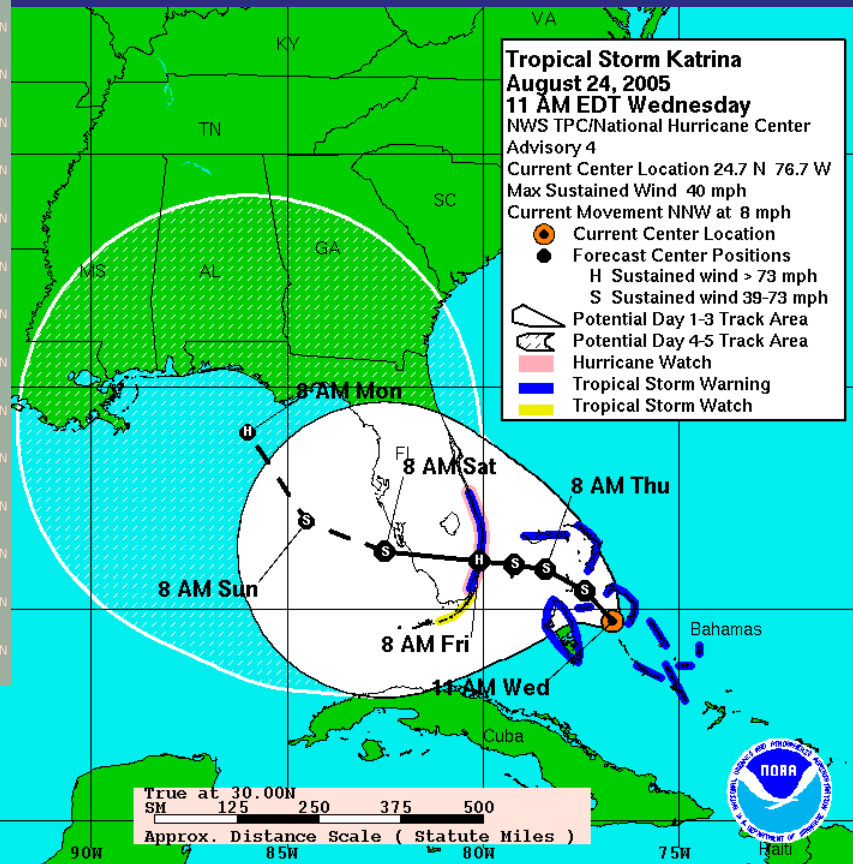
Post Ivan

Post Katrina

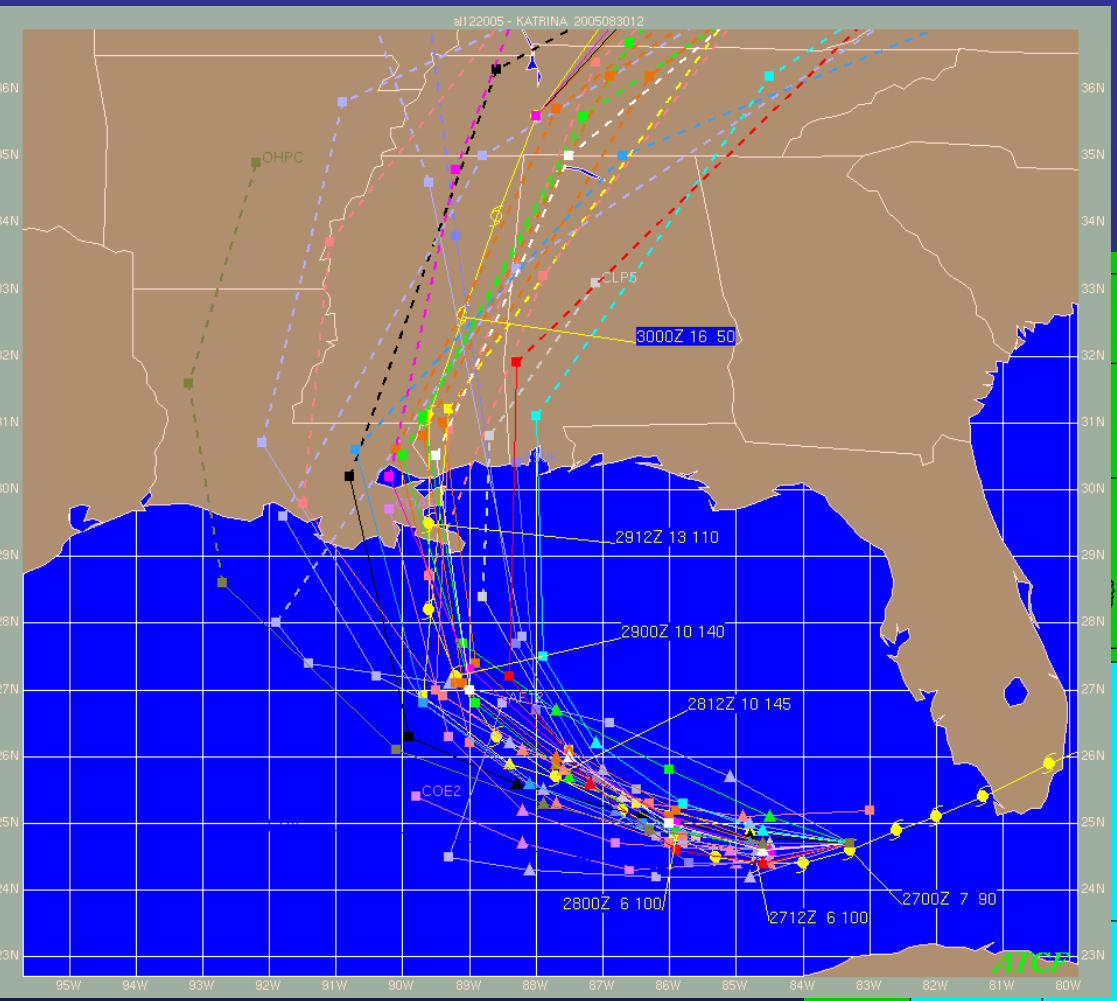
USGS

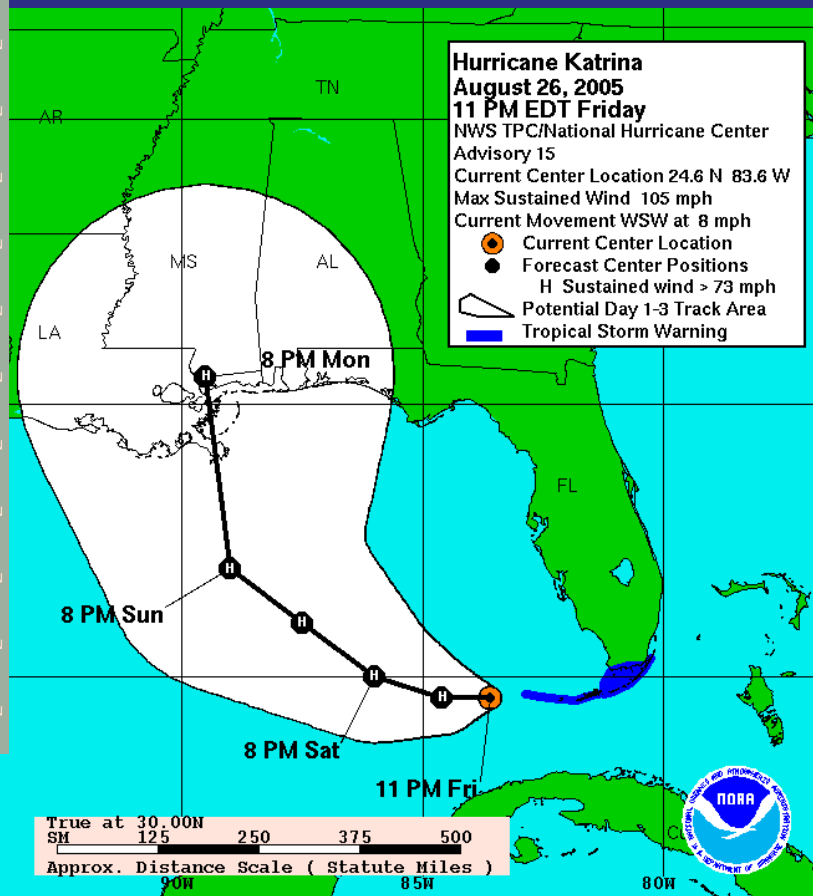
Katrina Track Forecasts
1200 UTC 24 August





Katrina Track Forecasts
0000 UTC 27 August





HURRICANE HOTLINE at NHC

Andy Newman

Michael Brown, former director of the Federal Emergency Management Agency updated on Hurricane Dennis track with Brock Long, Bill O'Brien and Rodney Rose, Saturday, July 9, 2005

Andy Newman

Michael Brown, former director of the Federal Emergency Management Agency reviews projected-Hurricane Dennis tidal surge levels for the Gulf coast with Brock Long and Matthew Green, Saturday, July 9, 2005.

HLT

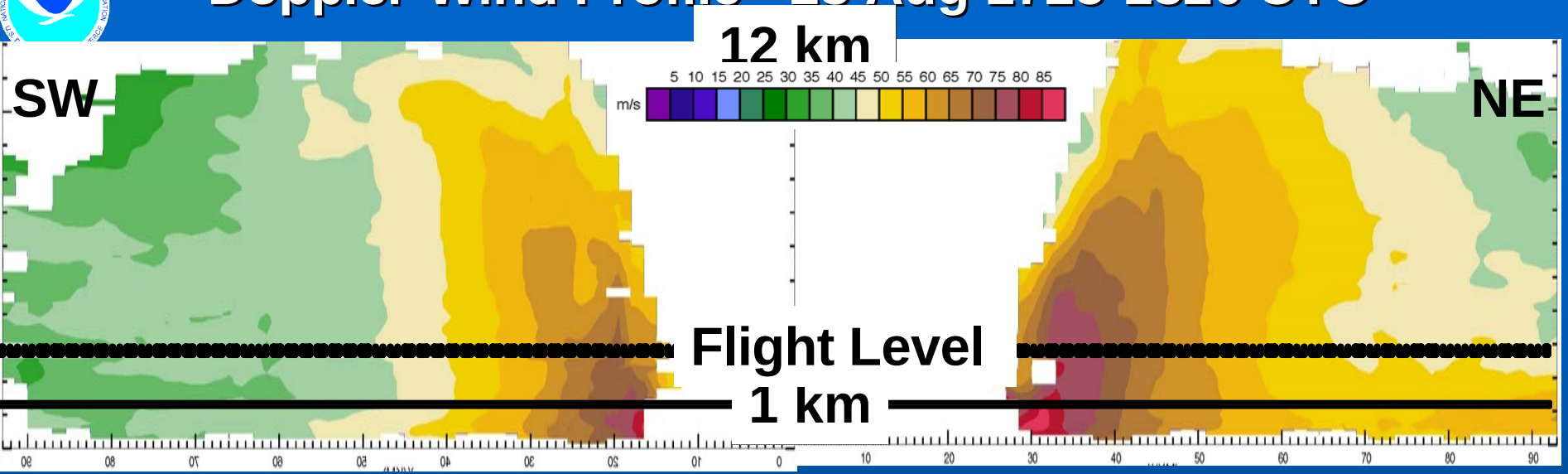
Melissa Ann Janssen/FEMA

FEMA Hurricane Liaison Team Leader Brock Long and NWS hydrometeorologist Keith Stellman keep FEMA and affected States informed.

