



2006 NOAA Educational Partnership Program Bi-Annual Education and Science Forum

Overview of the Record Breaking 2005 Atlantic Hurricane Season

October 31, 2006

Max Mayfield

NATIONAL HURRICANE CENTER

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°

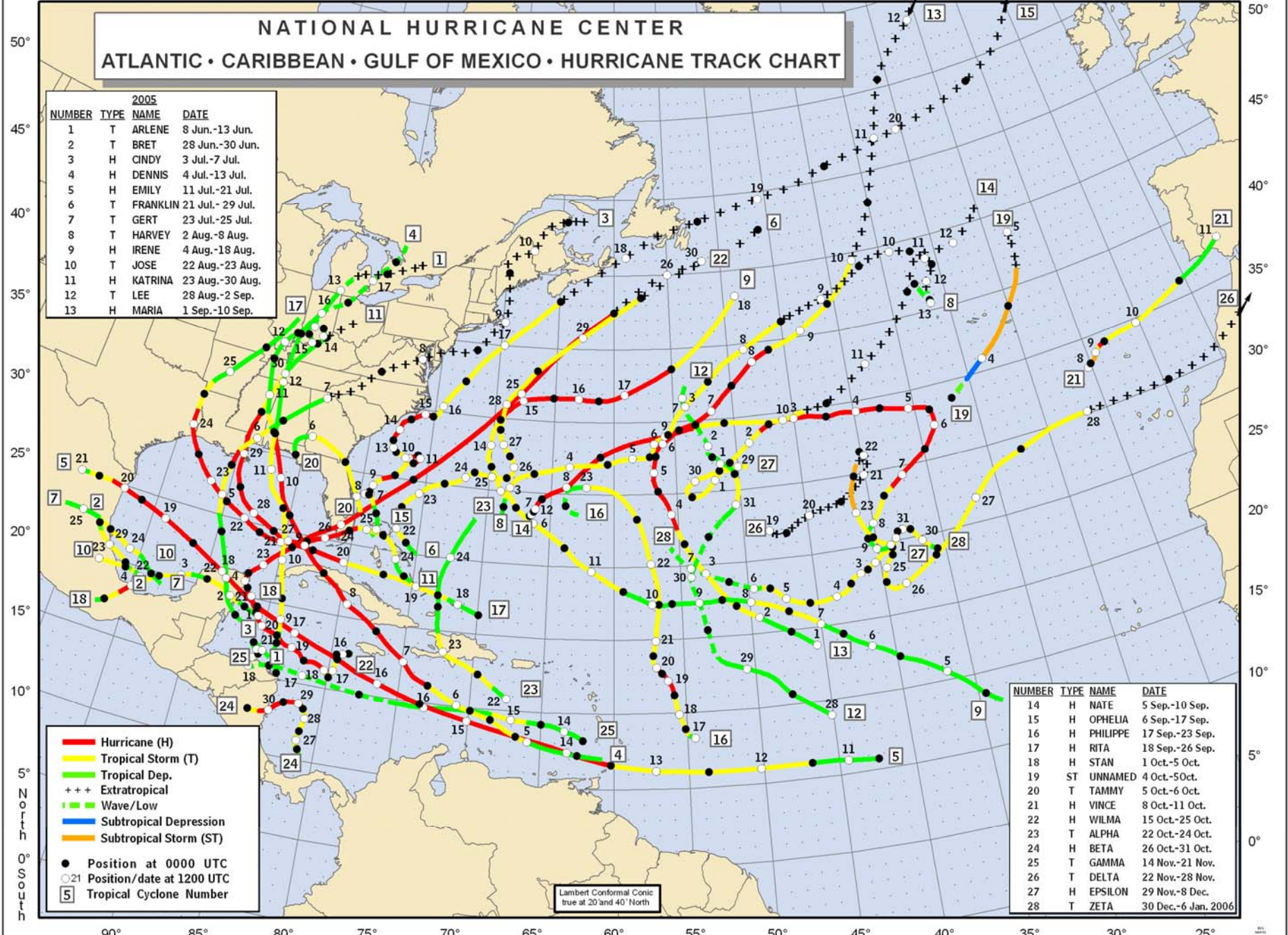
NATIONAL HURRICANE CENTER ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART

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.

- 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

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.-5 Oct.
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



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)	1500	81000
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	11300
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)	23	20600
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

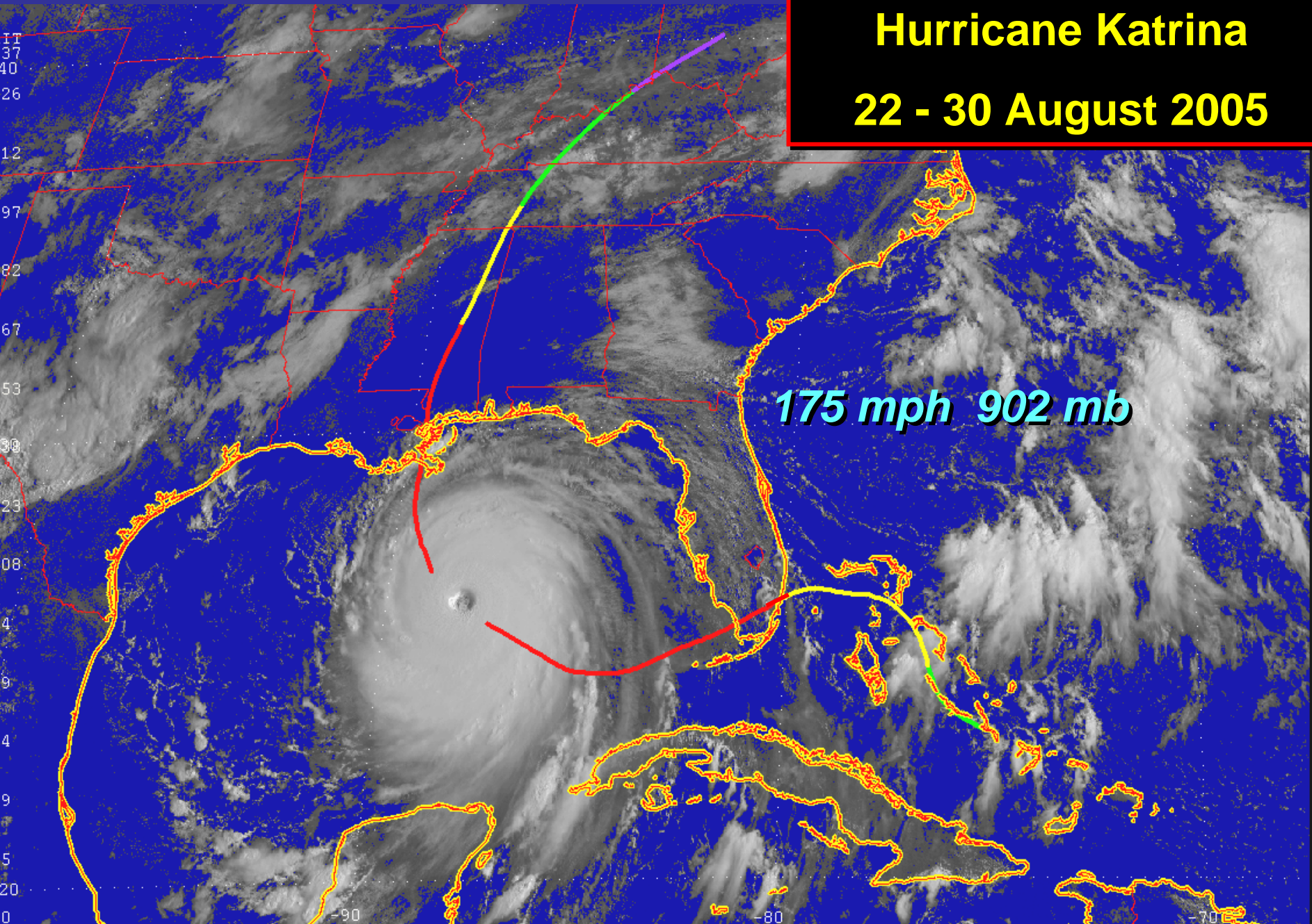
- Most active Atlantic hurricane season of record - **28 storms** developed including 27 named tropical storms and one subtropical storm. This breaks the old record of 21 set in 1933.
- **Fifteen** tropical storms became **hurricanes**, breaking the record of 12 set in 1969.
- **Seven** of the hurricanes 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

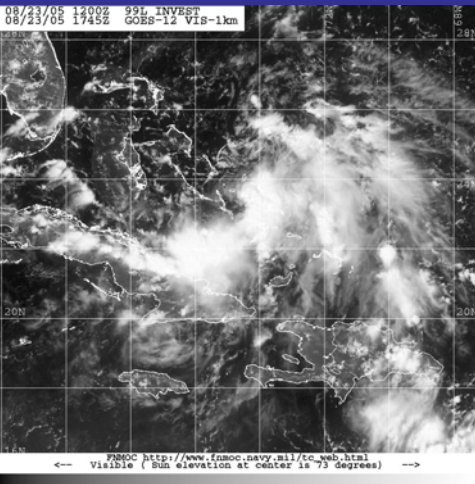
- **Seven landfalls in the United States, including Hurricane Cindy, Dennis, Katrina, Rita, and Wilma along with Tropical Storms Arlene and Tammy. Hurricane Ophelia also struck the North Carolina coast, although the center stayed just offshore.**
- **Death toll near 1400, including around 1200 from Katrina 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.**

