



**Federal Emergency Management Agency
Florida Division of Emergency
Management**



G-363

**Hurricane Readiness—Coastal
Communities**





Unit 1: Course Introduction

- ◆ Administrative Details
- ◆ Activity: Getting to Know Each Other
- ◆ Course Overview





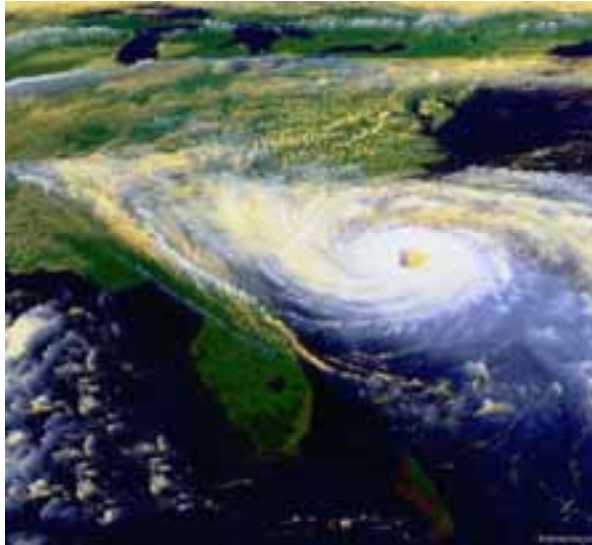
Administrative Details

- ◆ Start and end times each day
- ◆ Lunch and other breaks
- ◆ Restroom and telephone locations
- ◆ Emergency exits
- ◆ Smoking policy
- ◆ Pager/cell phones on silent



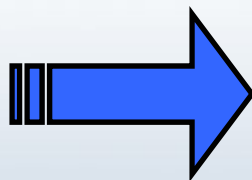


Course Background



Hurricane Readiness Challenges:

- ◆ Areas are vulnerable to hurricanes
- ◆ Population is growing and seasonal
- ◆ Population is not experienced with hurricanes
- ◆ Forecasting technology has limitations
- ◆ Hurricanes are not just a coastal problem



Elected and emergency management officials must make critical decisions to save lives and protect property.





Course Goal

Develop a **Hurricane Readiness Checklist** that covers tasks to be accomplished within your functional areas.



The checklist should also address internal and external communication and coordination issues required for effective operation.





Course Objectives

1. Explain the hazards associated with a hurricane for their local areas.
2. Use National Weather Service (NWS) advisory products to determine the level of threat that an approaching storm poses.
3. Describe technical information from Hurricane Evacuation Studies (HES), HURREVAC, and other sources that can be used when developing or evaluating an integrated and comprehensive hurricane action plan for local jurisdictions.





Course Objectives (continued)

4. Describe the communication and coordination efforts needed within a jurisdiction, with other jurisdictions and agencies, and with the state throughout the hurricane action planning process.
5. Develop a Hurricane Readiness Checklist as a guide for time-phased actions.
6. Identify community/individual performance needs and the training needed to meet them.





Course Agenda

Day 1

- ◆ Unit 1: Introduction
- ◆ Unit 2: Hurricane Readiness
- ◆ Unit 3: Hurricanes and Hazards
- ◆ Unit 4: Pre-Season Readiness
- ◆ Unit 5: Hurricane Evacuation Studies
- ◆ Unit 6: Monitoring the Storm





Course Agenda

Day 2

- ◆ Unit 7: Evacuation Decision Considerations
- ◆ Unit 8: Hurricane Readiness Checklist
- ◆ Unit 9: Re-entry
- ◆ Unit 10: Conclusion





Course Materials

- ◆ Participant Guide
- ◆ Hurricane Readiness Checklist





Unit 2: Hurricane Readiness

- ◆ Overview of Sequence of Actions
- ◆ Key Individuals and Agencies
- ◆ Activity 2:1—Hurricane Readiness—Coastal Communities
- ◆ Lessons Learned





Unit 2: Objectives

At the conclusion of this unit, participants should be able to:

- ◆ Explain the acronyms, terms, and definitions relevant to this unit;
- ◆ Describe the components of a Hurricane Readiness Checklist;
- ◆ List the key emergency management positions, agencies, and organizations responsible for the development and implementation of the Emergency Operations Plan;
- ◆ Identify the roles and responsibilities for each of the individuals and/or agencies; and
- ◆ Identify the Emergency Support Functions (ESFs) involved in hurricane decision-making and protective actions.