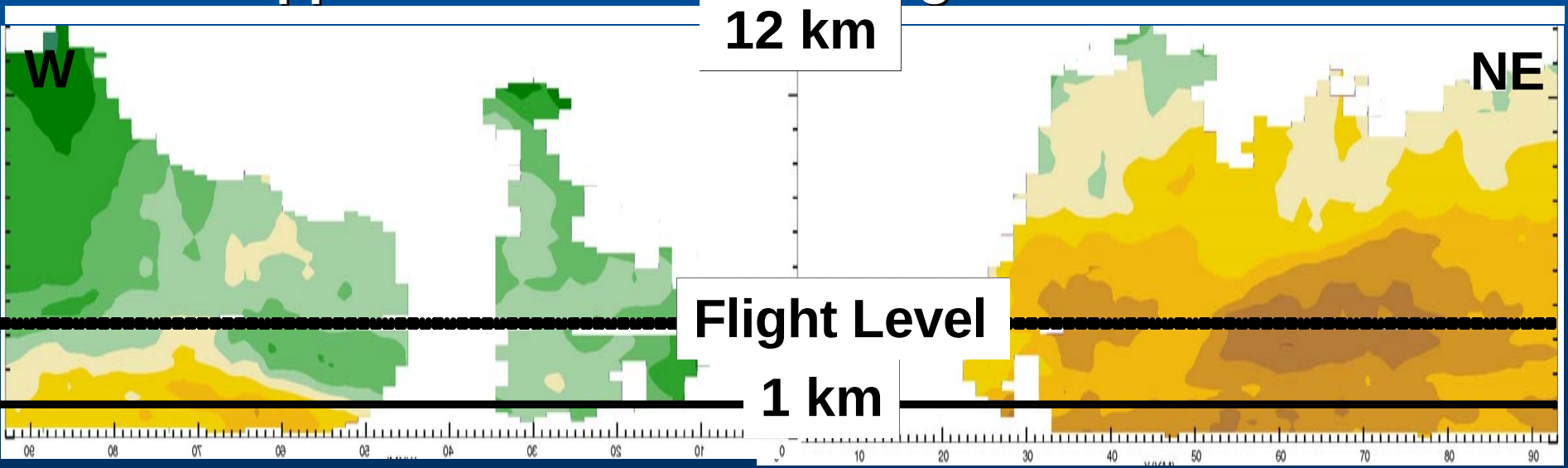
White House Photo

President George W. Bush is handed a map by Deputy Chief of Staff Joe Hagin, center, during a video teleconference with federal and state emergency management organizations on hurricane Katrina from his Crawford, Texas ranch on Sunday August 28, 2005.

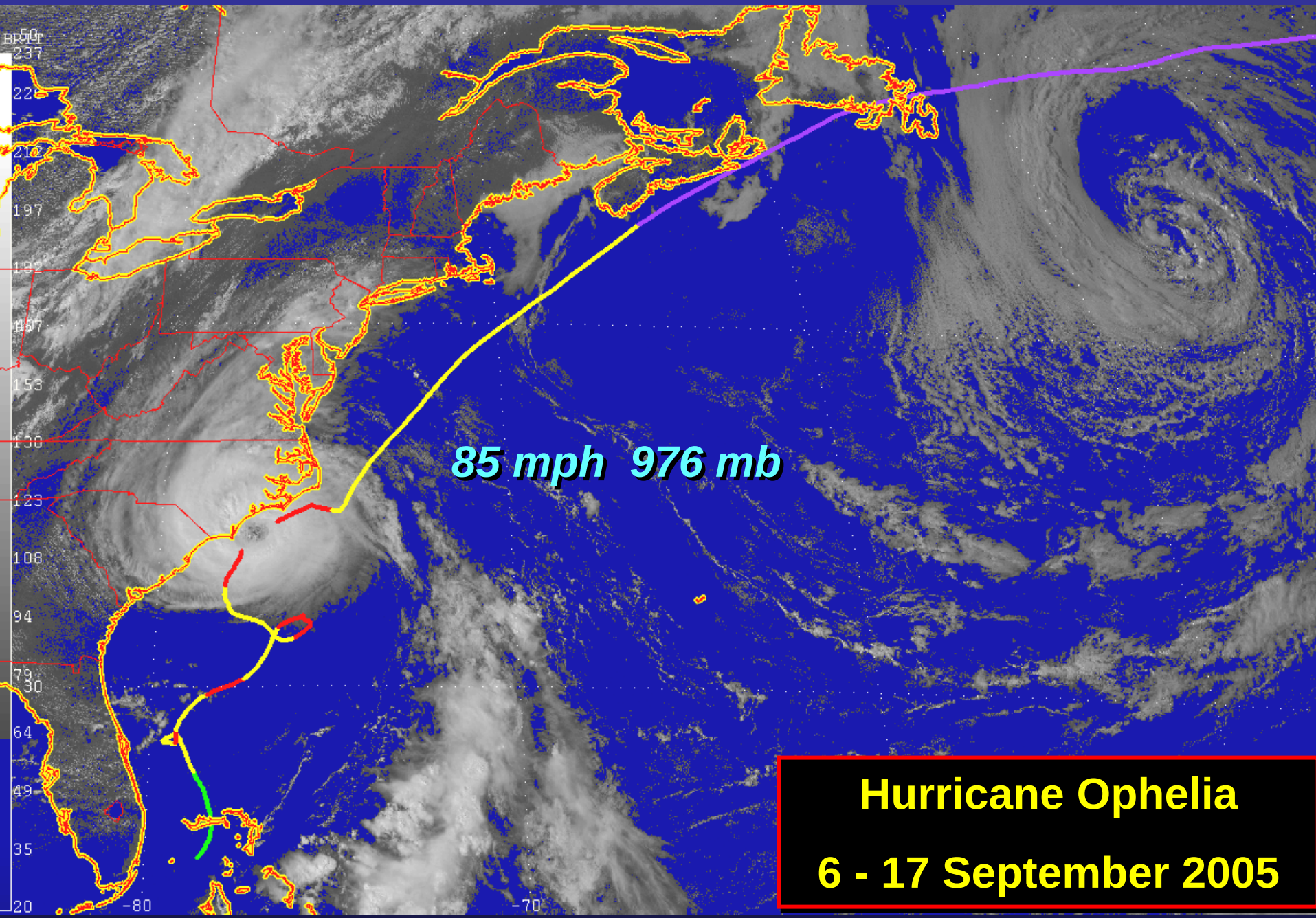
Doppler Wind Profile - 28 Aug 1725-1820 UTC



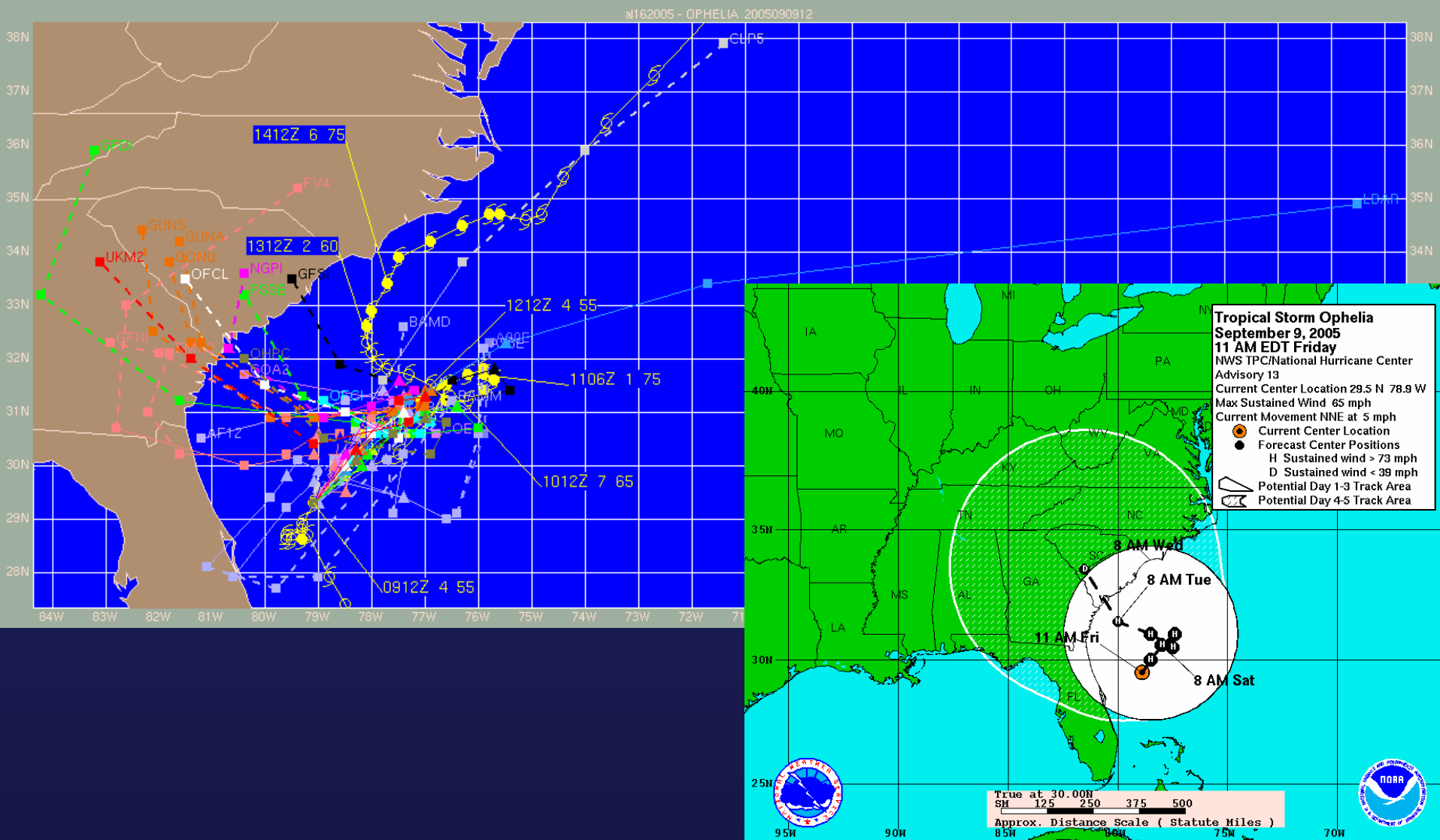
Doppler Wind Profile - 29 Aug 1000-1040 UTC