Hurricane Katrina

22 - 30 August 2005



Images of Katrina



August 23



August 24



August 25



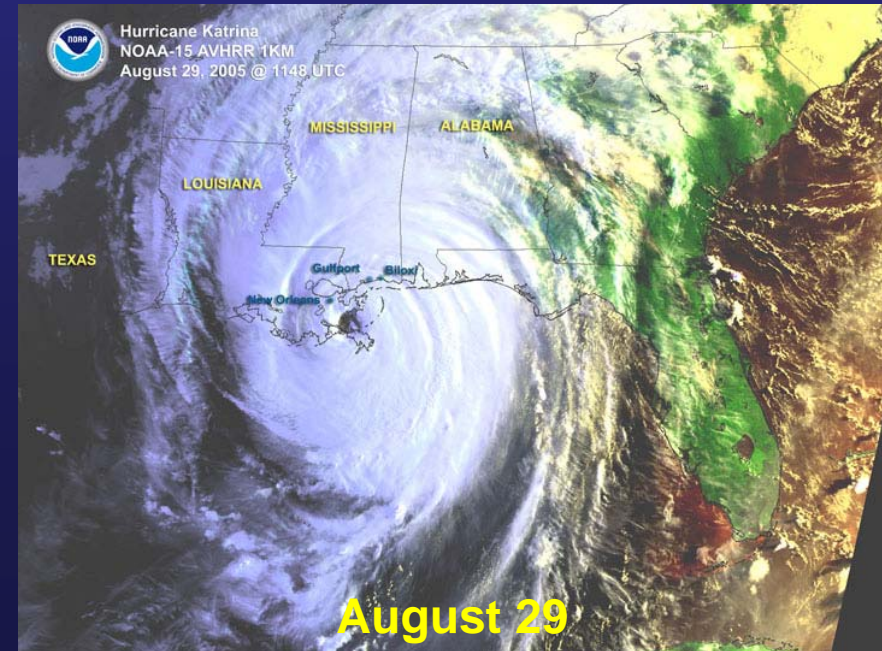
August 26



August 27

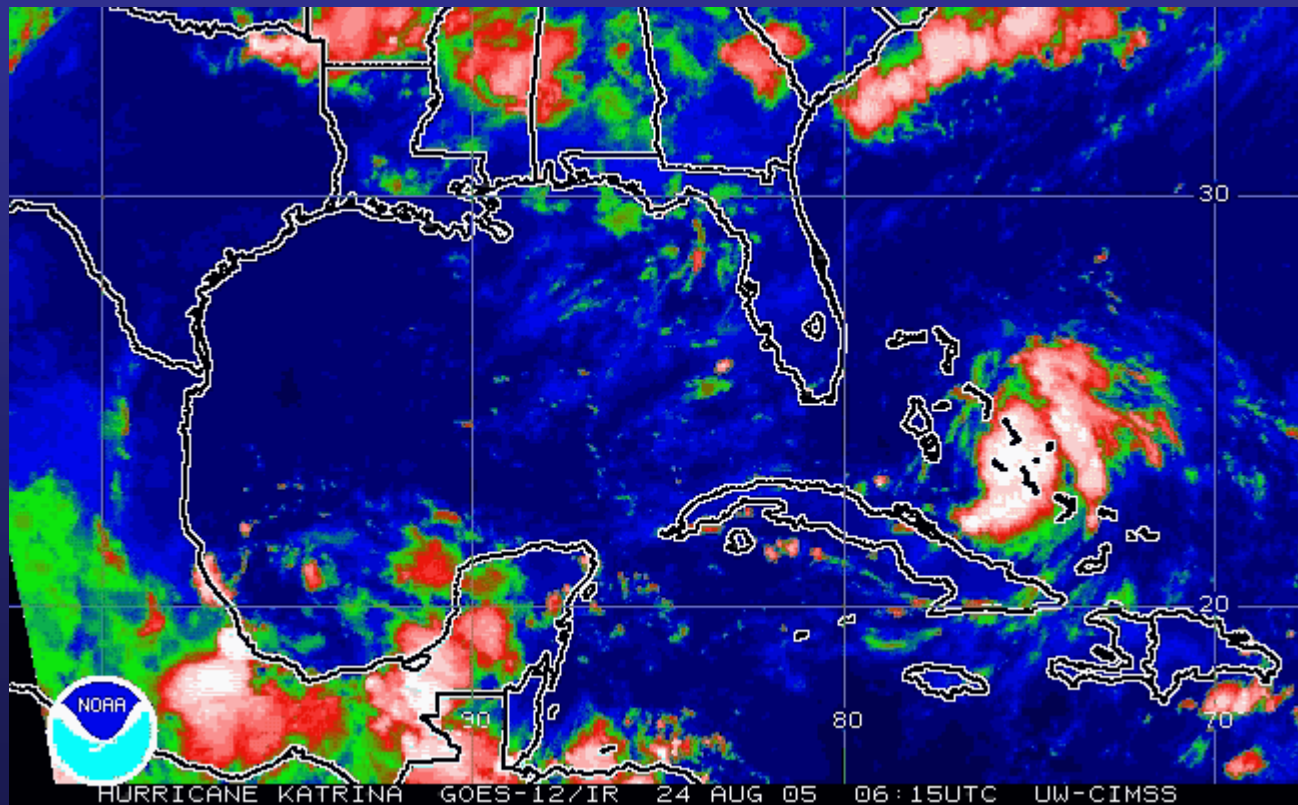


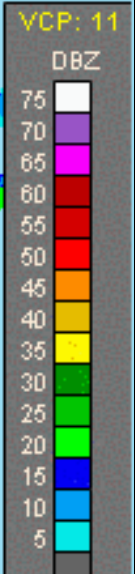
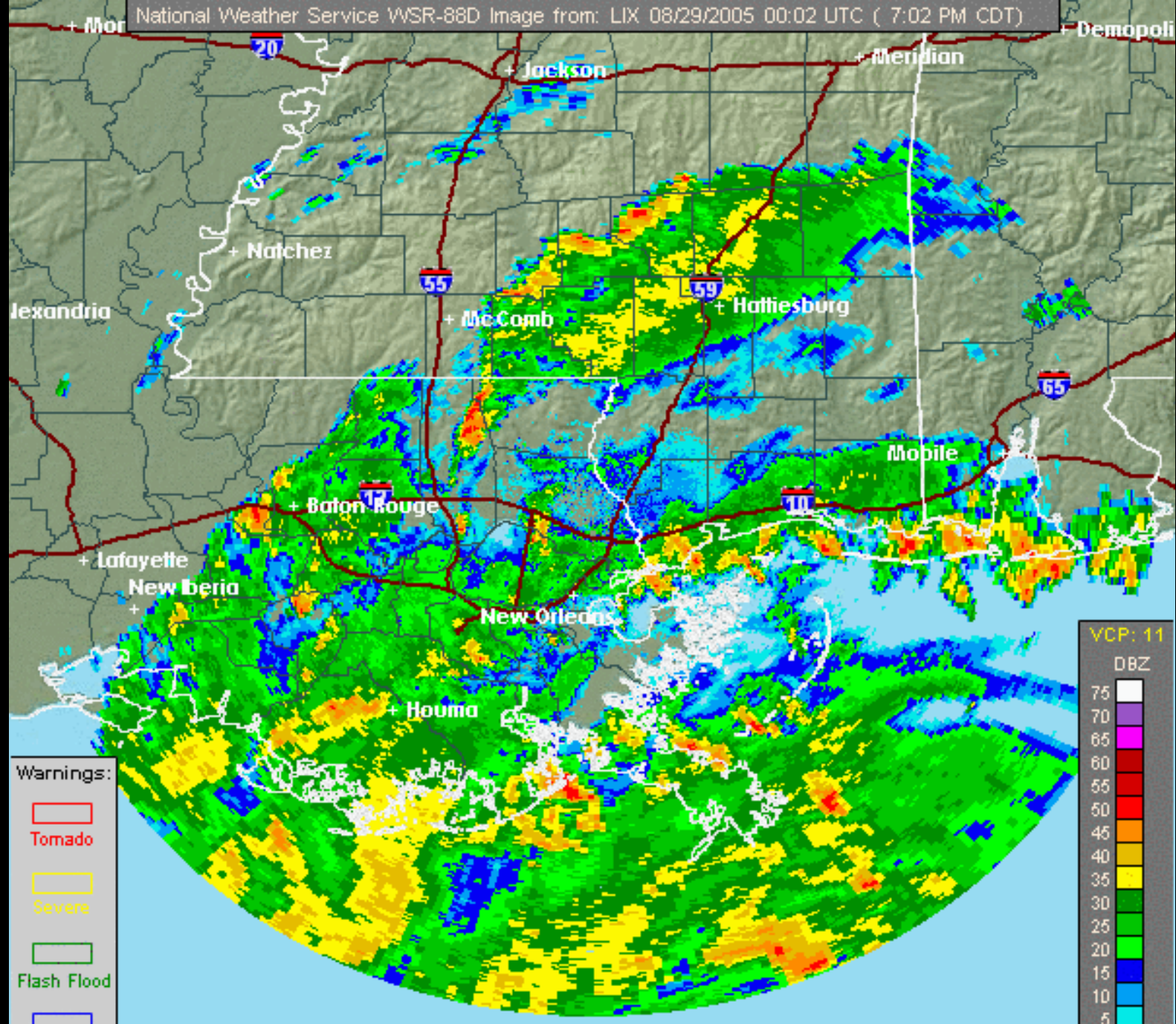
August 28