Hurricane Readiness Checklist

- ◆ Comprehensive guide to direct hurricane preparedness and decision-making both pre- and post-storm
- ◆ Decision/Actions are effective if based on an understanding of tropical cyclones, their hazards, community vulnerabilities, NWS forecast products, and a good decision-making process
- ◆ Public and private involvement is essential





Hurricane Readiness Checklist

The Hurricane Readiness Checklist should be community-specific:

- ◆ The checklist should be time-sequenced
- ◆ Identify responsible agencies or officials for each task
- ◆ Evaluate priority of actions to be addressed





Phases of the HRC

- ◆ Hurricane Readiness Checklists are structured around the following phases:
 - Pre-season and preparedness
 - Monitoring
 - Protective actions (evacuate or stay...)
 - Post-storm actions
 - Re-entry





Importance of the HRC

Why is a Hurricane Readiness Checklist important?





Importance of the HRC

- ◆ Prompts for timely action
- ◆ Supports decision/action-making accountability
- ◆ Structures documentation
- ◆ Ensures coordination and communication





Key Individuals and Agencies

Who should be involved in the HRC development?





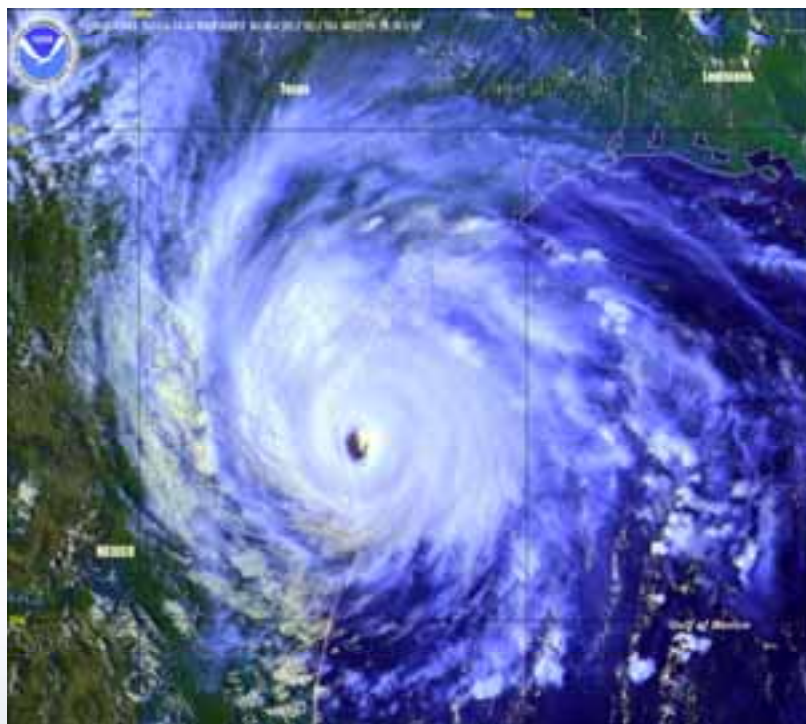
Unit 3: Hurricanes and Hazards

- ◆ Hazards
- ◆ Potential Effects of a Tropical Storm or Hurricane
- ◆ Precautions for each Tropical Storm System Threat Level
- ◆ Activity 3:1—Assessing Hurricanes and Hazards
- ◆ Lessons Learned