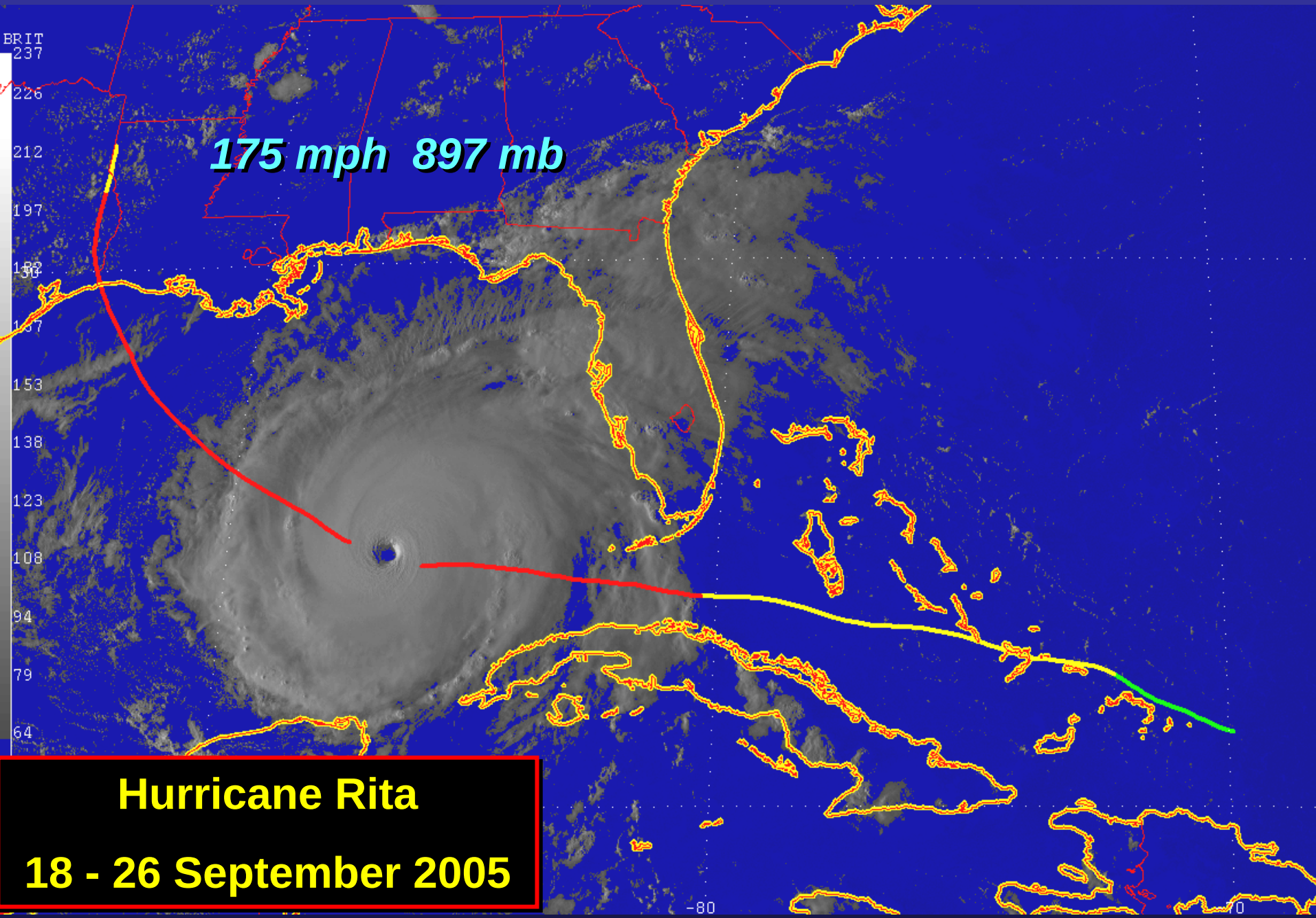


Dramatic 12-h change in Katrina Wind Profile: CAT5-CAT3


85 mph 976 mb
Hurricane Ophelia
6 - 17 September 2005

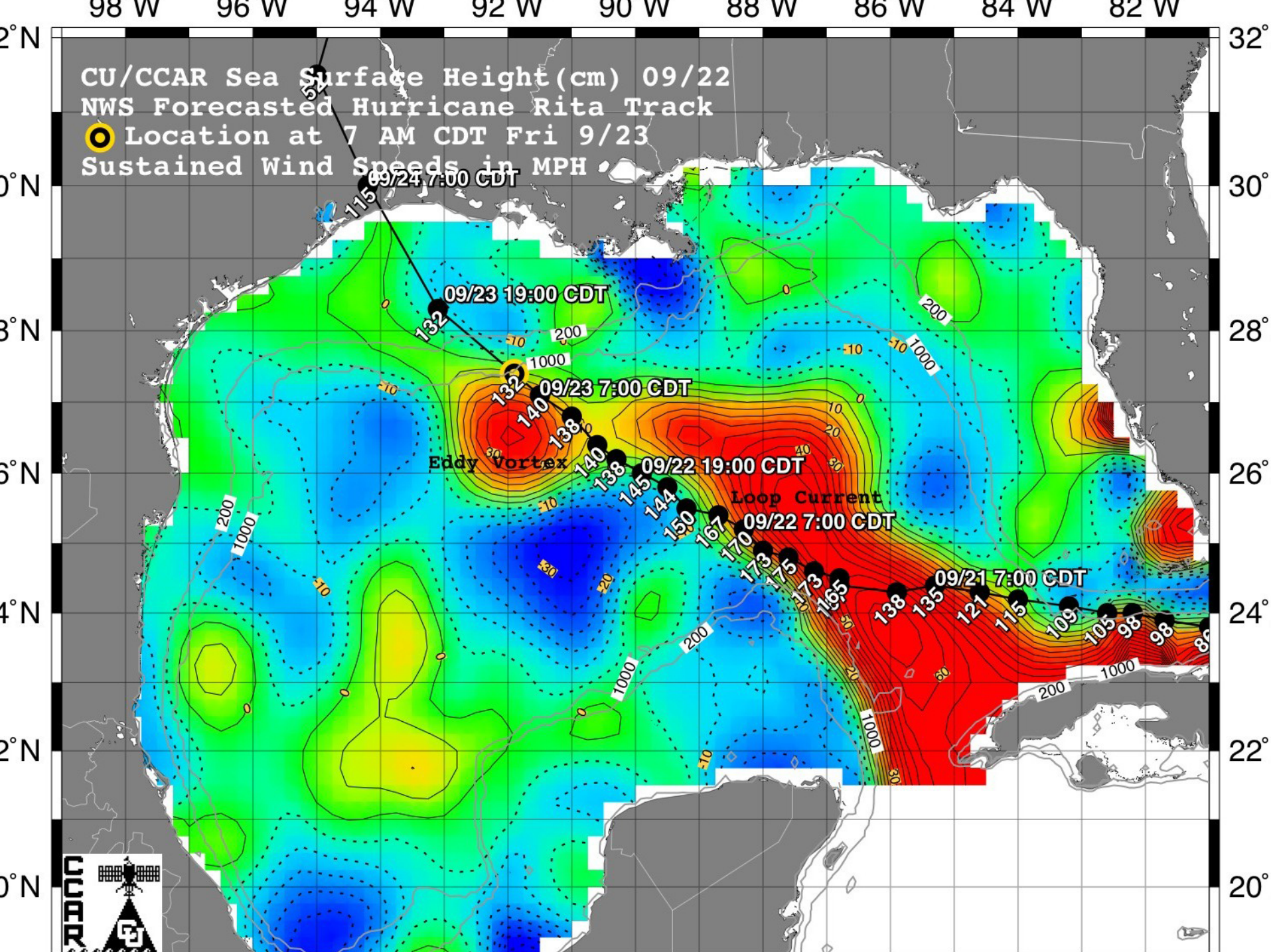
Ophelia Track Forecasts
1200 UTC 9 September



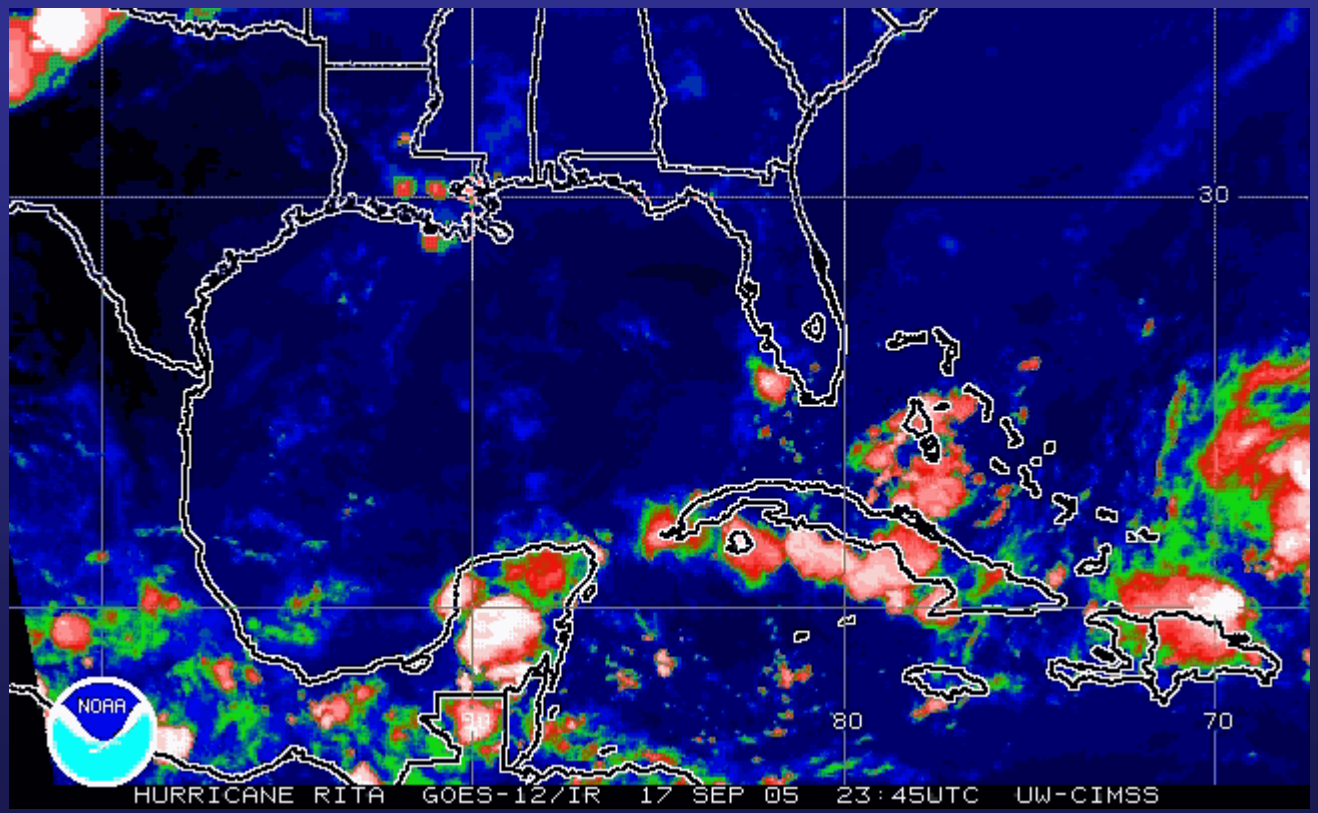


Hurricane Rita

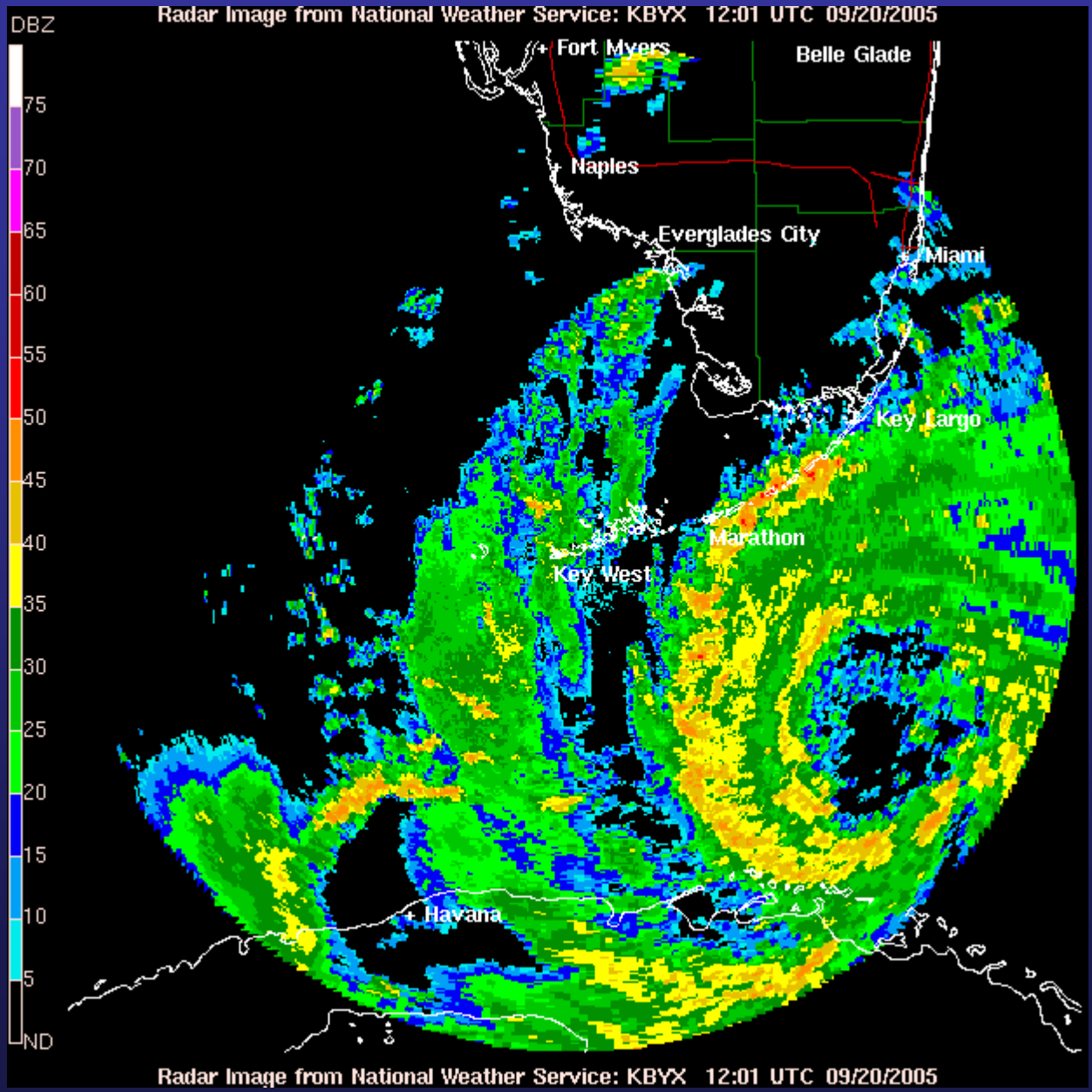
18 - 26 September 2005


CU/CCAR Sea Surface Height(cm) 09/22
NWS Forecasted Hurricane Rita Track
Location at 7 AM CDT Fri 9/23
Sustained Wind Speeds in MPH
09/24 7:00 CDT
09/23 19:00 CDT
09/23 7:00 CDT
09/22 19:00 CDT
09/22 7:00 CDT
09/21 7:00 CDT
Eddy Vortex
Loop Current
98 W
96 W
94 W
92 W
90 W
88 W
86 W
84 W
82 W
32°
30°
28°
26°
24°
22°
20°