August 29

Satellite Life Cycle of Katrina





- Warnings:
- Tornado
 - Severe
 - Flash Flood
 - Marine

New Orleans



Interstate 10



17th Street Levee Breach



Lakeview



Orleans Parish



Orleans Parish

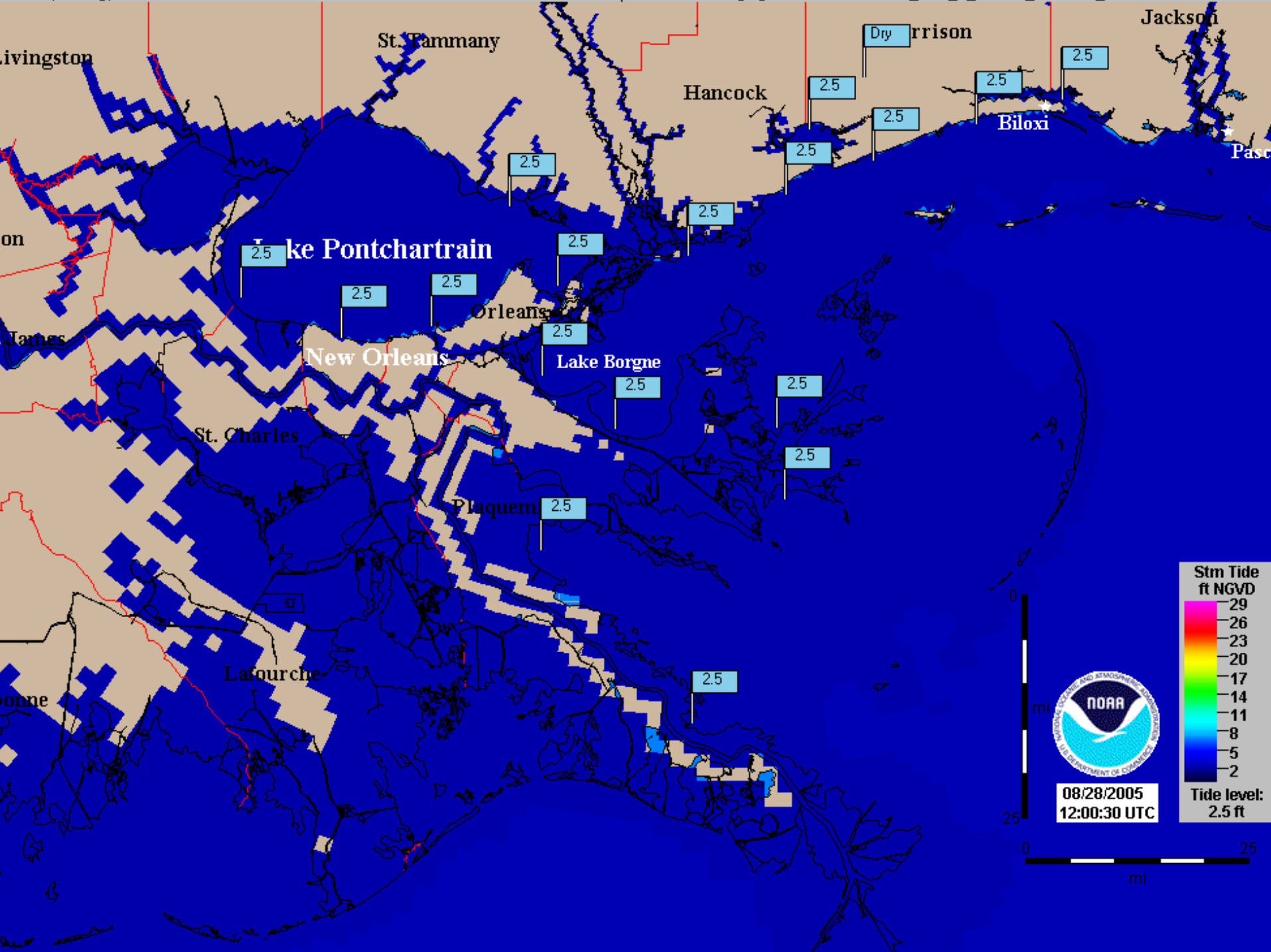


New Orleans Convention Center



St Rita's Nursing Home, St Bernard Parish





Livingston

St. Tammany

Hancock

Dry Tortugas

Jackson

Biloxi

Pascagoula

Orleans

Lake Pontchartrain

Orleans

Lake Borgne

New Orleans

St. Charles

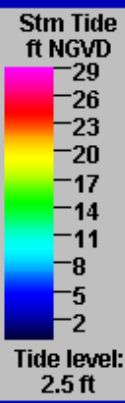
Plaquemine

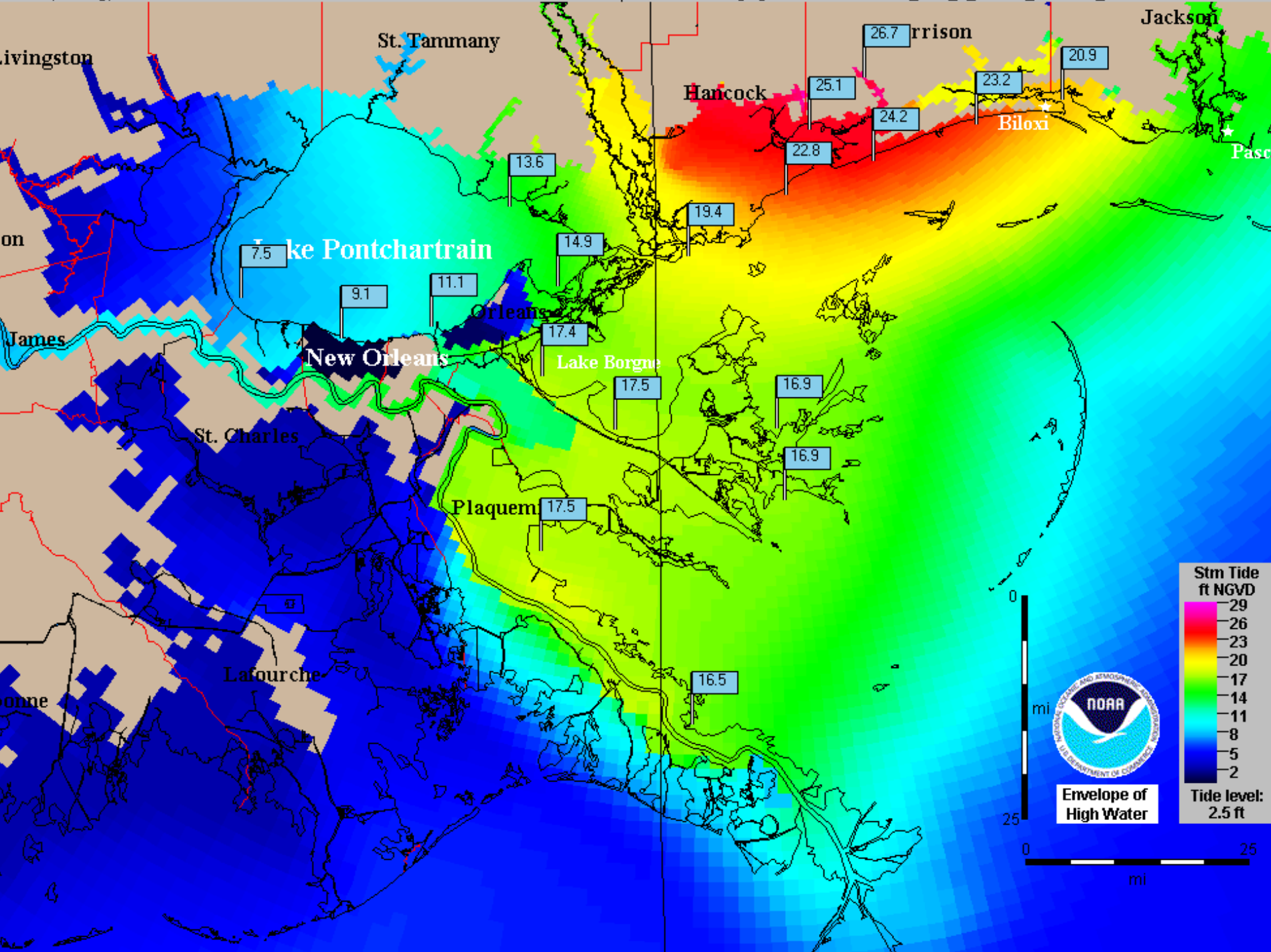
Lafourche

Terrebonne

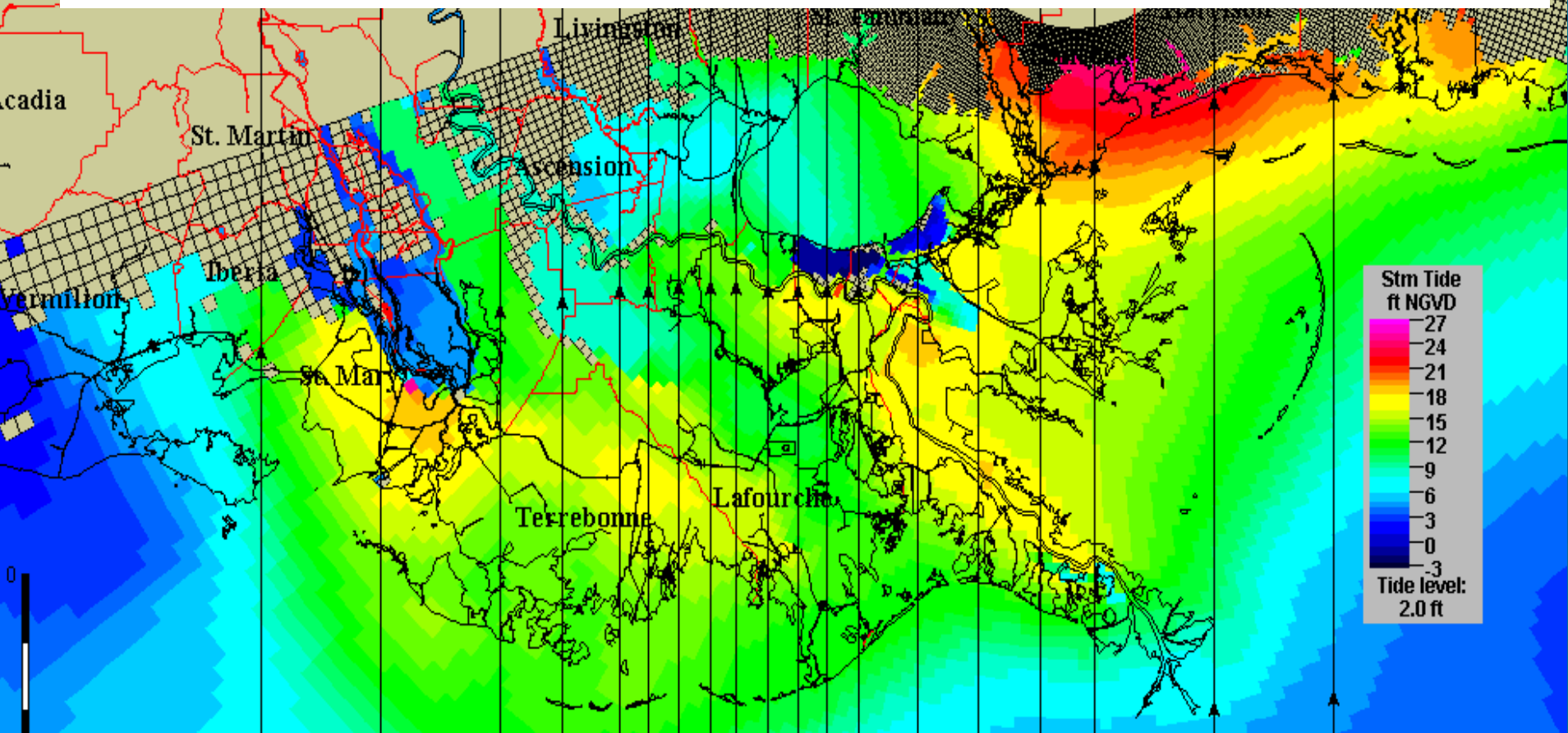


08/28/2005
12:00:30 UTC





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

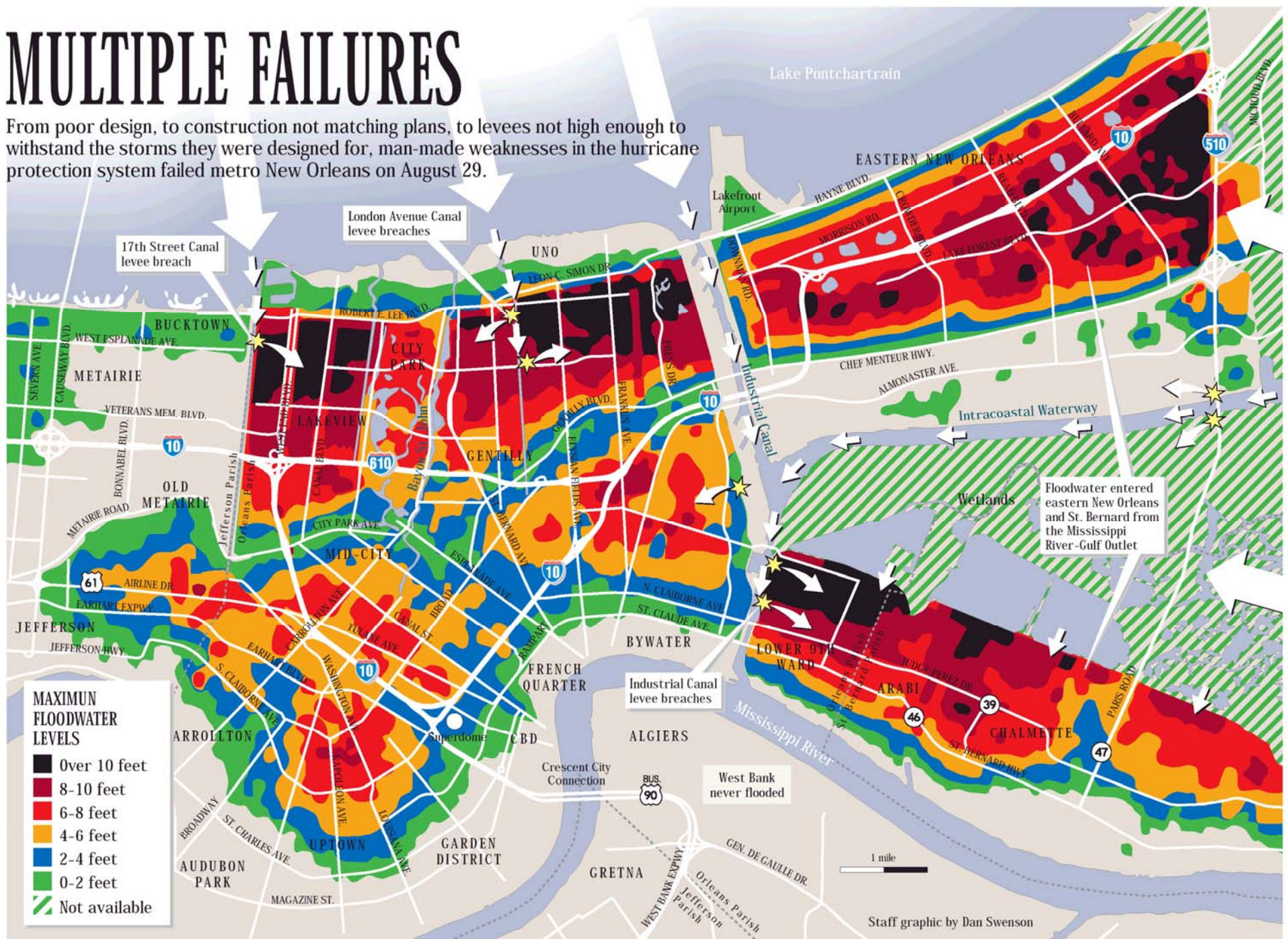


NOAA SLOSH Storm Surge Data First Provided to New Orleans Area in 1989. NOAA first provided guidance for forecasting storm surge along the open U.S. Gulf and east coasts from the precursor to SLOSH known as "SPLASH", in 1972.