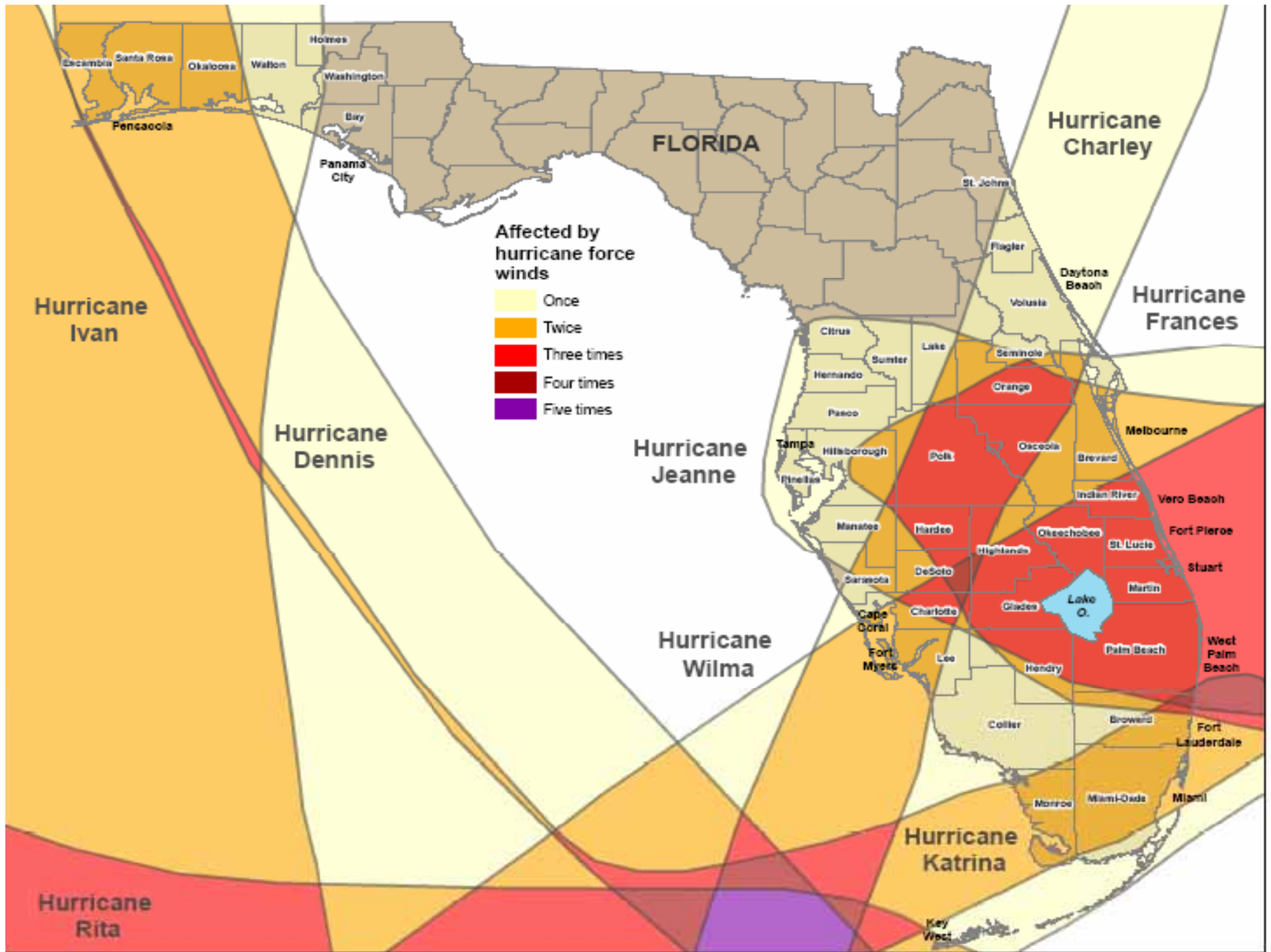


Hurricanes and Hazards



- ◆ Average of 11 tropical storms each year; 6 of these become hurricanes, of which 2 become major hurricanes.
- ◆ About 5 hurricanes strike the U.S. coastline in an average three-year period. Landfalling hurricanes normally cause billions in damages.