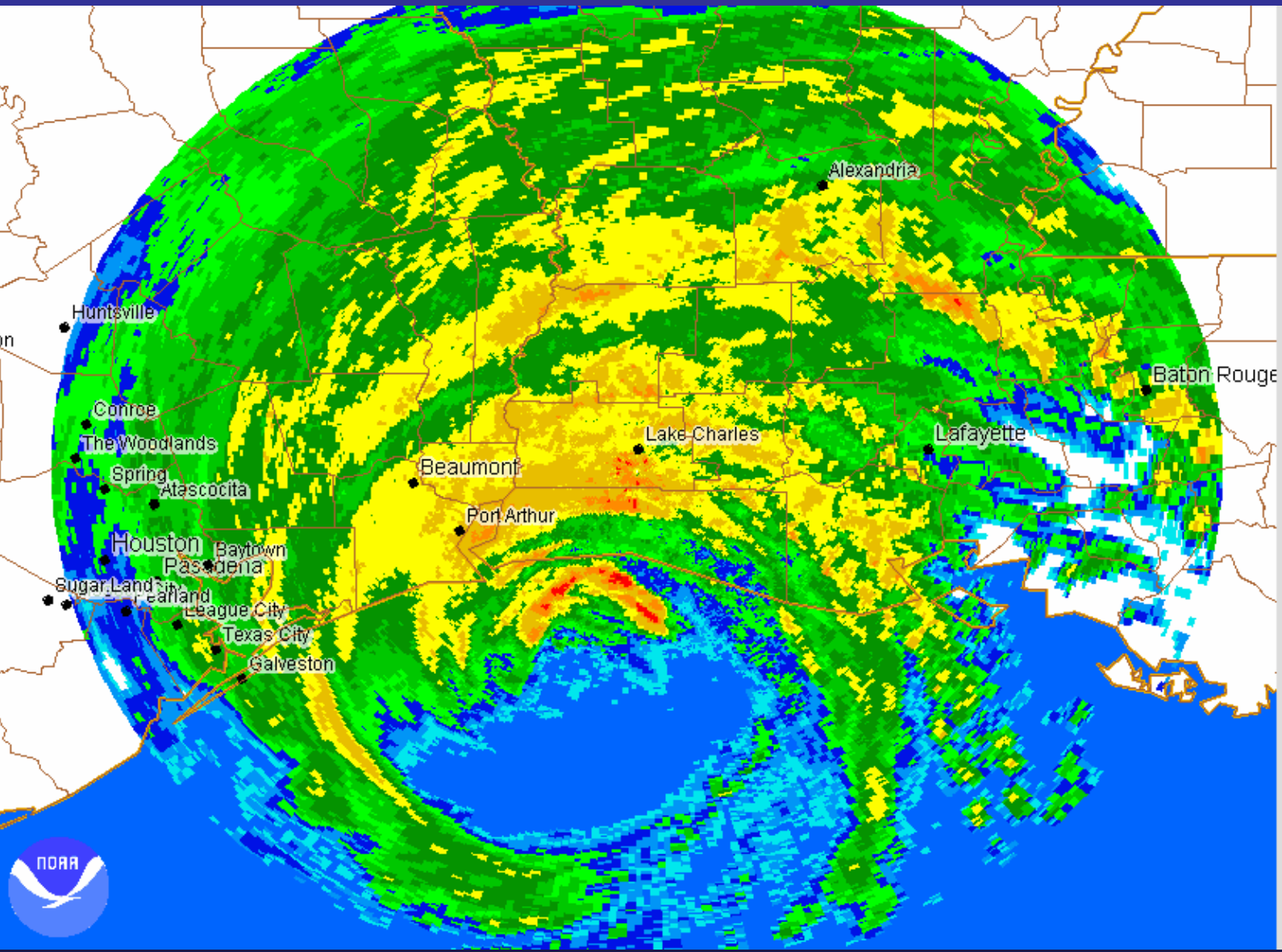
Satellite Life Cycle of Rita



Hurricane Rita Passing the Florida Keys



Hurricane Rita Landfall



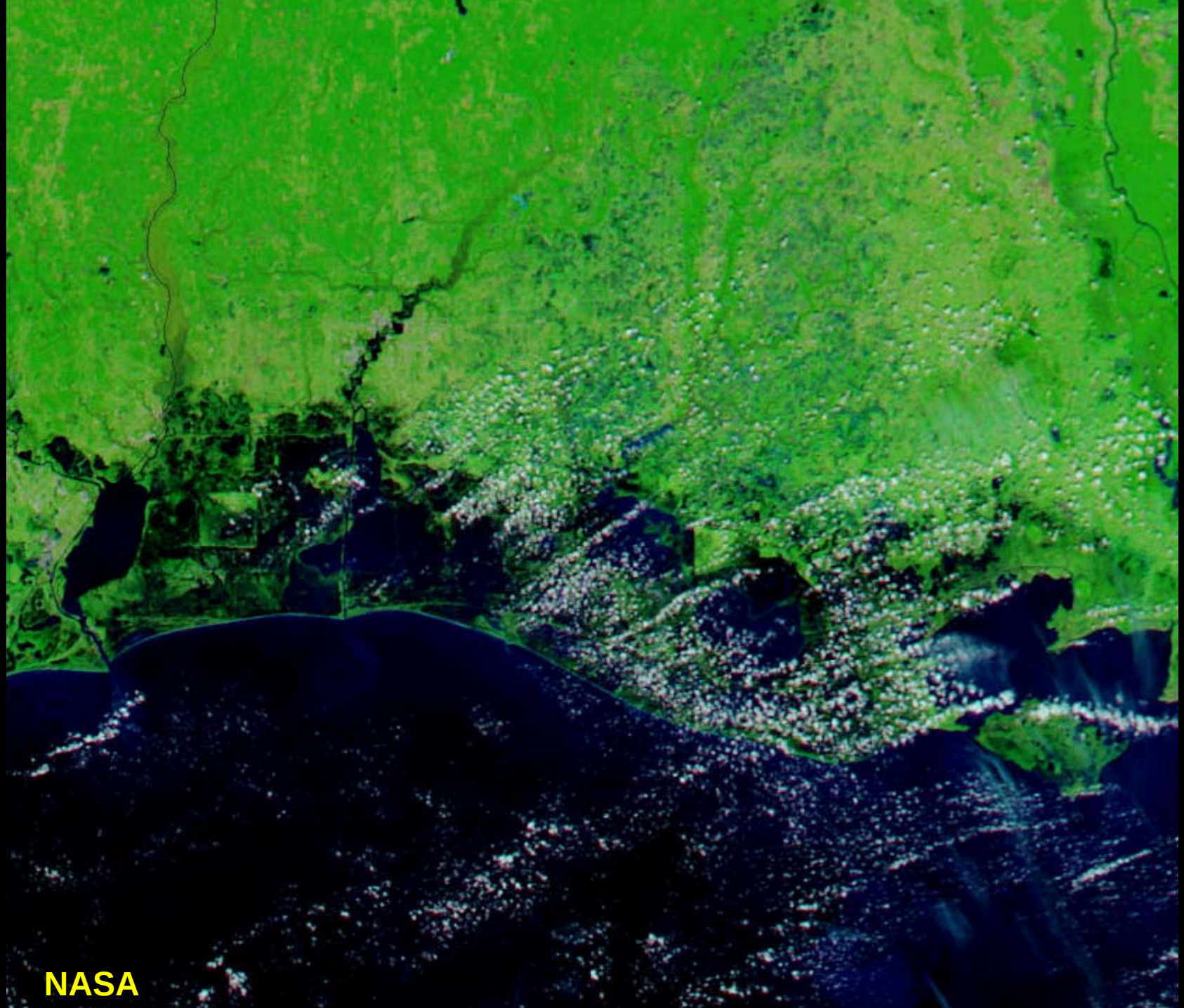
BASE REFLECTIVITY
KLCH - LAKE CHARLES, LA
09/24/2005 05:29:42 GMT
LAT: 30/07/30 N
LON: 93/12/57 W
ELEV: 94.0 FT
MODE/VCP: A / 21

ELEV ANGLE: 0.50 °
MAX: 55 dBZ

Legend: (Category) dBZ

(15) 75
(14) 70
(13) 65
(12) 60
(11) 55
(10) 50
(9) 45
(8) 40
(7) 35
(6) 30
(5) 25
(4) 20
(3) 15
(2) 10
(1) 5