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.



Levee overtopping in Katrina



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

September 1998

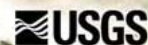


**Pre
Katrina**

**Post
Katrina**

**Mainland
Mississippi**

August 31, 2005



September 1998



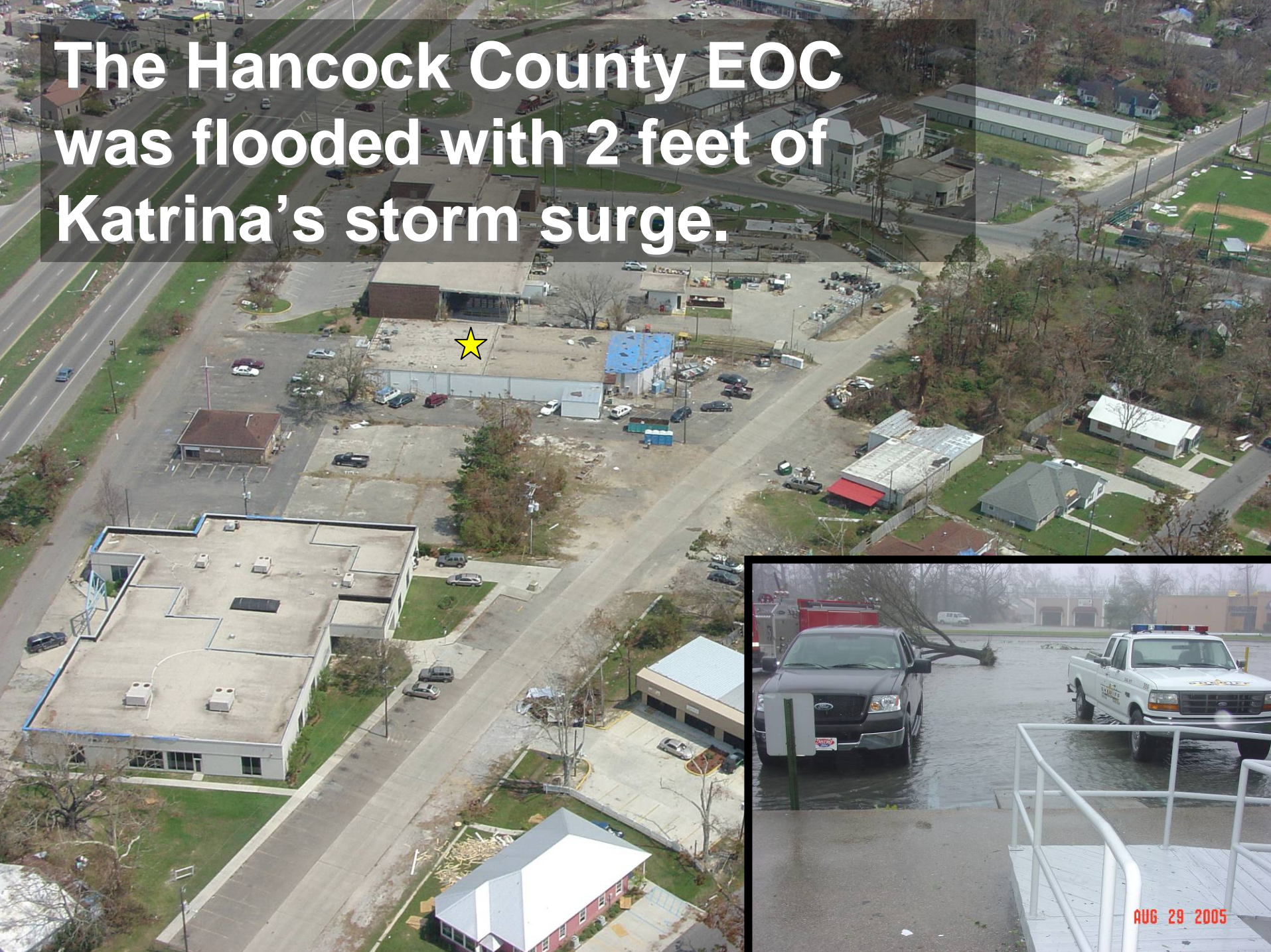
Pre
Katrina

Post
Katrina

August 31, 2005



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



Bed & Breakfast Before Katrina Bay St. Louis, Mississippi



Bed & Breakfast After Katrina Bay St. Louis, Mississippi





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

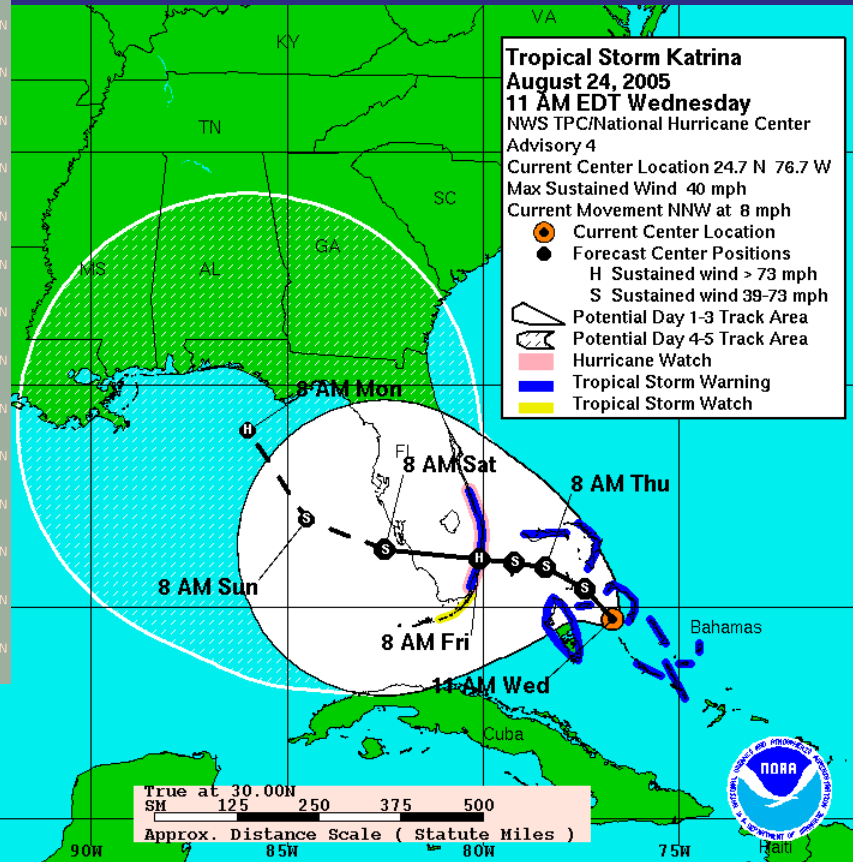
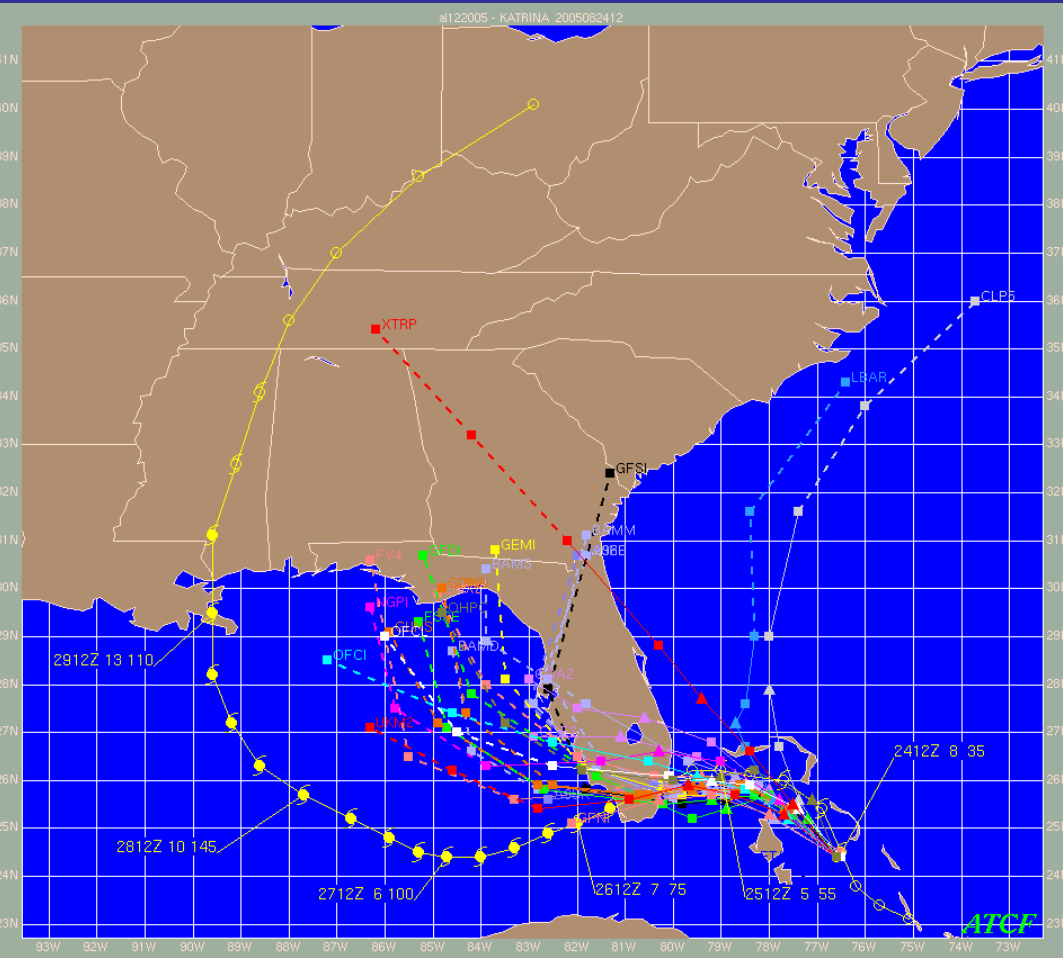