125° 120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65° 60° 55° 50° 45° 40° 35° 30° 25° 20° 15° 10° 5° 0° 5° 10°

Preliminary North Atlantic Tropical Storms and Hurricanes of 2008

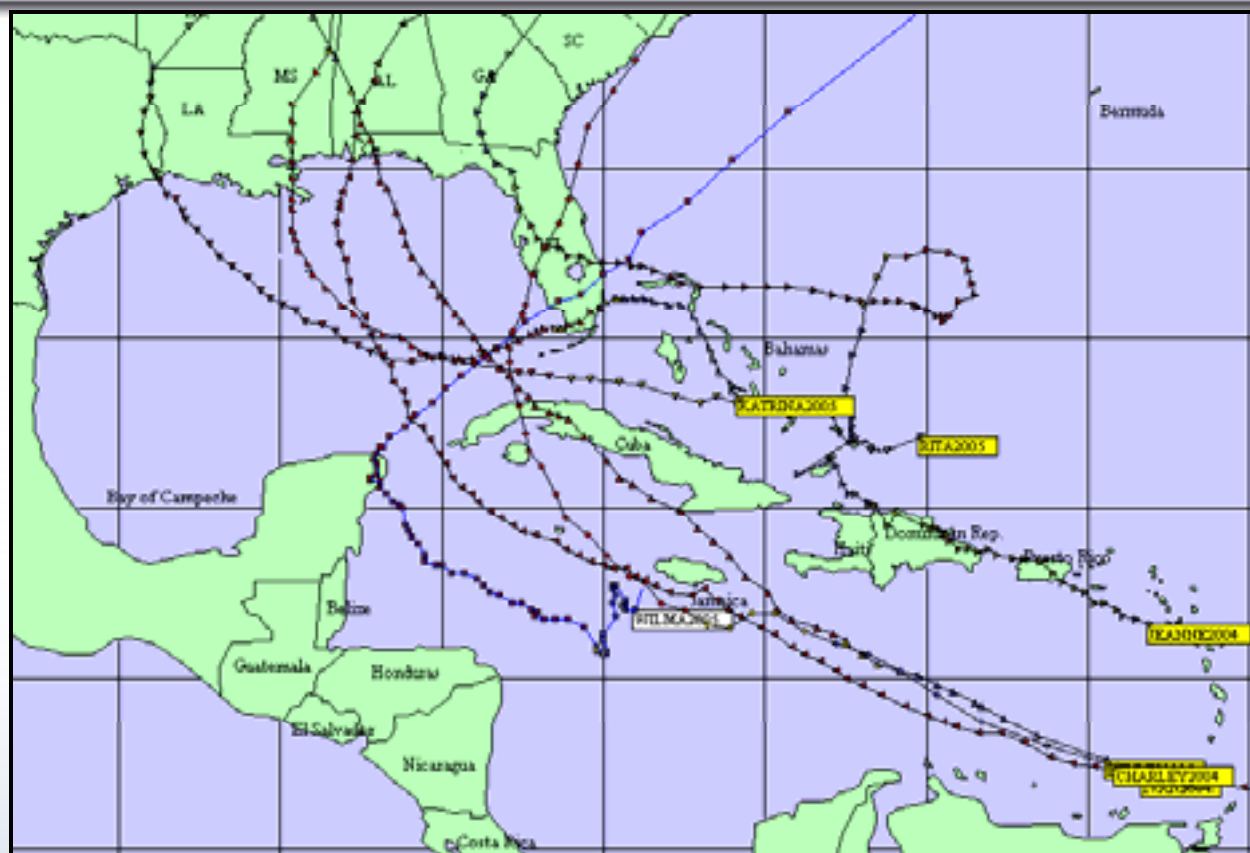


95° 90° 85° 80° 75° 70° 65° 60° 55° 50° 45° 40° 35° 30° 25°



Major U.S. Hurricane Strikes 2004-2005, Winds > 110 MPH

1. Charley – CAT 4
2. Ivan – CAT 3 (5)
3. Jeanne – CAT 3
4. Dennis – CAT 3 (4)
5. Katrina – CAT 3 (5)
6. Rita – CAT 3 (5)
7. Wilma – CAT 3 (5)



Two CAT 4 and Five CAT 3 struck U.S. Mainland



Major Hurricanes, 2006-2008 Winds > 110 MPH

1. **Gordon – CAT 3**
2. **Helene – CAT 3**
3. **Dean – CAT 5**
4. **Felix – CAT 5**
5. **Bertha – CAT 3**
6. **Gustav – CAT 4**
7. **Ike – CAT 4**
8. **Omar – CAT 4**
9. **Paloma – CAT 4**



Gustav and Ike made landfall as CAT 2 Hurricanes.