NASA


NASA

Holly Beach, LA

USGS

University of New Orleans

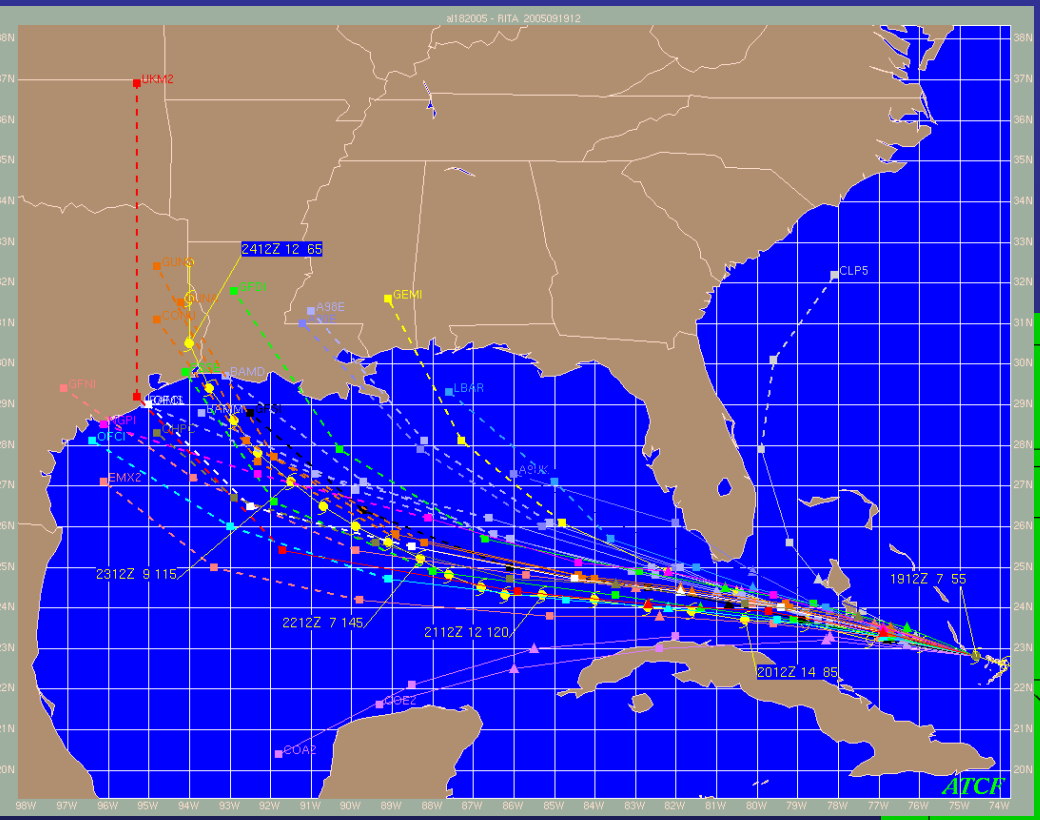
before

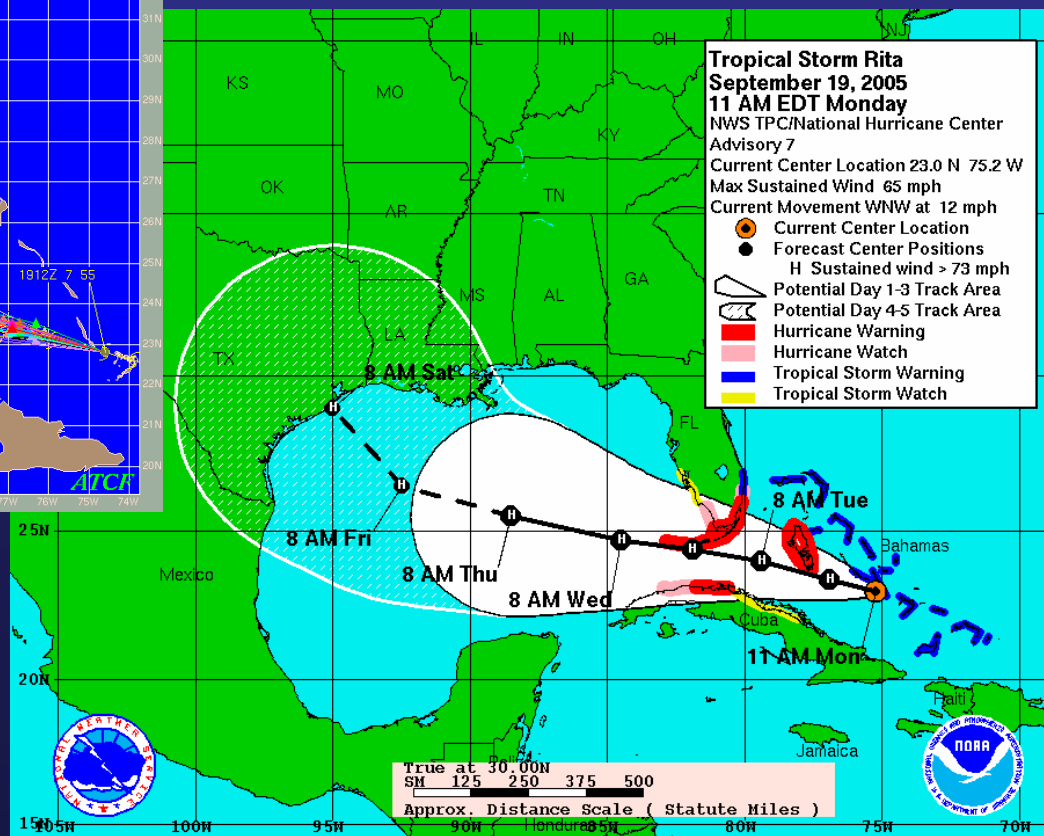
Hurricane Rita

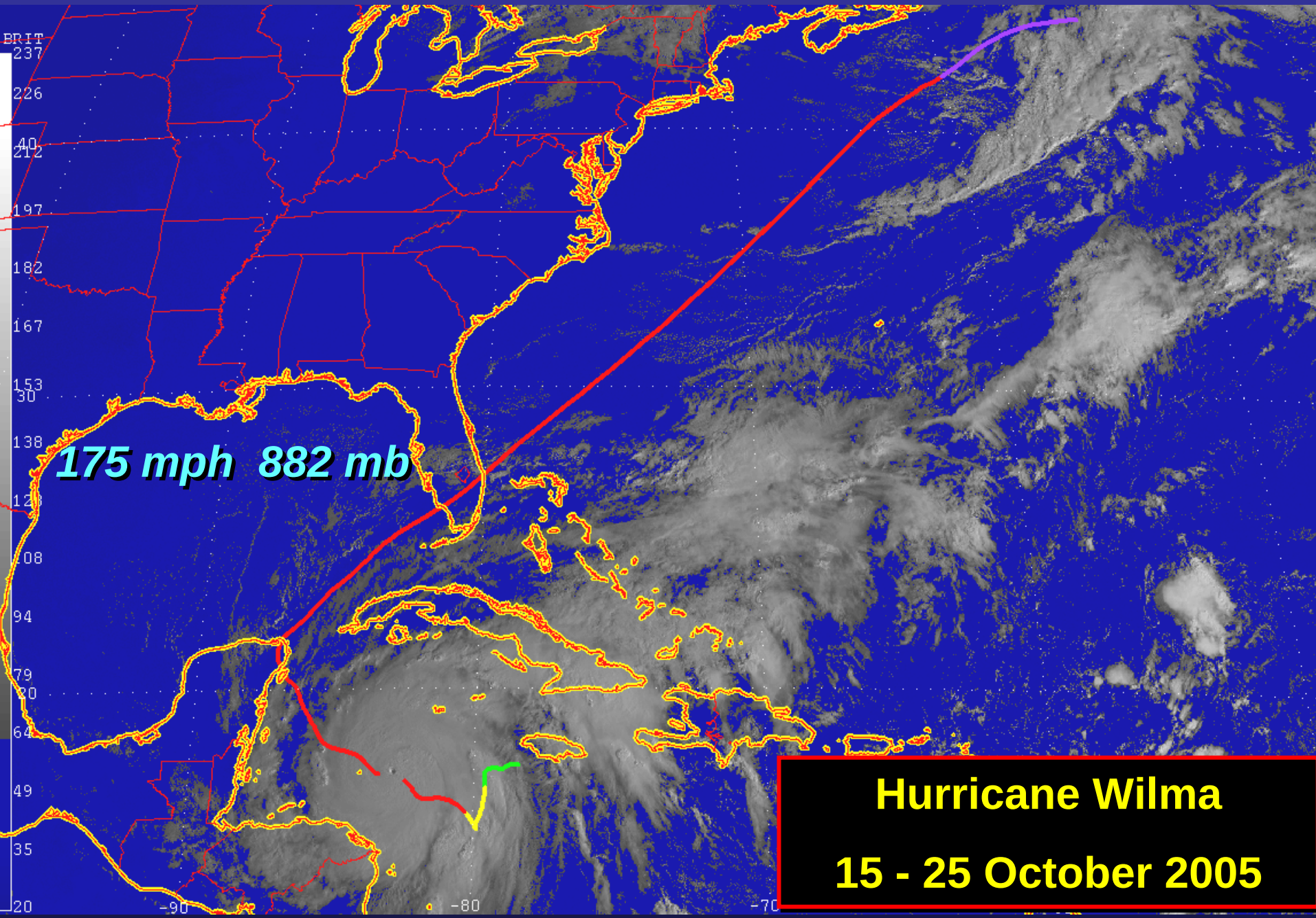
after

Pictures by Rob Perillo

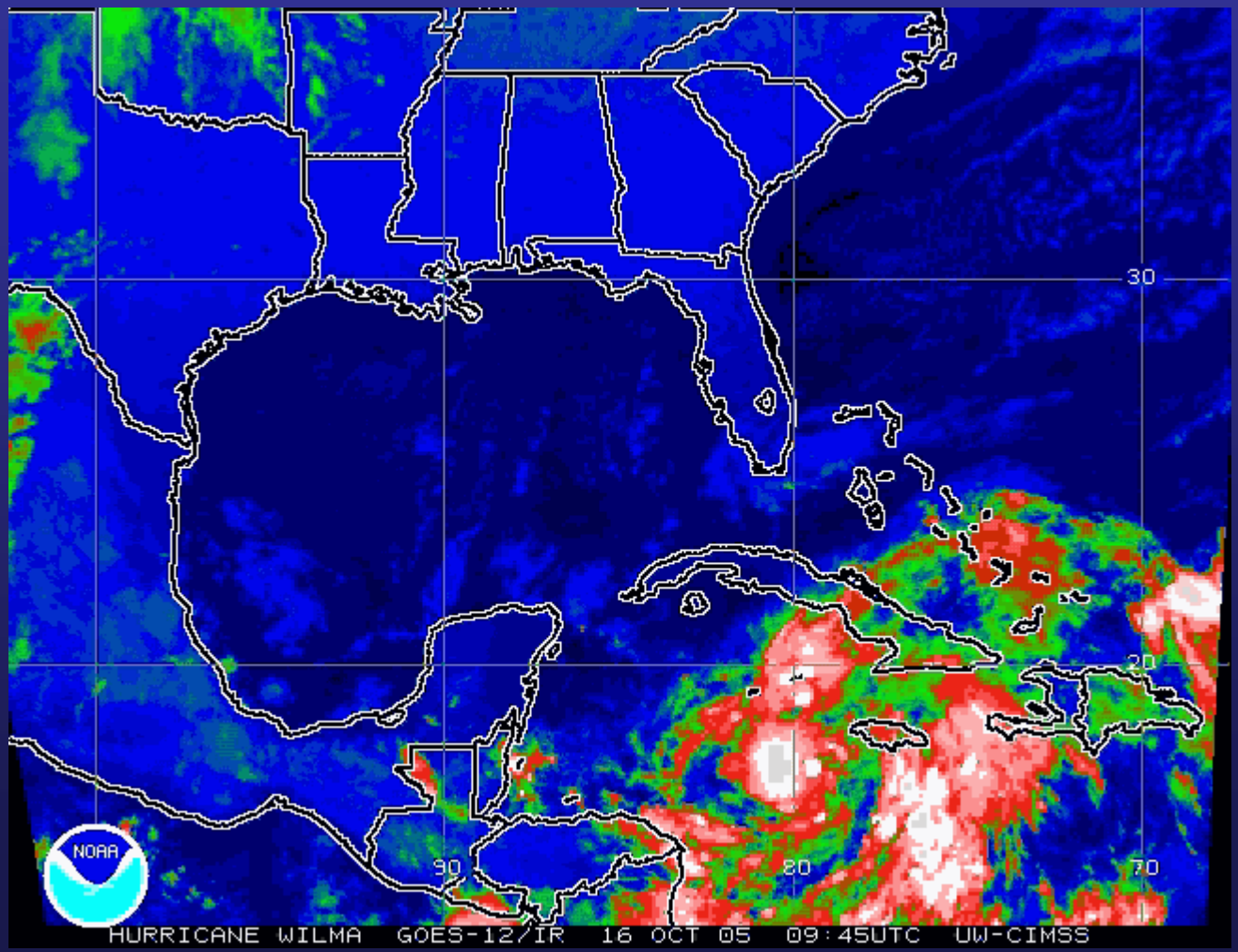
Rita Track Forecasts
1200 UTC 19 September