Post Katrina



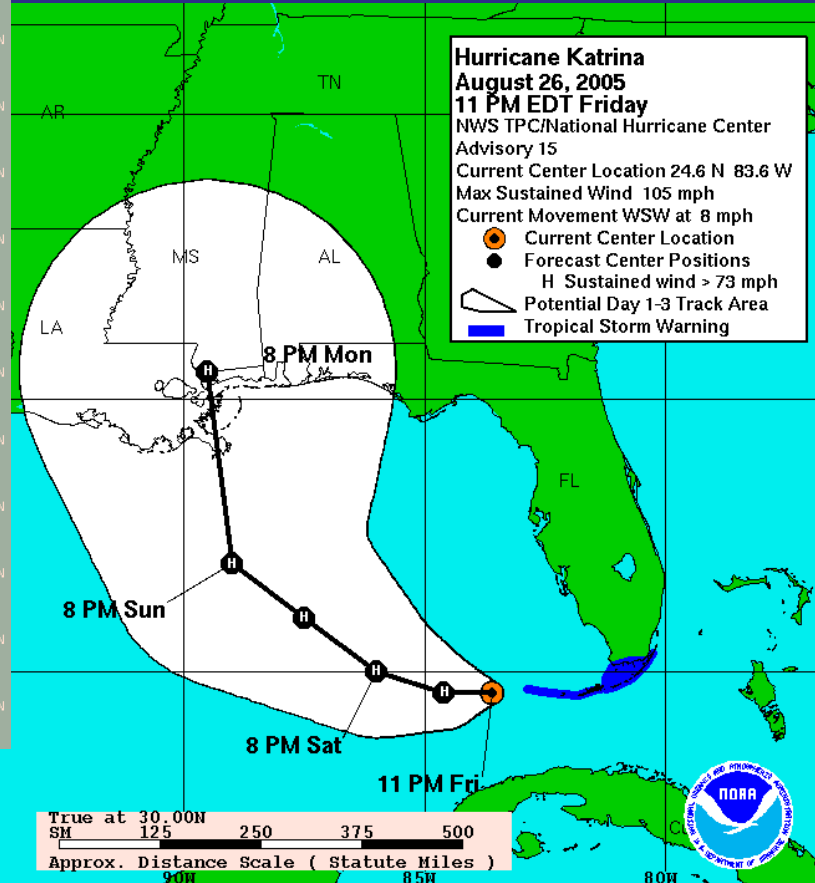
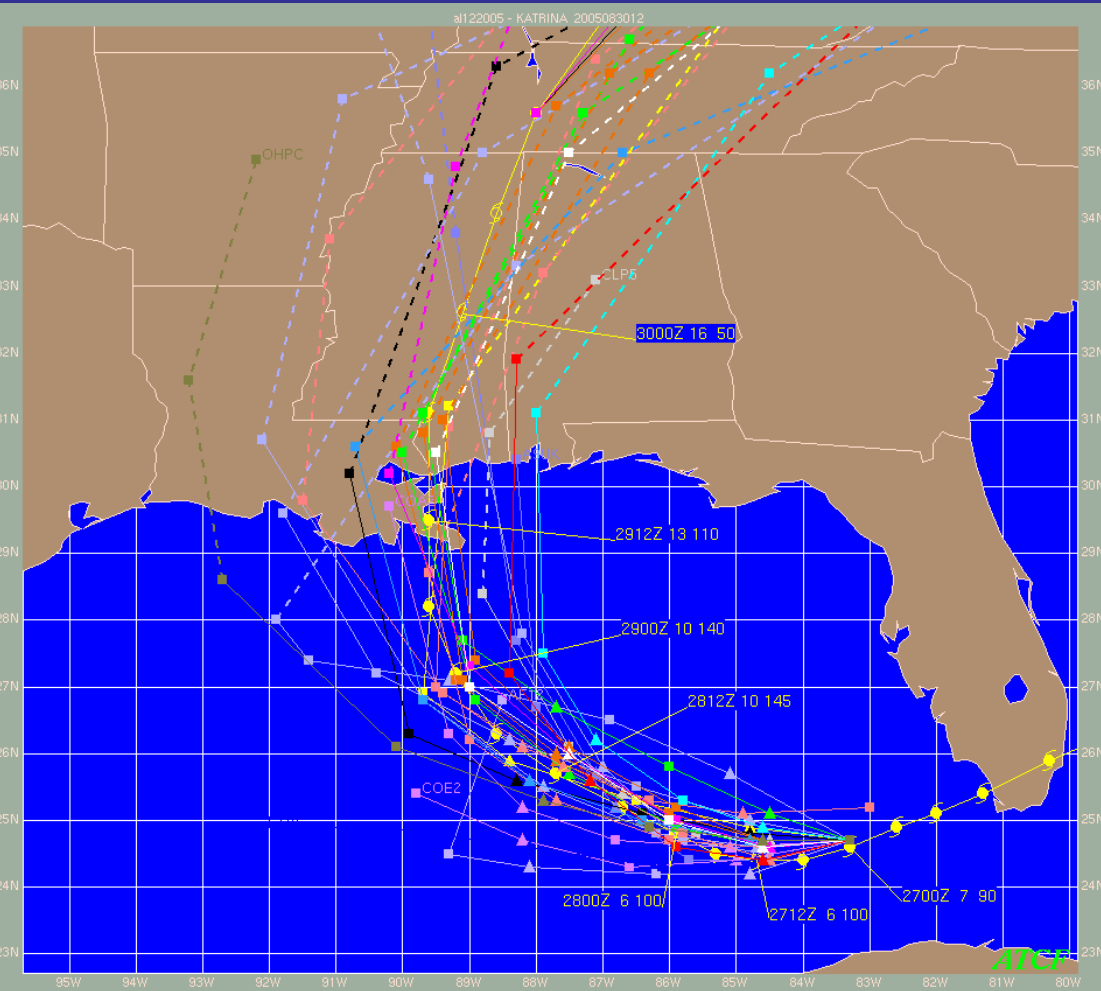
Katrina Track Forecasts

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.

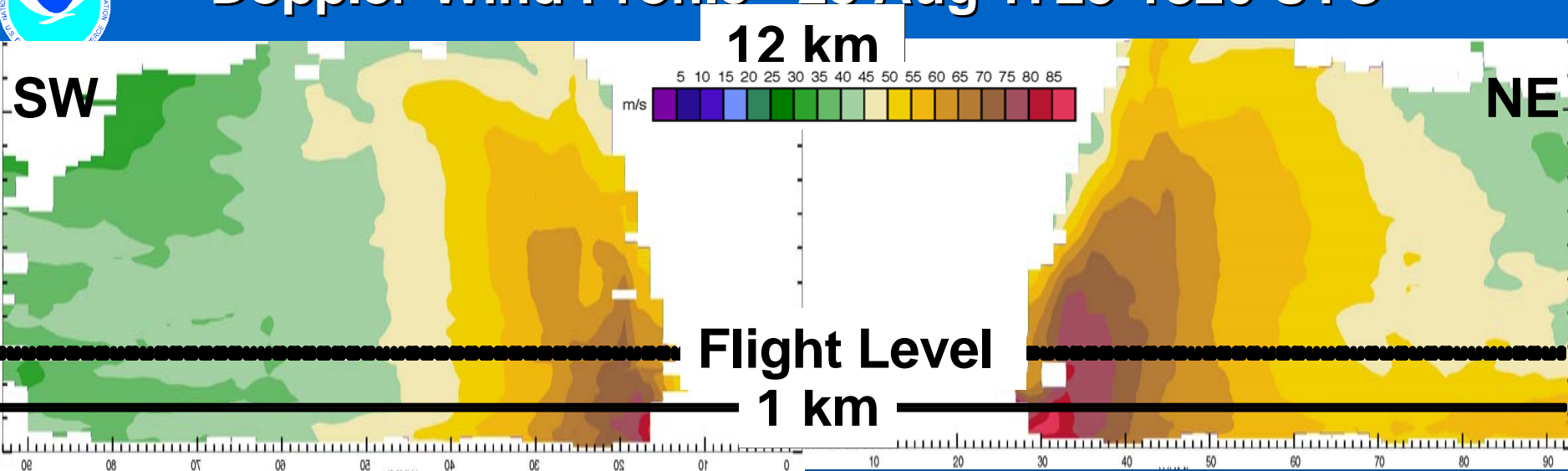


White House Photo

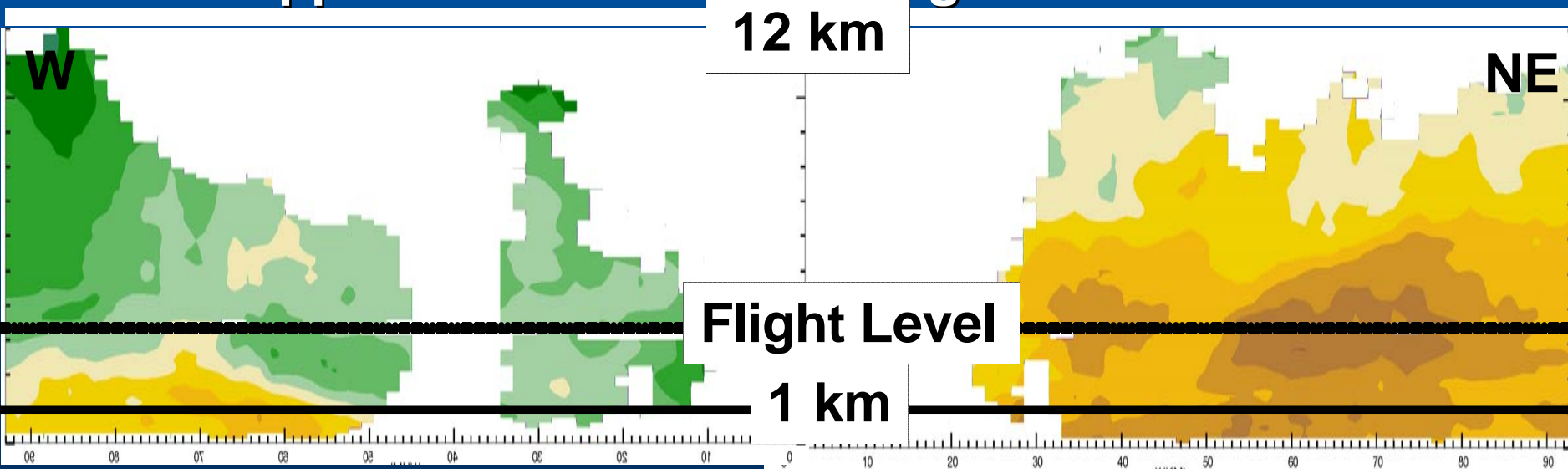
President George W. Bush is handed a map by Deputy Chief of Staff Joe Hagin, center, during a video teleconference with federal and state emergency management organizations on hurricane Katrina from his Crawford, Texas ranch on Sunday August 28, 2005.