2005-2008 Hurricane Seasons

	Normal	2005	2006	2007	2008
Named Storms	11	*28	*10	15	16
Hurricanes	6	15	5	6	8
Major Hurricanes (winds >110 mph)	2	7	2	2	5

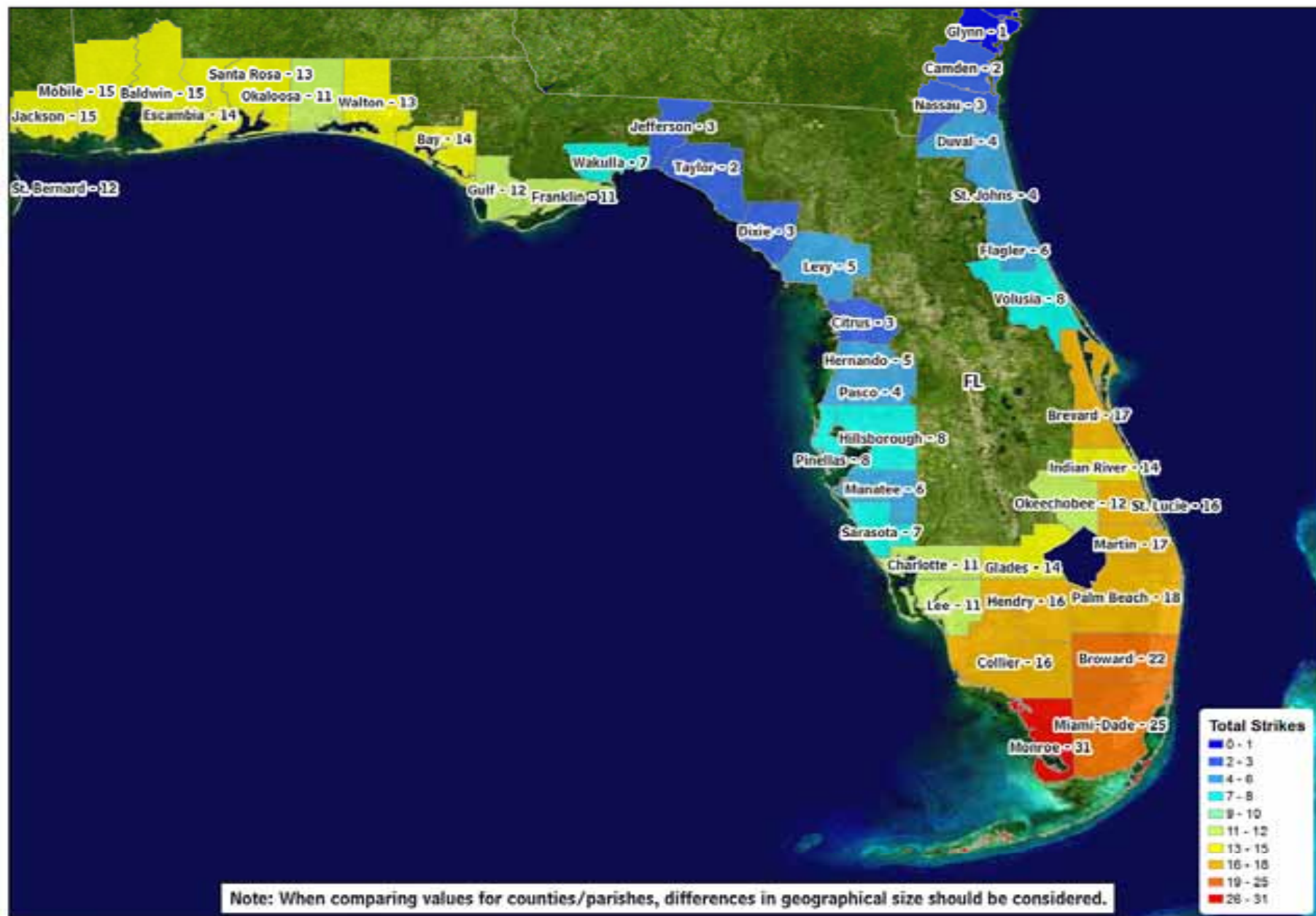
*Post-season analysis identified one additional tropical cyclone during the 2005 and 2008 seasons. These storms were unnamed.