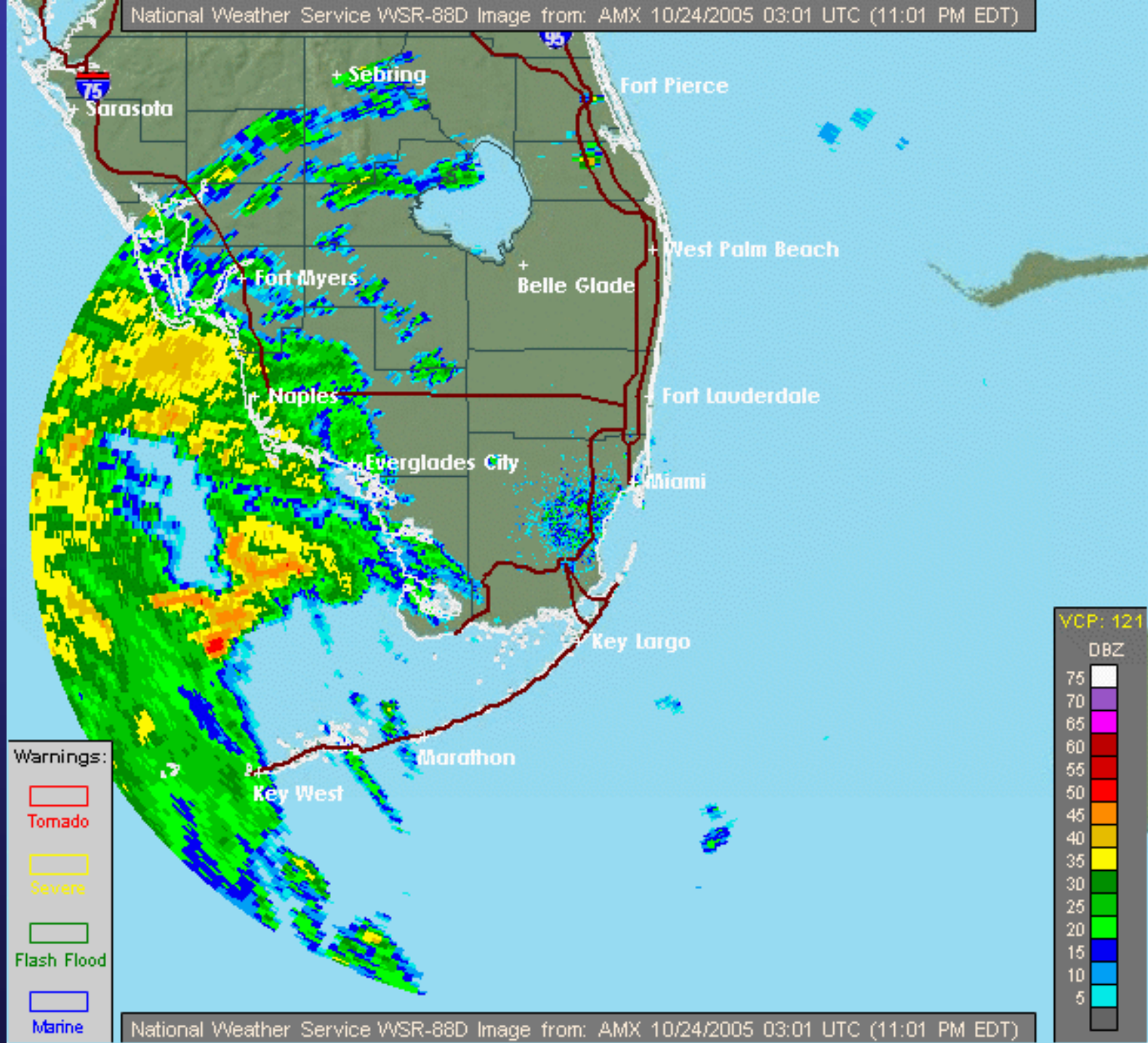




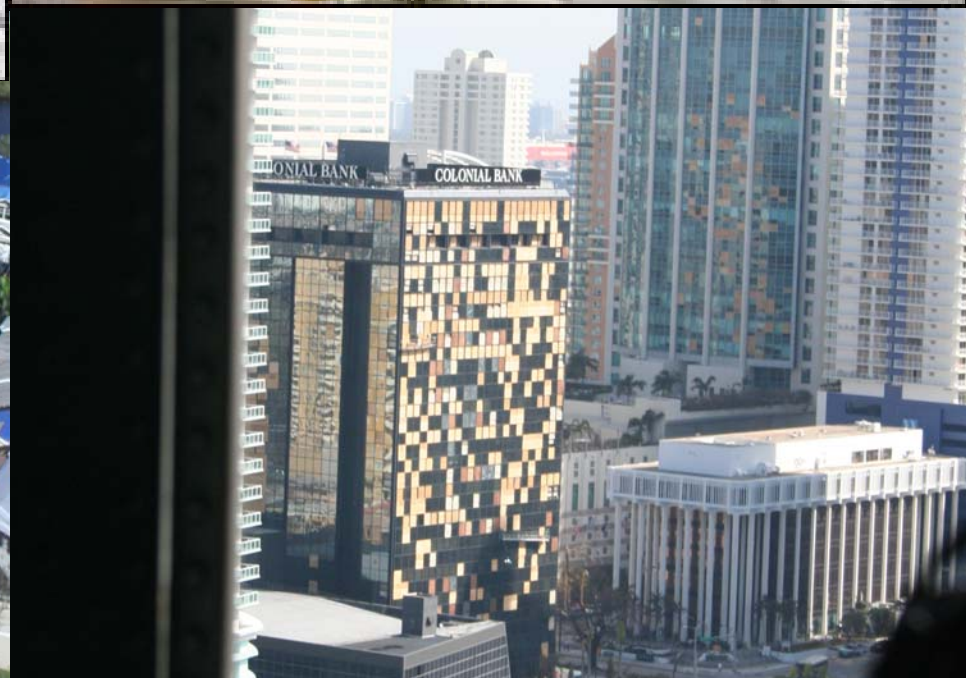

BRIT
237
226
212
197
182
167
153
138
123
108
94
79
64
49
35
20
-90
-80
-70
175 mph 882 mb
Hurricane Wilma
15 - 25 October 2005

Satellite Life Cycle of Wilma




National Weather Service WSR-88D Image from: AMX 10/24/2005 03:01 UTC (11:01 PM EDT)
Sebring
Fort Pierce
Sarasota
West Palm Beach
Fort Myers
Belle Glade
Naples
Fort Lauderdale
Everglades City
Miami
Key Largo
Marathon
Key West
Warnings:
Tornado
Severe
Flash Flood
Marine
VCP: 121
DBZ
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
National Weather Service WSR-88D Image from: AMX 10/24/2005 03:01 UTC (11:01 PM EDT)