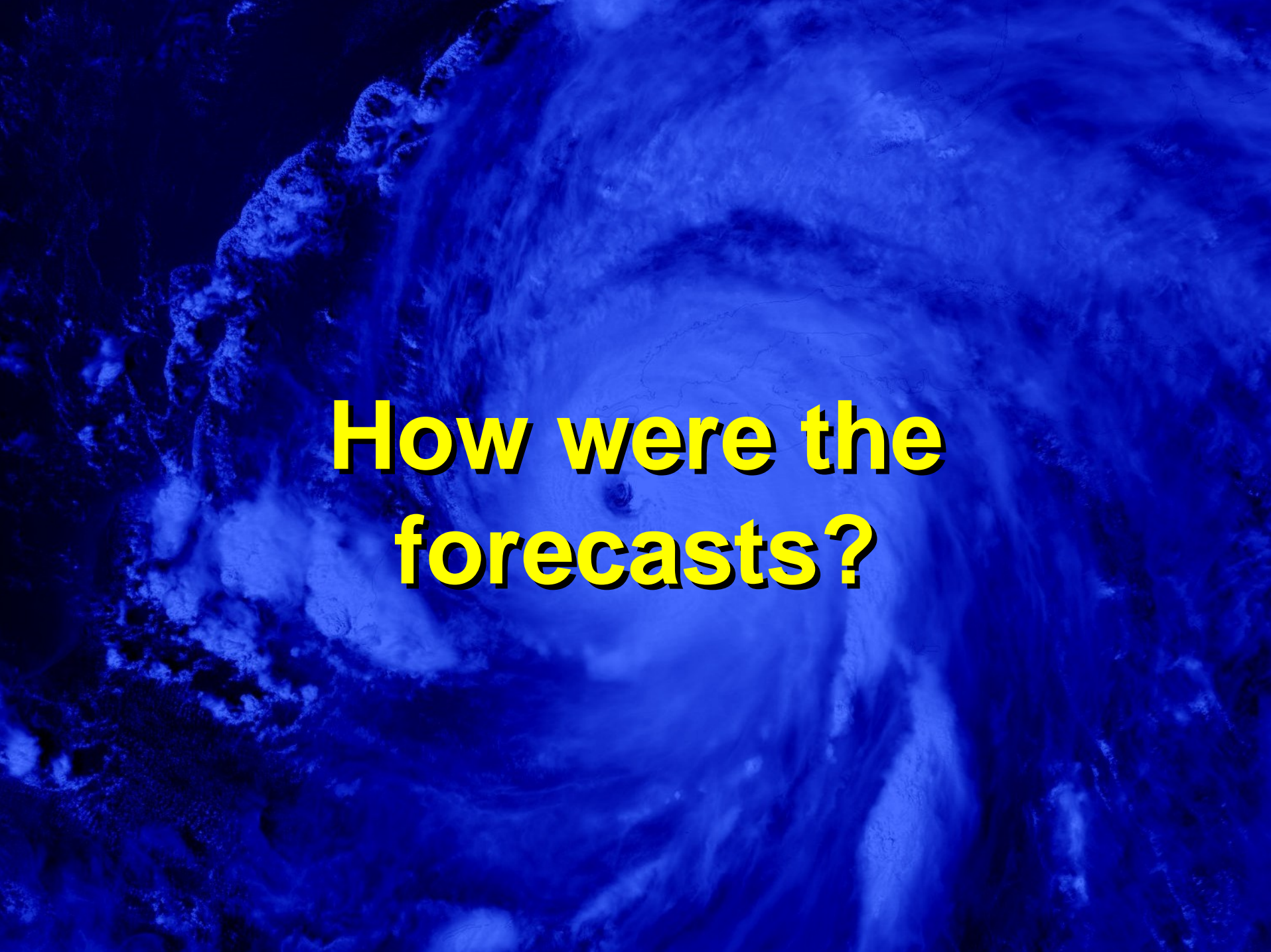
Doppler Wind Profile - 28 Aug 1725-1820 UTC



Doppler Wind Profile - 29 Aug 1000-1040 UTC



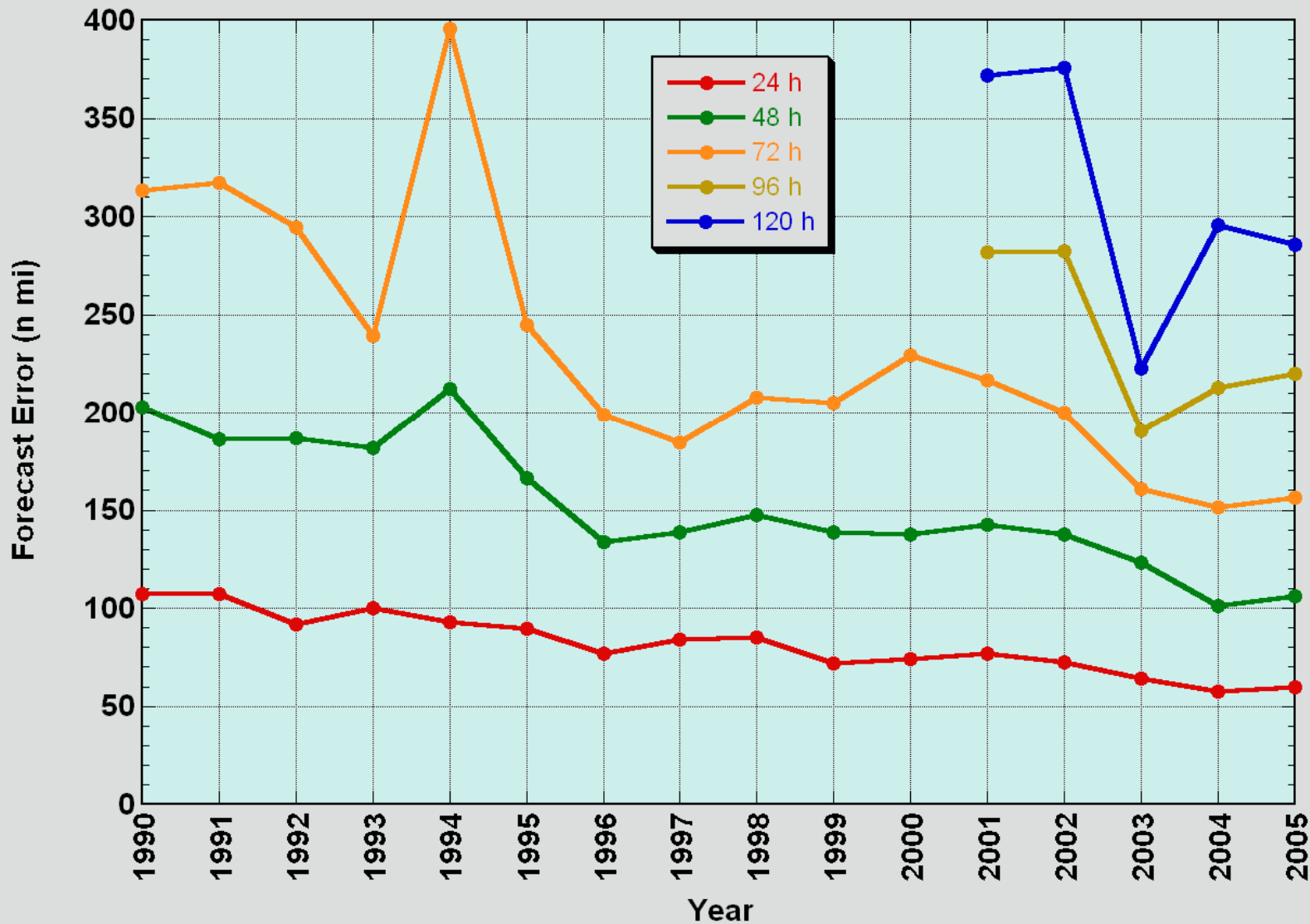
Dramatic 12-h change in Katrina Wind Profile: CAT5-CAT3



**How were the
forecasts?**

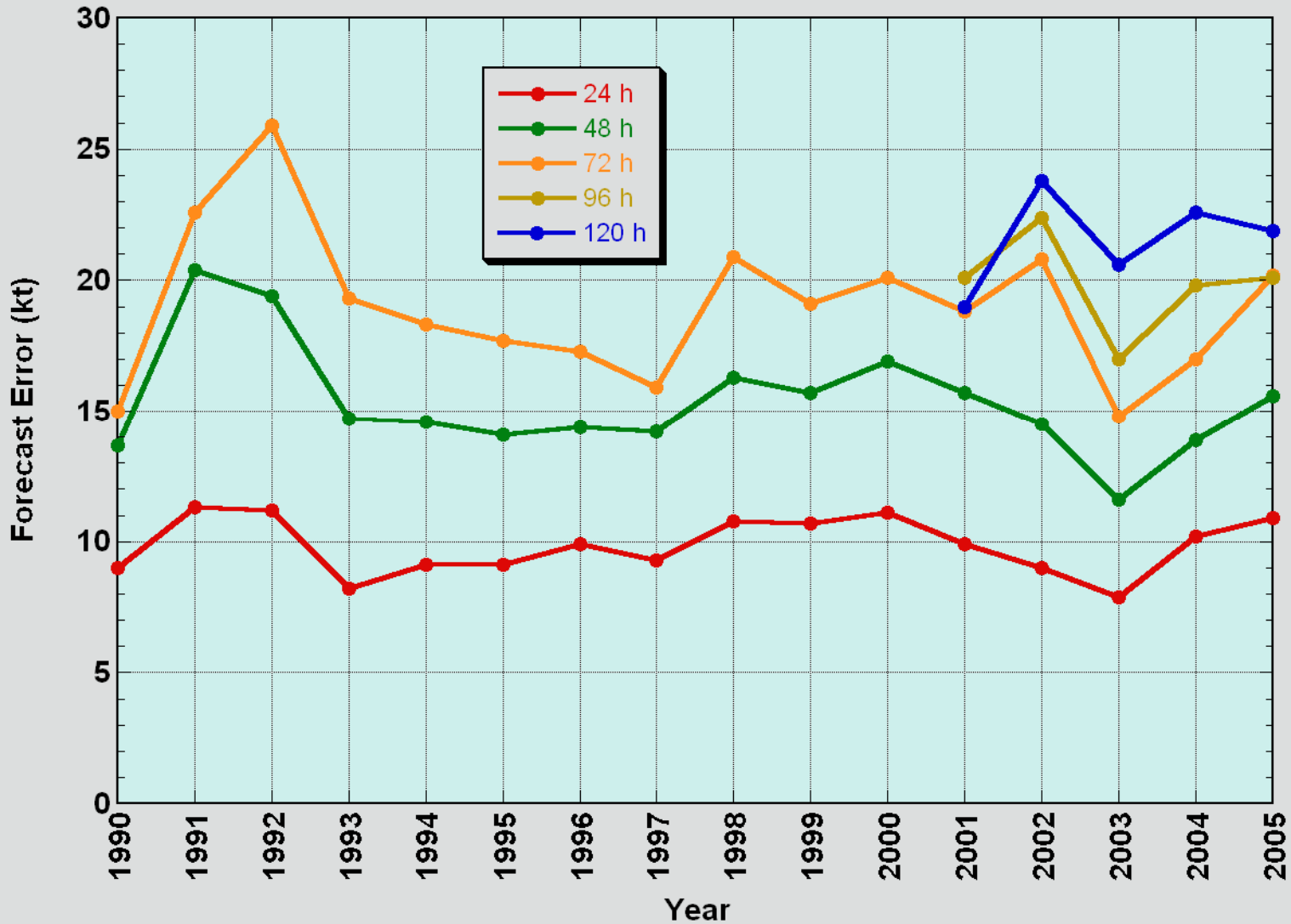
Errors cut in half in 15 years

NHC Official Track Error Trend
Atlantic Basin



No progress with intensity?