Tropical Cyclone History

Data from 1949 in the Pacific, from 1851 in the Atlantic

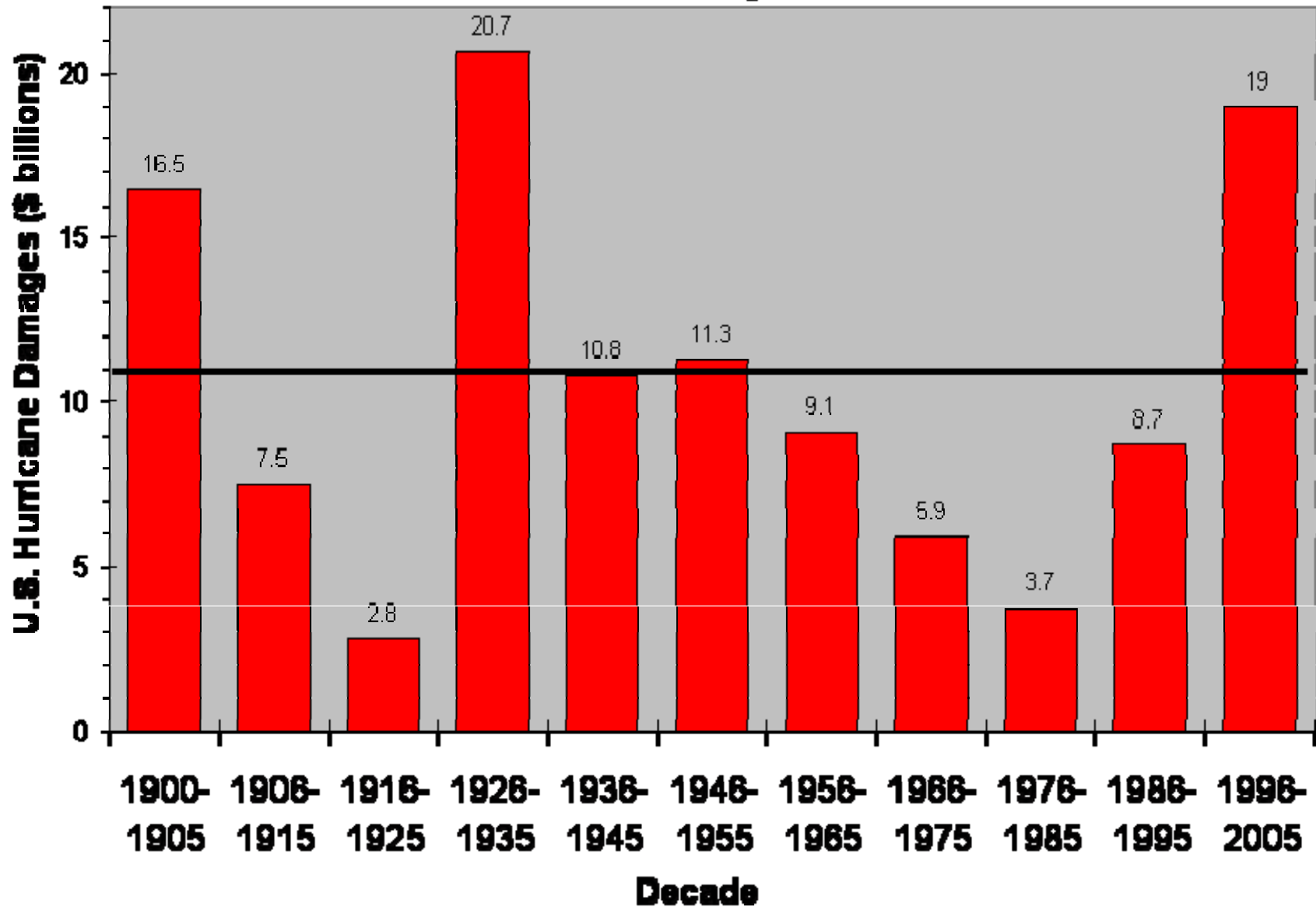




Total number of hurricane strikes by counties/parishes, 1900-2007