Wilma's Damage



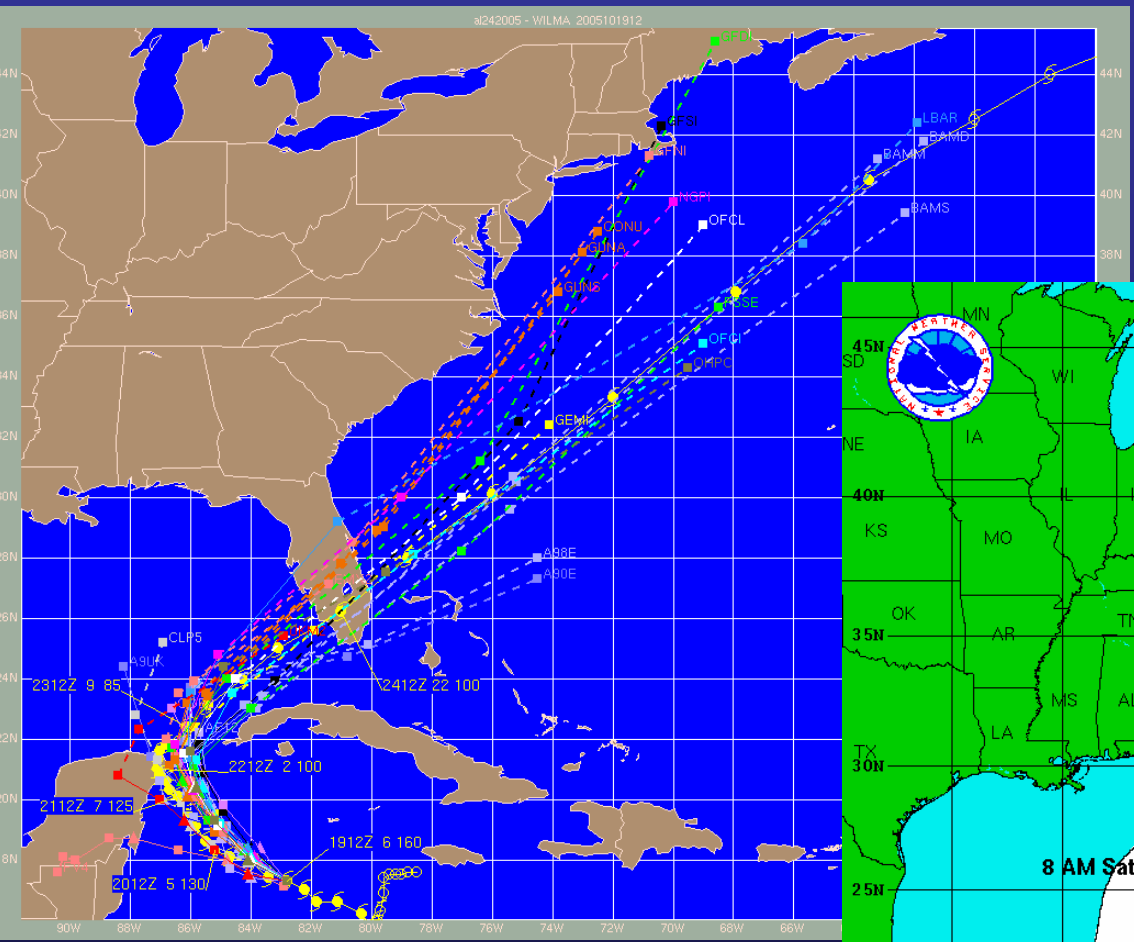
Key West

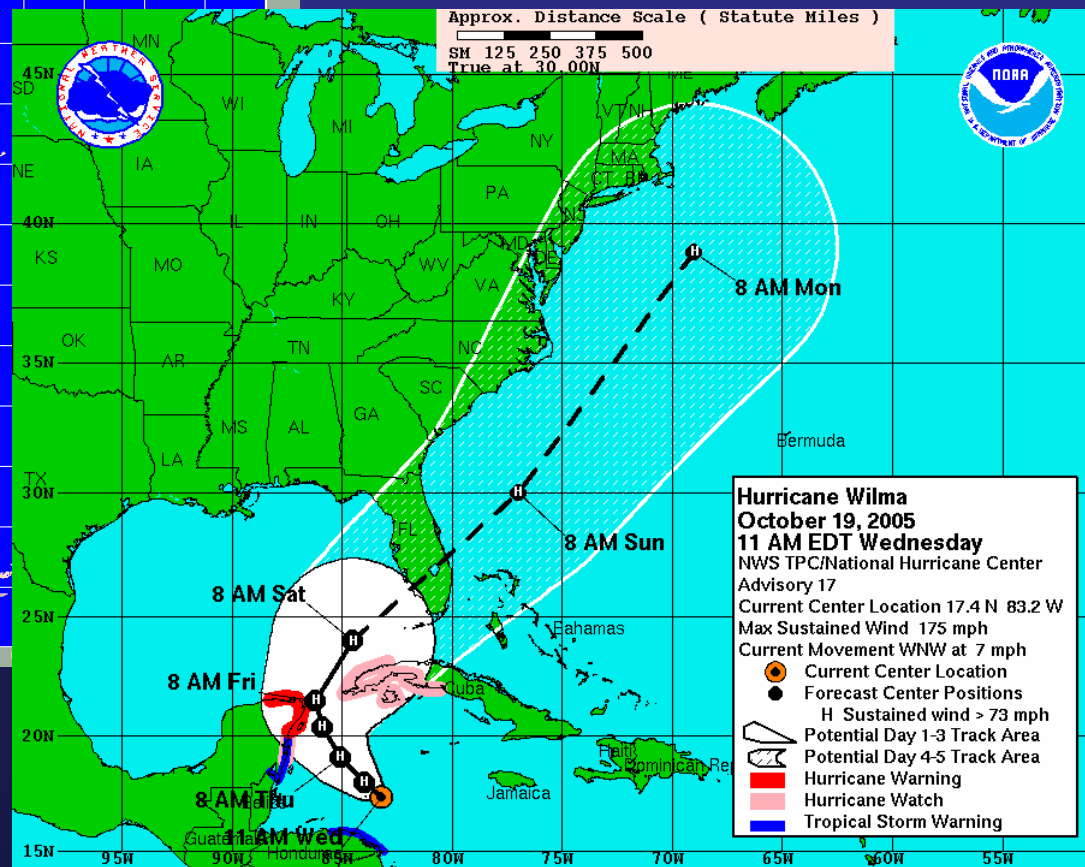
Marathon

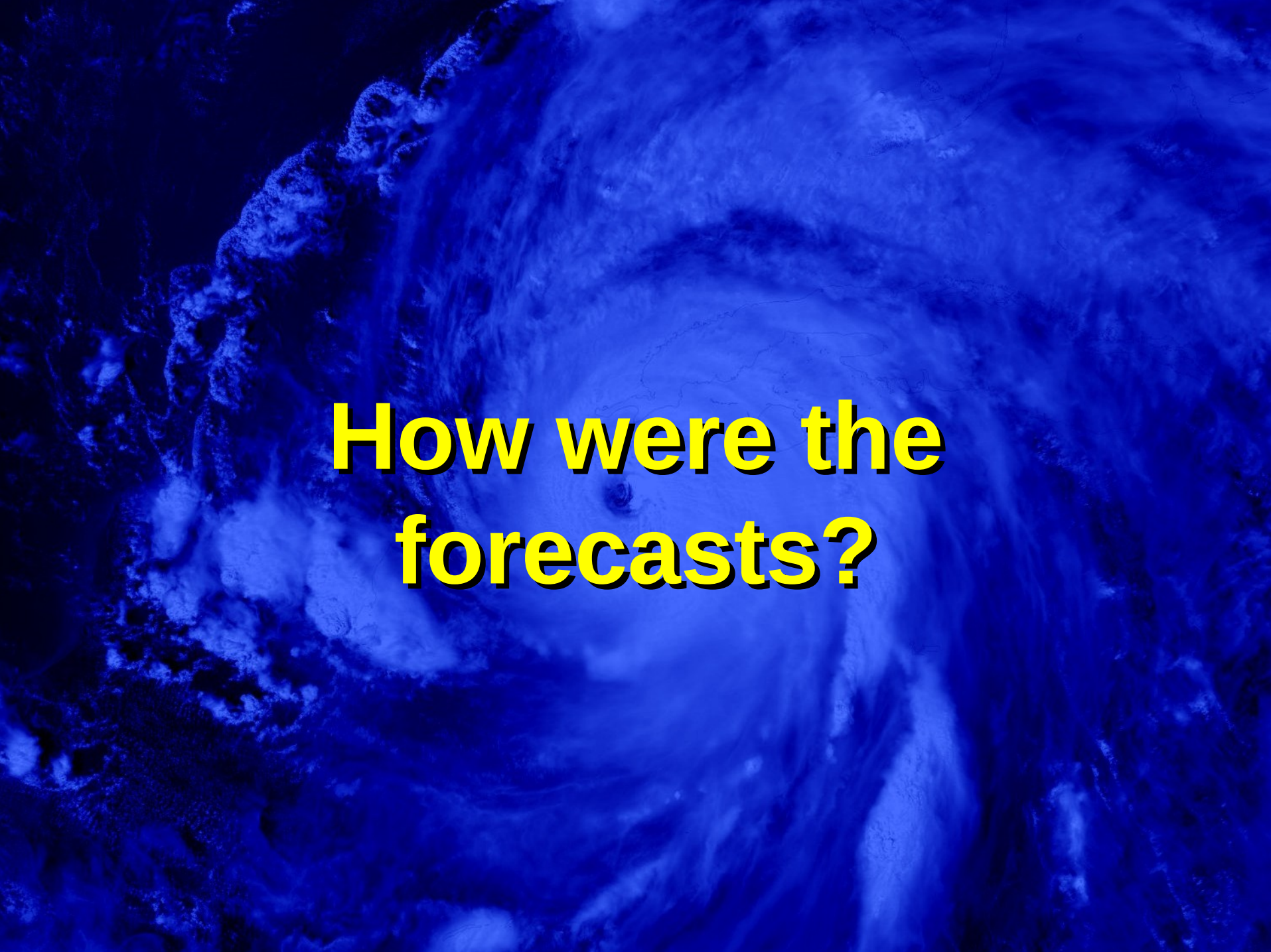
Marathon

Marathon

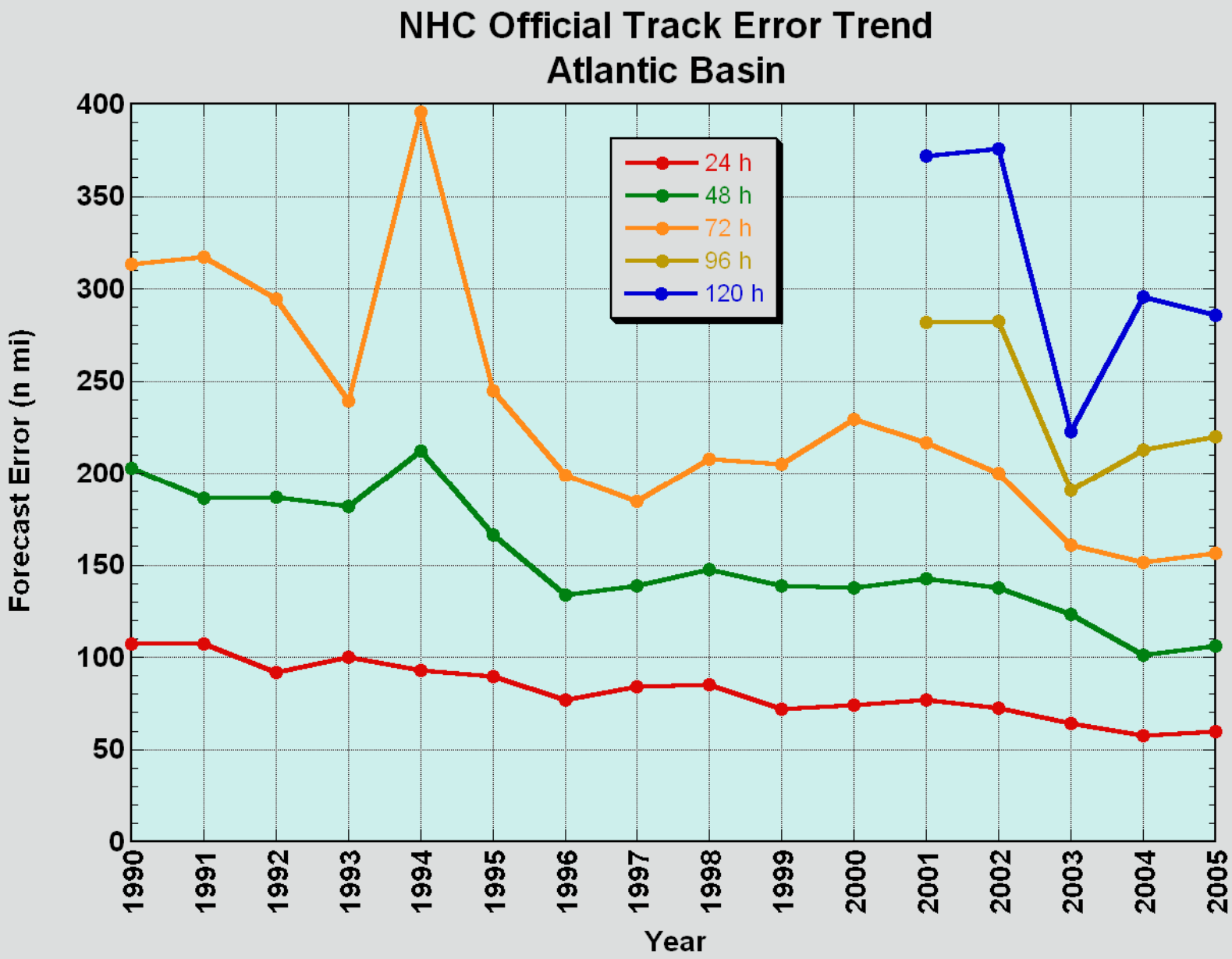
Wilma Track Forecasts
1200 UTC 19 October



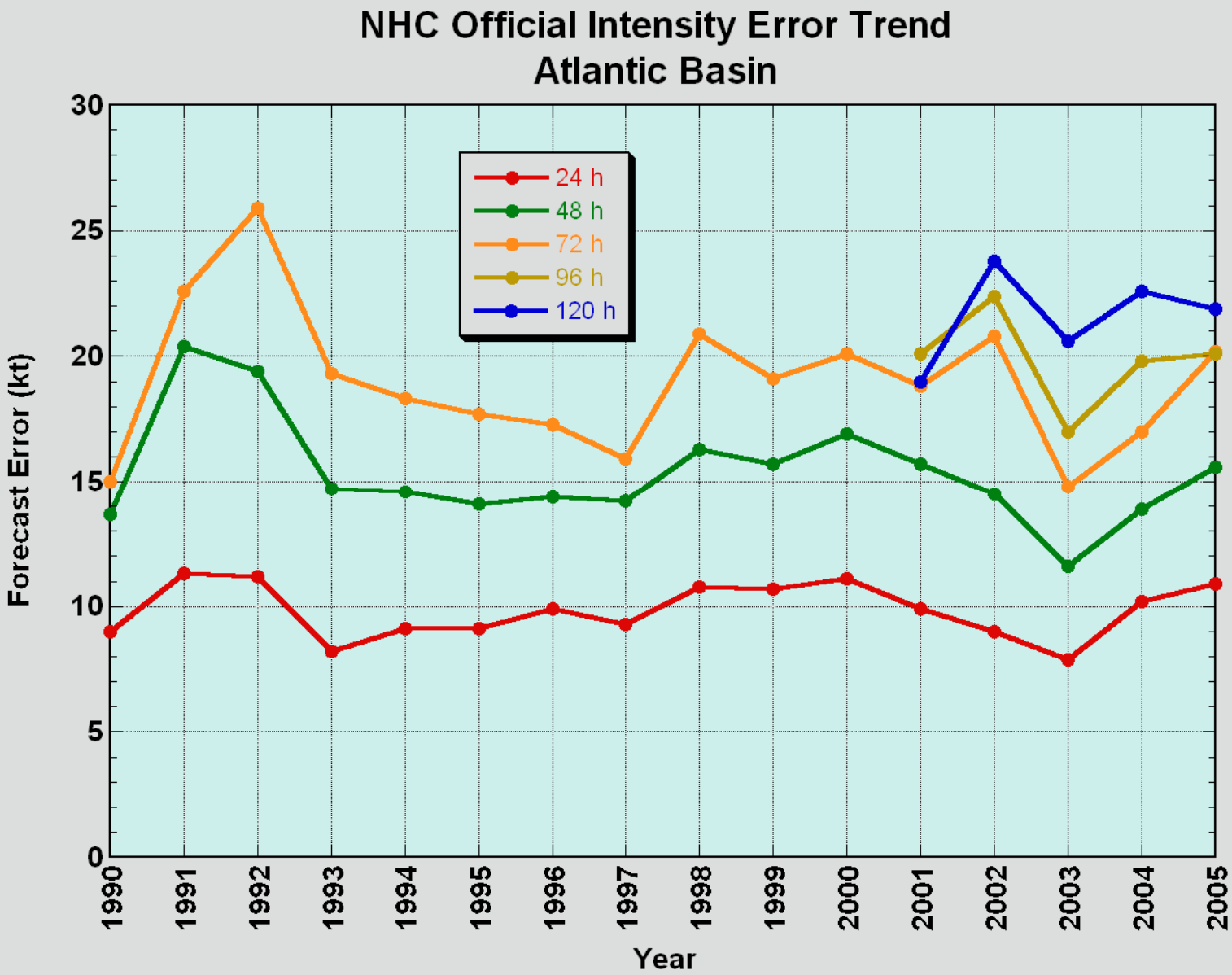



How were the forecasts?

Errors cut in half in 15 years



No progress with intensity?




How do we change
the outcome?

JHT Website
www.nhc.noaa.gov/jht/index.shtml

- JHT Home
- Terms of Reference (PDF)
- Staff
- Steering Committee
- Main Activities
- Highlights - 2001 to present
- Current Projects (2005-2007)
- Past Projects
- Administrative Presentations and Information

Mission Statement

The mission of the Joint (National Oceanic and Atmospheric Administration - NOAA, Navy, and National Aeronautics and Space Administration - NASA) Hurricane Test Bed is to transfer more rapidly and smoothly new technology, research results, and observational advances of the United States Weather Research Program (USWRP), its sponsoring agencies, the academic community and other groups into improved tropical cyclone analysis and prediction at operational centers.

WHAT'S NEW

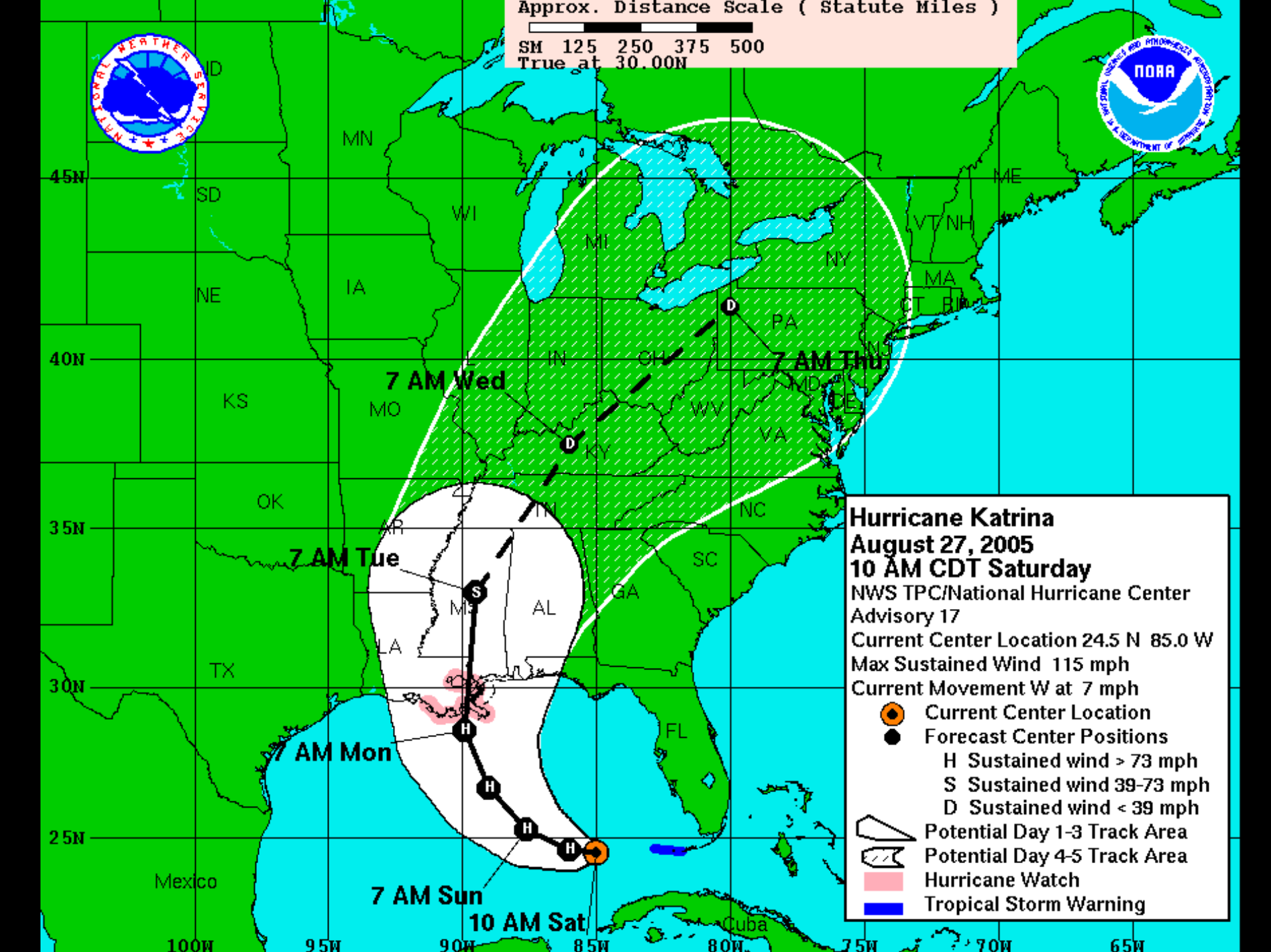
Updated January 31, 2006:

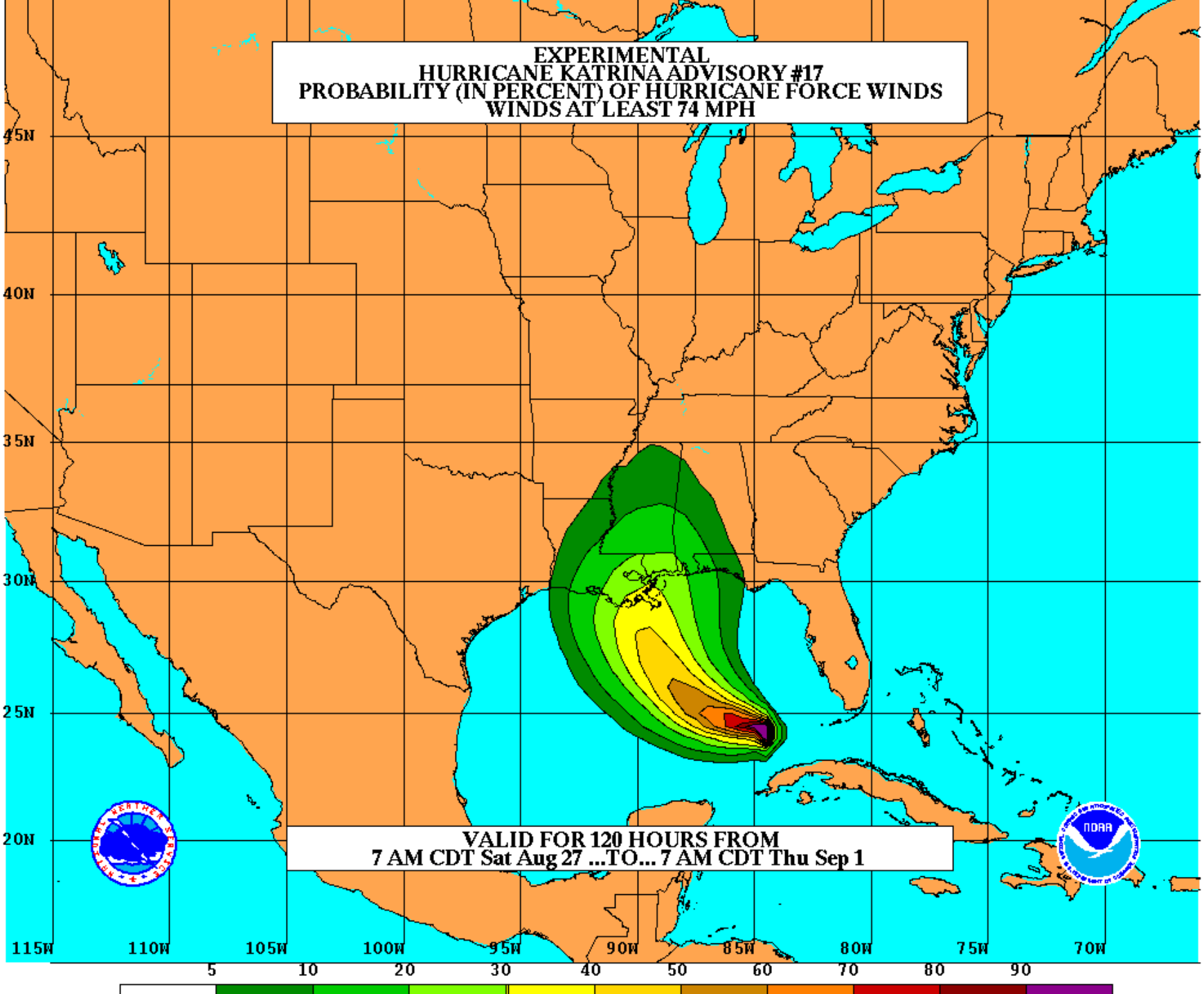
- 2005-2007 Projects and Goals
- The 2005 Midyear Reports are available in the Project Table

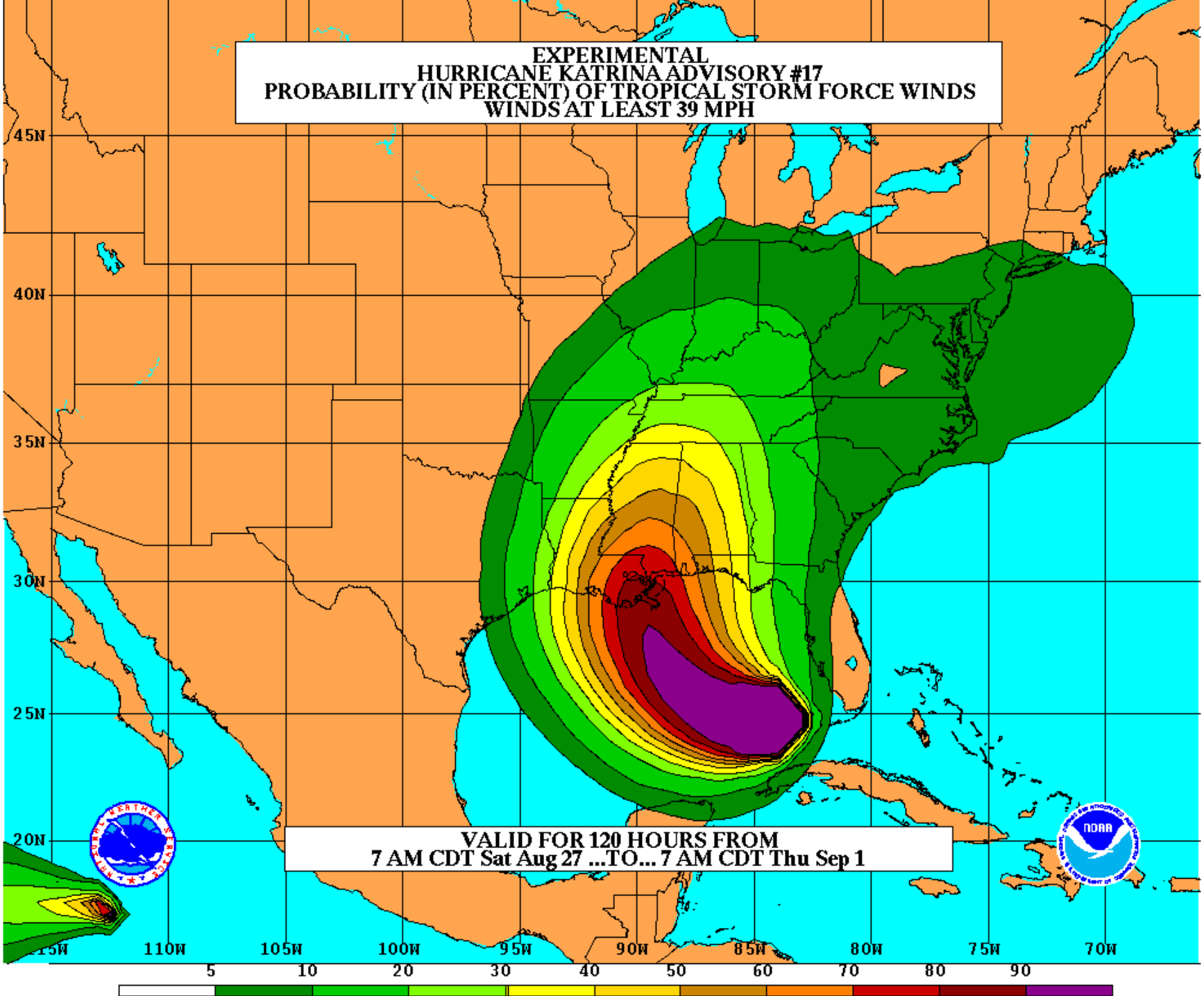
Added February 10, 2006:

- The Joint Hurricane Testbed (JHT): Progress and Future Plans, Chris Landsea (TPC/NHC) - American Meteorological Society's Annual Meeting, February 2006 presentation. (PDF format)

Return to NHC Home – Contact NHC


Approx. Distance Scale (Statute Miles)
SM 125 250 375 500
True at 30.00N
45N
40N
35N
30N
25N
100W
95W
90W
85W
80W
75W
70W
65W
ID
MN
SD
WI
MI
NY
ME
VT
NH
MA
CT
RI
NE
IA
PA
NJ
IN
OH
MD
DE
KS
MO
WV
VA
KY
OK
TN
NC
AR
SC
MS
AL
GA
LA
TX
FL
Mexico
Cuba
7 AM Wed
7 AM Thu
7 AM Tue
7 AM Mon
7 AM Sun
10 AM Sat
Hurricane Katrina
August 27, 2005
10 AM CDT Saturday
NWS TPC/National Hurricane Center
Advisory 17
Current Center Location 24.5 N 85.0 W
Max Sustained Wind 115 mph
Current Movement W at 7 mph
Current Center Location
Forecast Center Positions
H Sustained wind > 73 mph
S Sustained wind 39-73 mph
D Sustained wind < 39 mph
Potential Day 1-3 Track Area
Potential Day 4-5 Track Area
Hurricane Watch
Tropical Storm Warning


EXPERIMENTAL
HURRICANE KATRINA ADVISORY #17
PROBABILITY (IN PERCENT) OF HURRICANE FORCE WINDS
WINDS AT LEAST 74 MPH
45N
40N
35N
30N
25N
20N
115W
110W
105W
100W
95W
90W
85W
80W
75W
70W
VALID FOR 120 HOURS FROM
7 AM CDT Sat Aug 27 ...TO... 7 AM CDT Thu Sep 1
5
10
20
30
40
50
60
70
80
90


EXPERIMENTAL
HURRICANE KATRINA ADVISORY #17
PROBABILITY (IN PERCENT) OF TROPICAL STORM FORCE WINDS
WINDS AT LEAST 39 MPH
45N
40N
35N
30N
25N
20N
115W
110W
105W
100W
95W
90W
85W
80W
75W
70W
VALID FOR 120 HOURS FROM
7 AM CDT Sat Aug 27 ...TO... 7 AM CDT Thu Sep 1
5
10
20
30
40
50
60
70
80
90

National Hurricane Preparedness Week

May 21-27, 2006

HISTORY	HURRICANE HAZARDS			FORECAST	PREPARE	ACT
						
S	M	T	W	Th	F	S
MAY 21	MAY 22	MAY 23	MAY 24	MAY 25	MAY 26	MAY 27
Hurricane Basics **Hurricane History**	**Storm Surge** **Marine Safety**	**High Winds** **Tornadoes**	**Inland Flooding**	**Forecast Process**	**Disaster Prevention**	**National Day of Family Preparedness**

www.nhc.noaa.gov


FROM THE PEOPLE
OF WAVELAND
In appreciation and gratitude
to all who gave of their time,
energy, and money to help us
recover from Hurricane Camille.
On August 17, 1969 our city was
devastated, but those who
cared came to her rescue.