NHC Official Intensity Error Trend
Atlantic Basin





**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

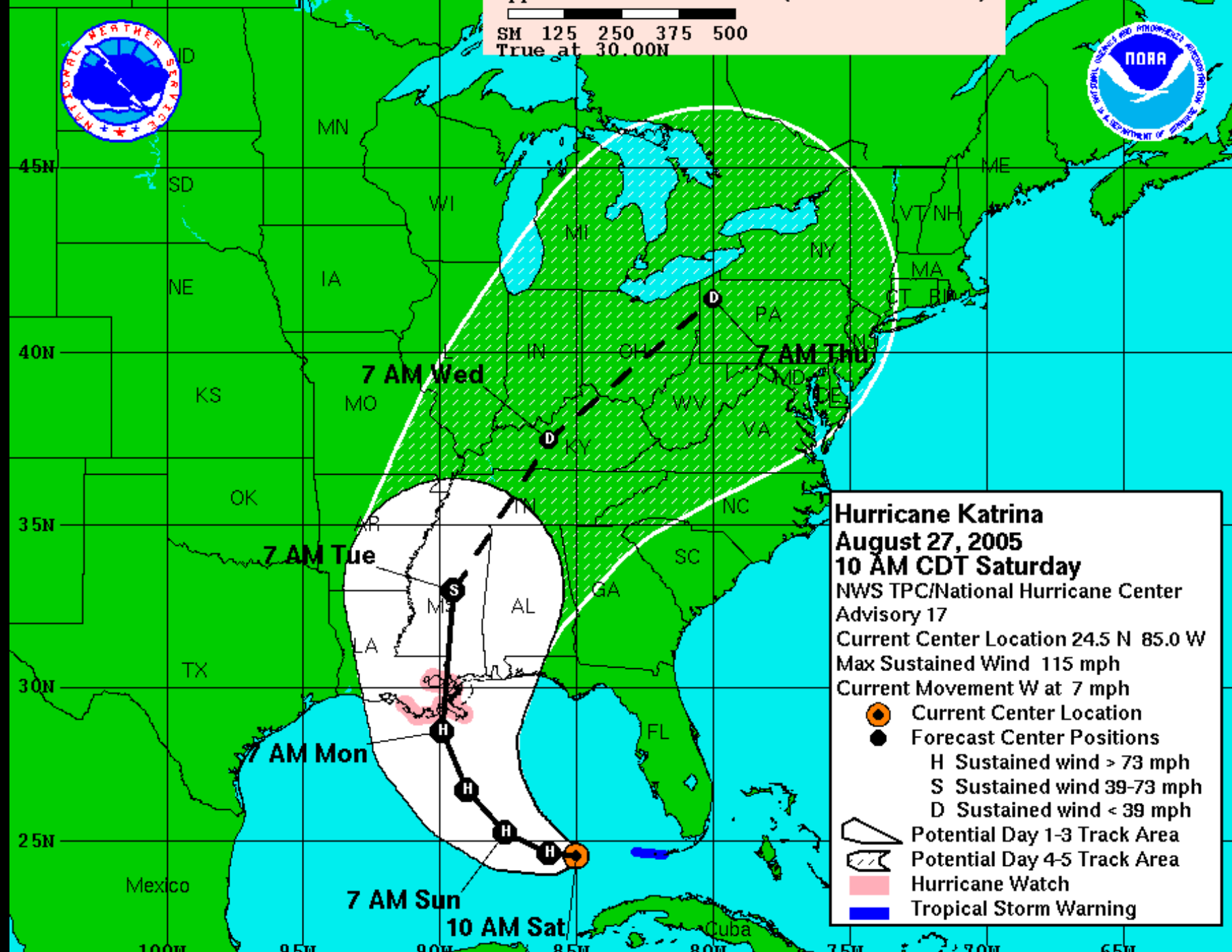
Updated January 31, 2006:

- 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. \(PDF format\)](#)

Approx. Distance Scale (Statute Miles)
 SM 125 250 375 500
 True at 30.00N

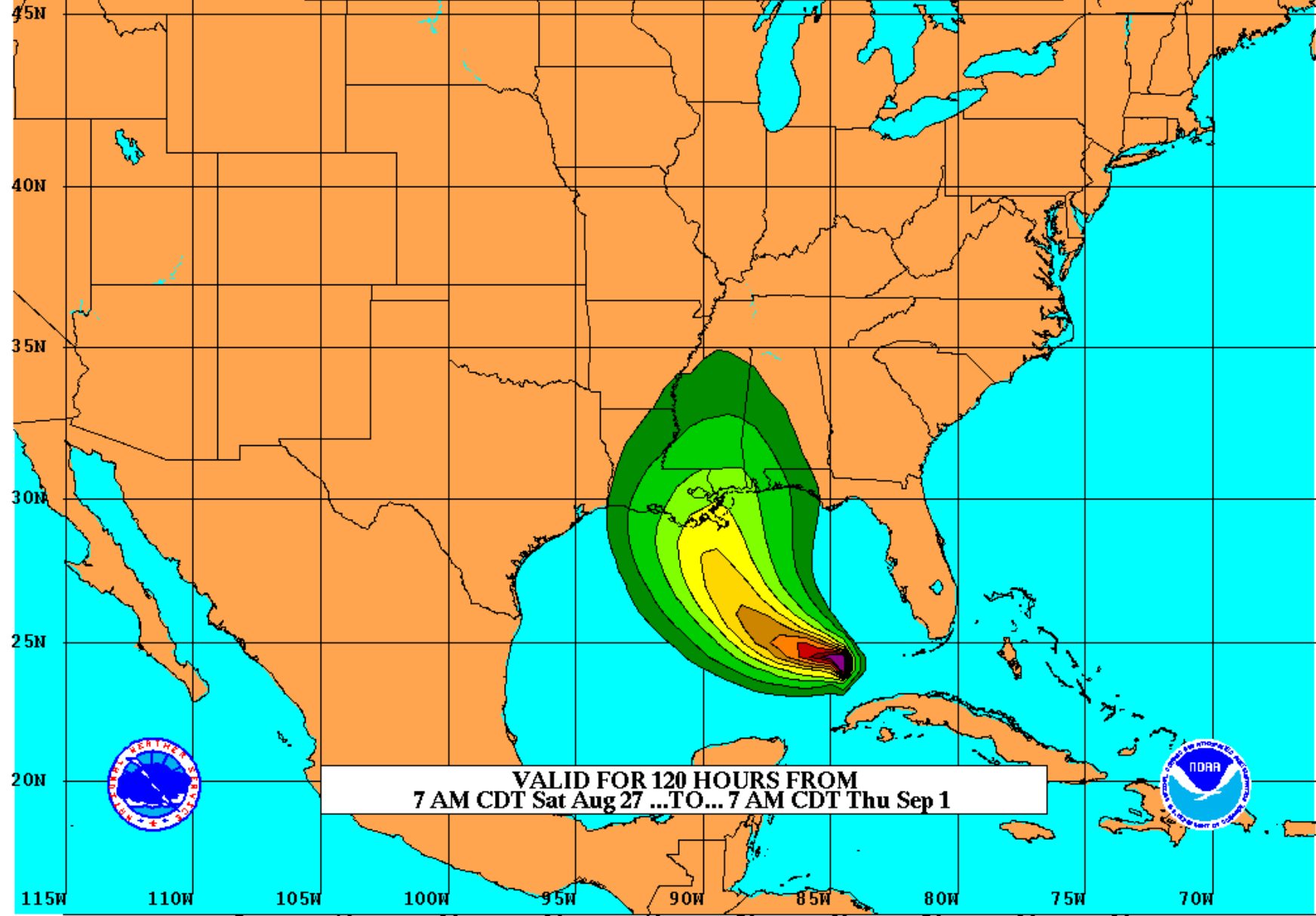


Hurricane Katrina
August 27, 2005
10 AM CDT Saturday
 NWS TPC/National Hurricane Center
 Advisory 17
 Current Center Location 24.5 N 85.0 W
 Max Sustained Wind 115 mph
 Current Movement W at 7 mph

- 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

7 AM Mon
 7 AM Tue
 7 AM Wed
 7 AM Thu
 7 AM Sun
 10 AM Sat

**EXPERIMENTAL
HURRICANE KATRINA ADVISORY #17
PROBABILITY (IN PERCENT) OF HURRICANE FORCE WINDS
WINDS AT LEAST 74 MPH**

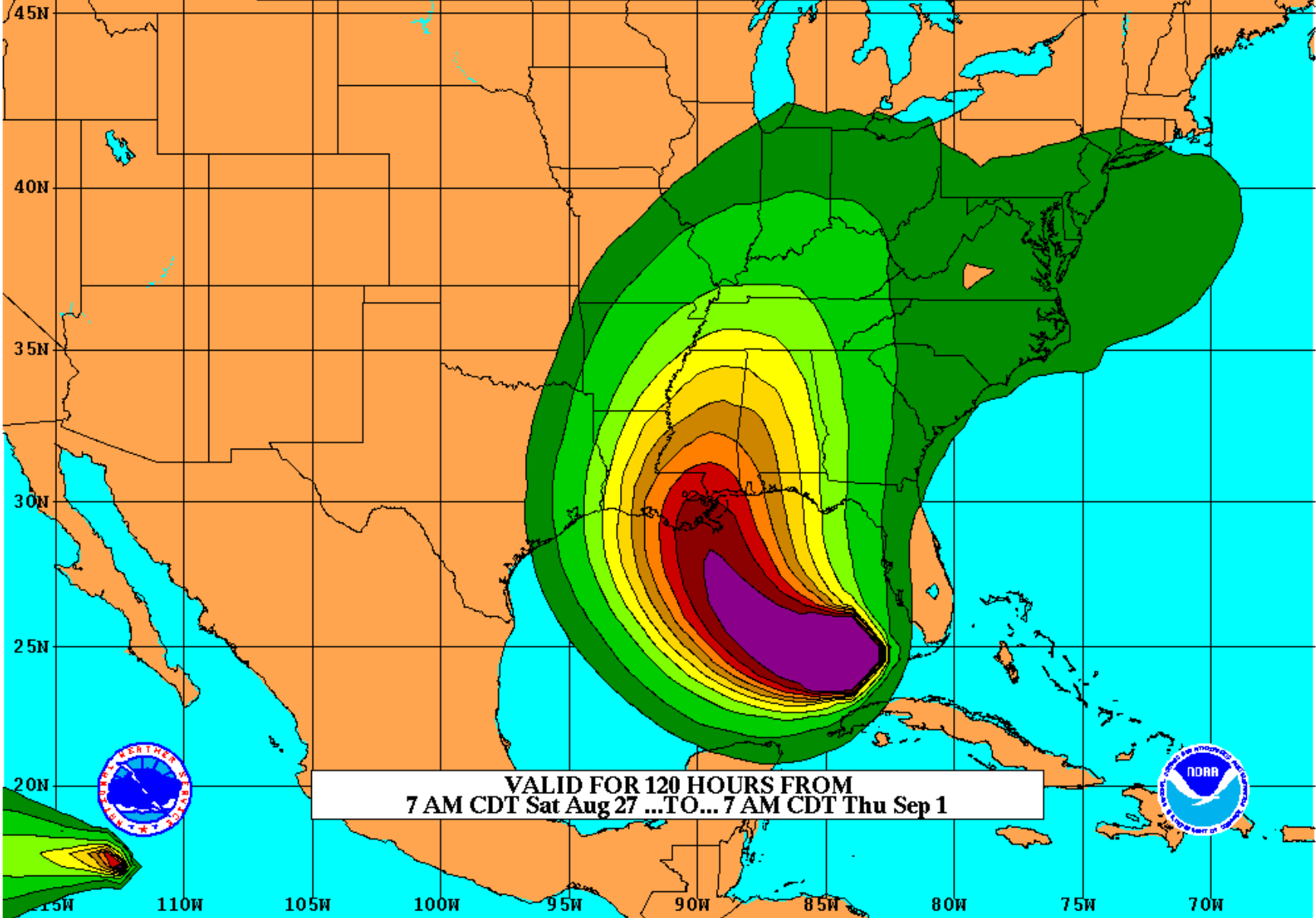


**VALID FOR 120 HOURS FROM
7 AM CDT Sat Aug 27 ...TO... 7 AM CDT Thu Sep 1**



115W 110W 105W 100W 95W 90W 85W 80W 75W 70W
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**








**VALID FOR 120 HOURS FROM
7 AM CDT Sat Aug 27 ...TO... 7 AM CDT Thu Sep 1**



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	Storm Surge	High Winds	Inland Flooding	Forecast Process	Disaster Prevention	National Day of Family Preparedness
Hurricane History	Marine Safety	Tornadoes				