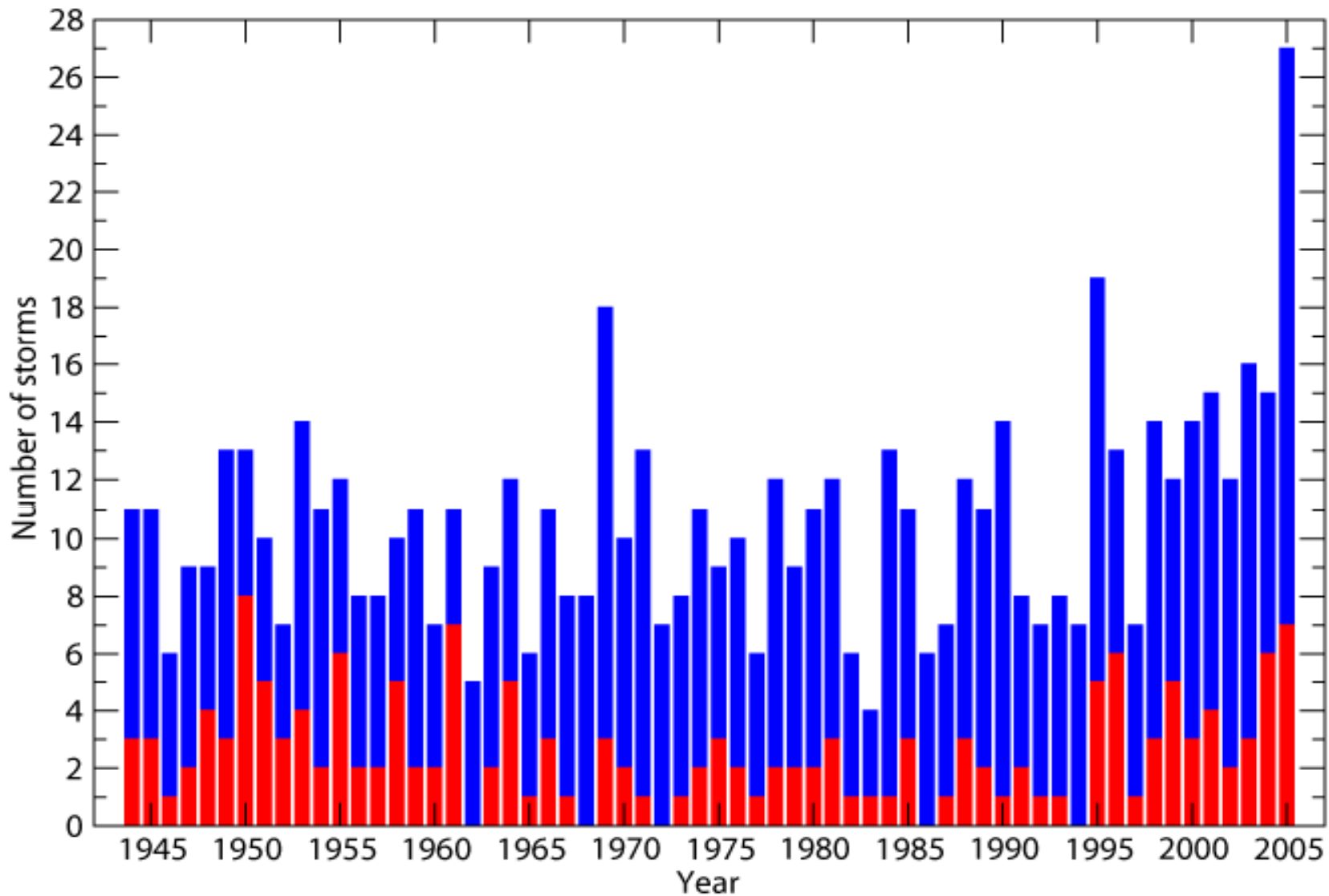
Data from NWS NHC 46: Hurricane Experience Levels of Coastal County Populations from Texas to Maine. Jerry D. Jarrell, Paul J. Hebert, and Max Mayfield, August, 1992, with updates.