Sat 27 May 2006

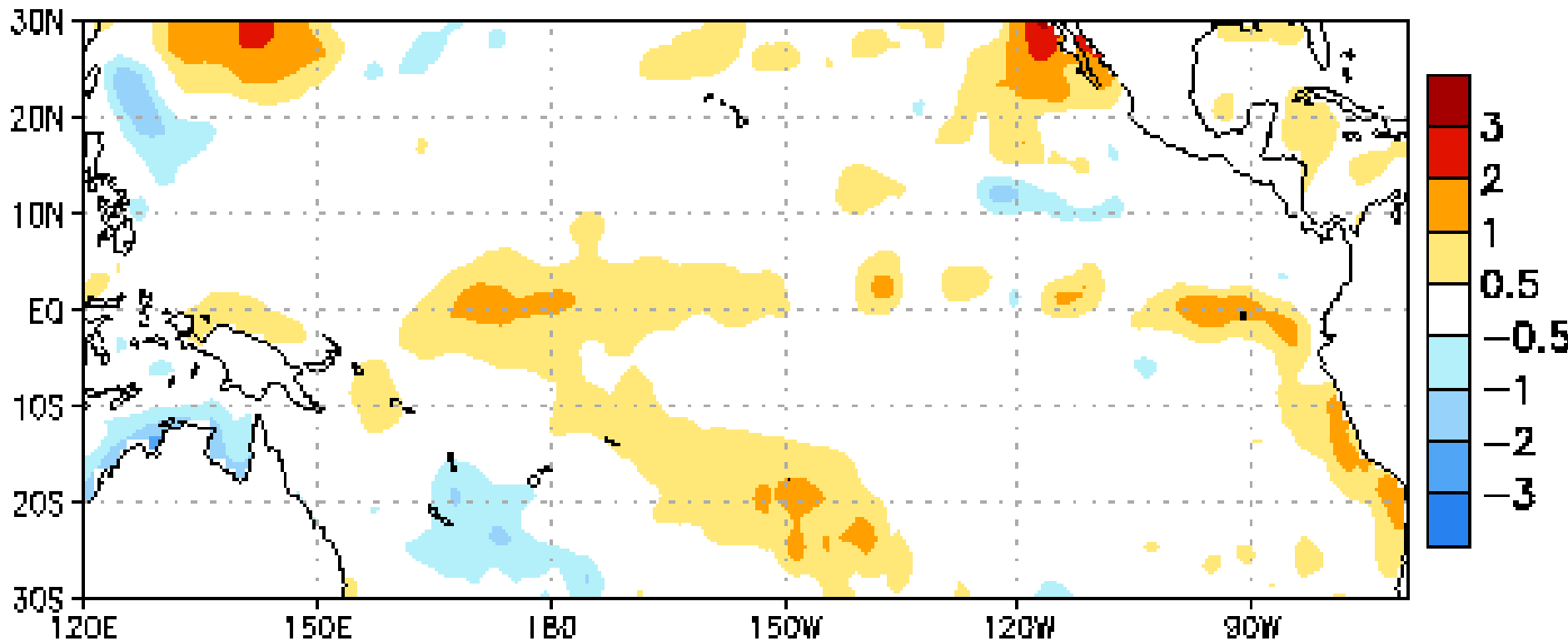
ARJW ©2006 DATE 5-24

THE
HURRICANE
SEASON
IS
NEAR!



DON'T LAUGH -
HE'S WITH
THE NATIONAL
WEATHER
SERVICE...

Week centered on 26 JUL 2006
SST Anomalies (°C)

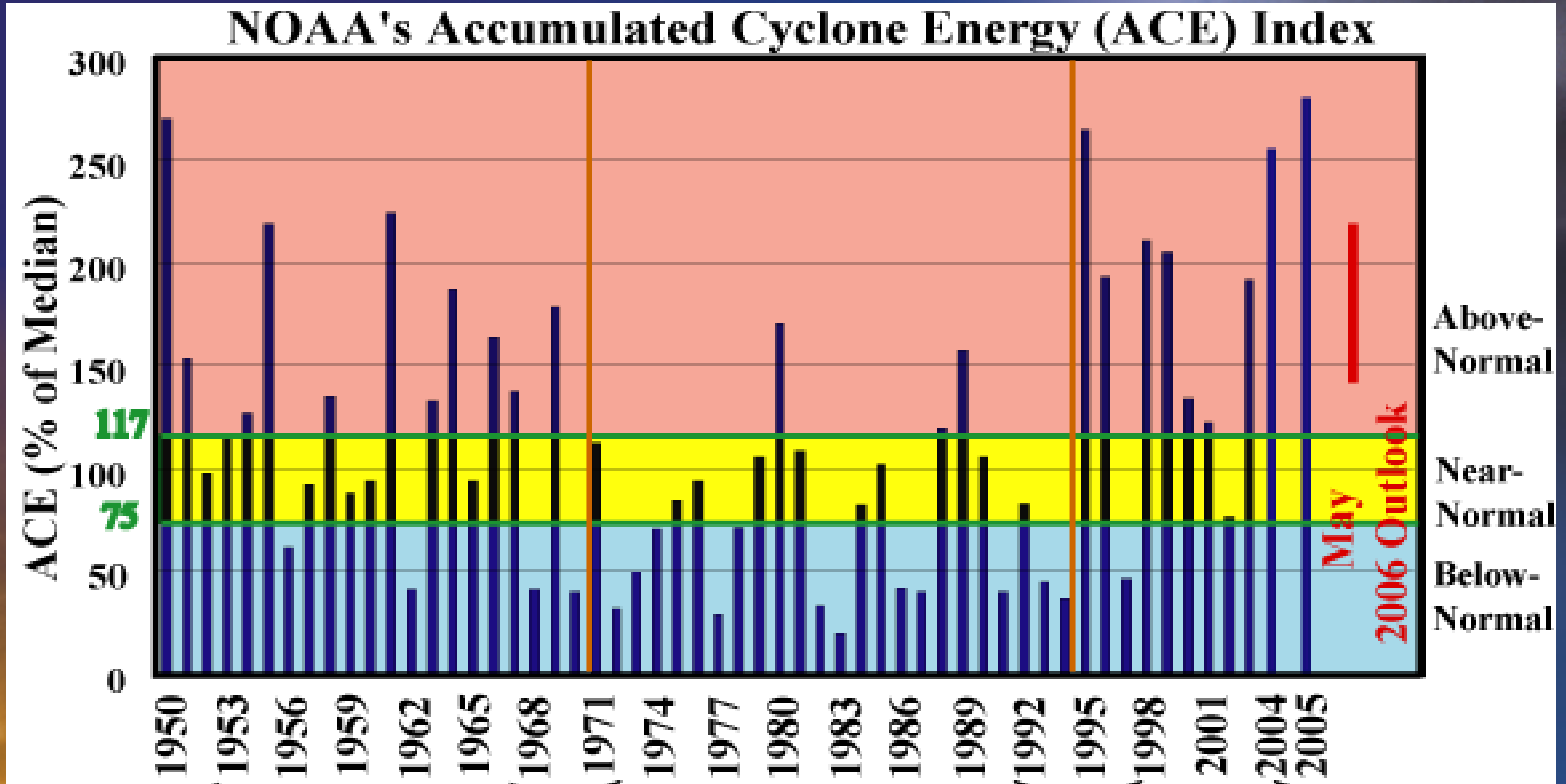




**Future
Hurricane
Activity ?**



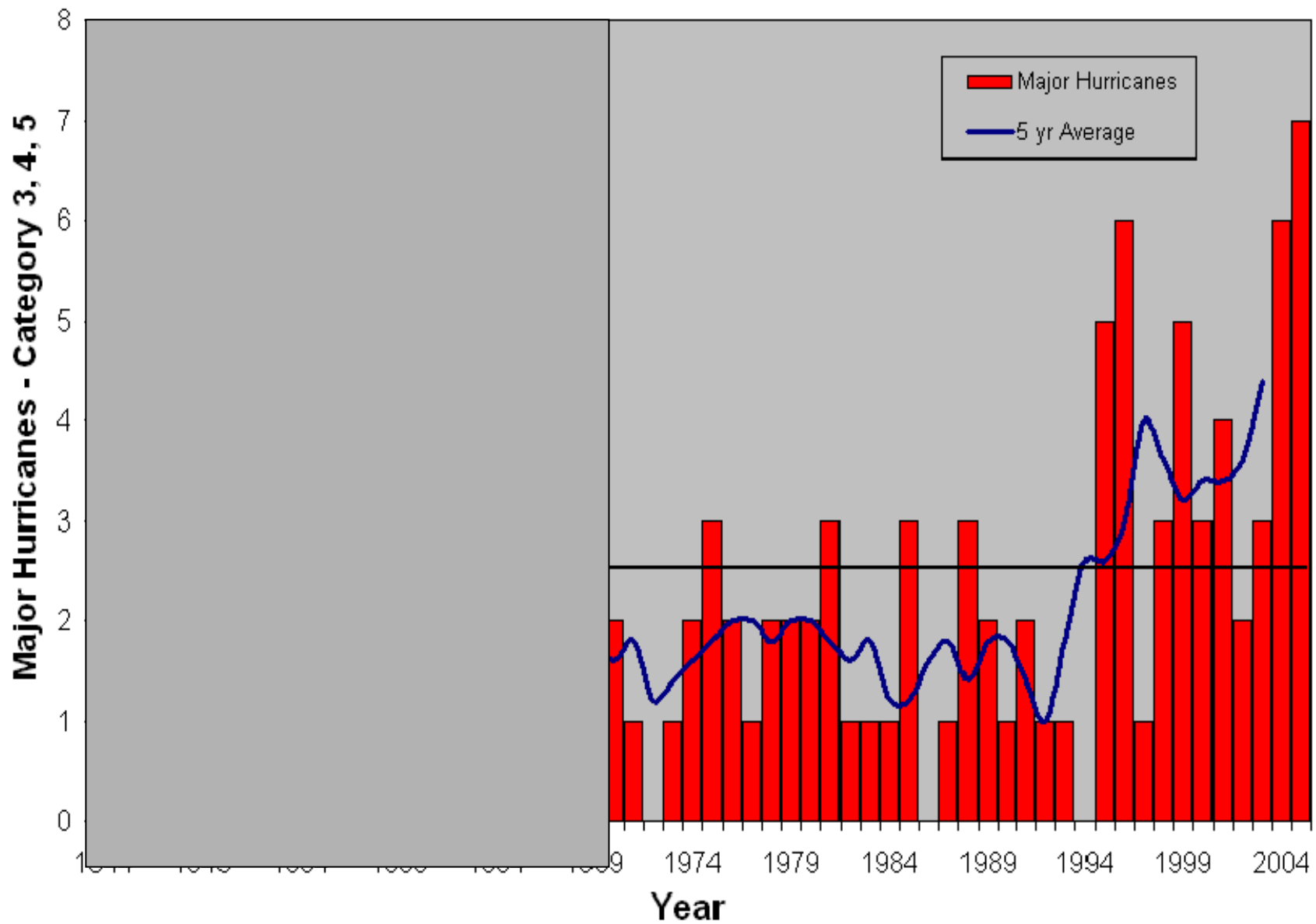
Historical Atlantic Seasonal Activity



The 2006 Atlantic hurricane outlook reflects the ongoing active Atlantic hurricane era that began in 1995.

Atlantic Major Hurricanes

1944 to 2005



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.