U.S. Tropical Storm and Hurricane Damages \$BILLIONS Annually - Normalized



Annual Number of Named Storms and Major Hurricanes

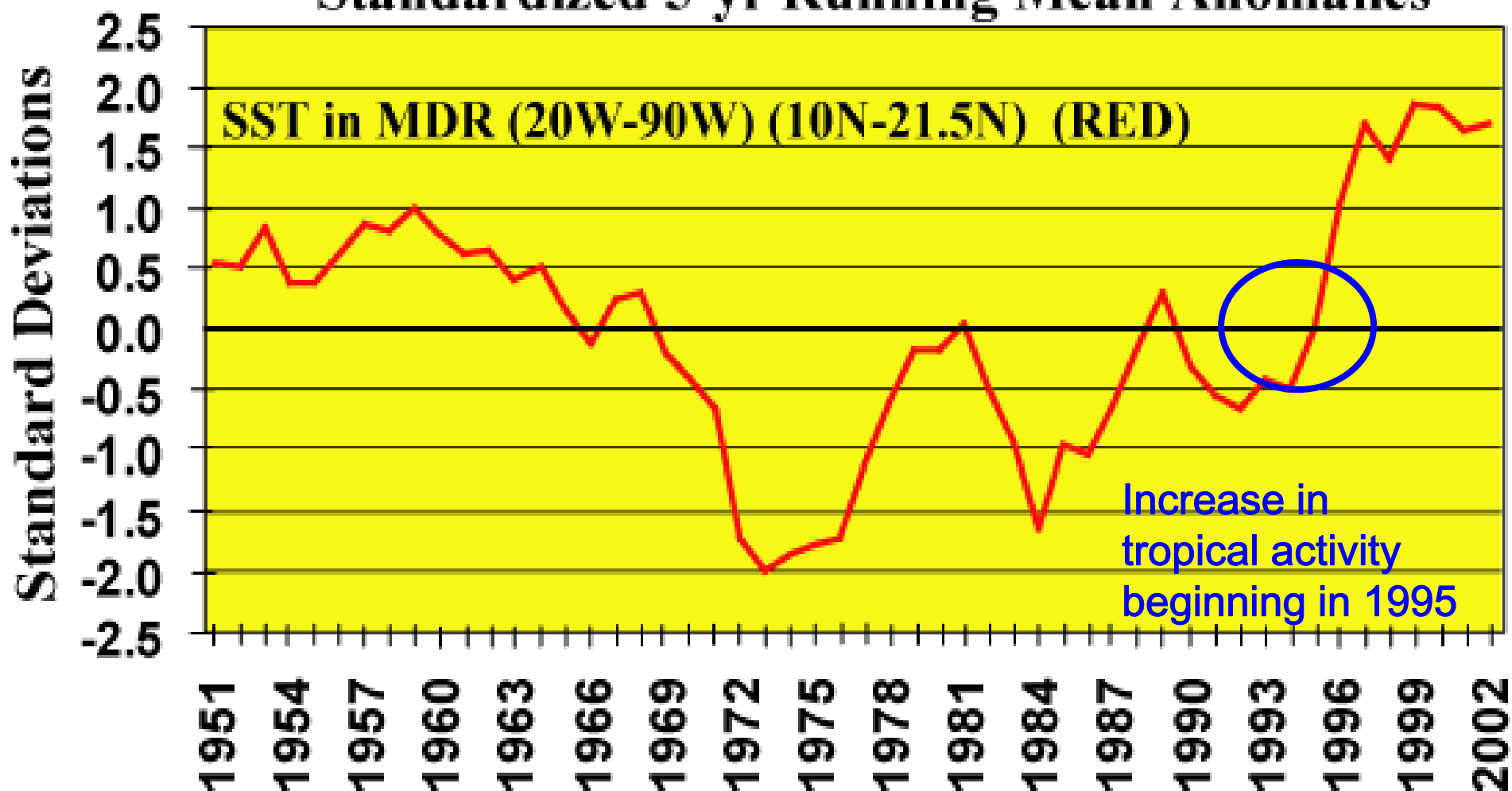
Atlantic, 1944-2005





Main Development Region Sea Surface Temperature Anomalies since 1951

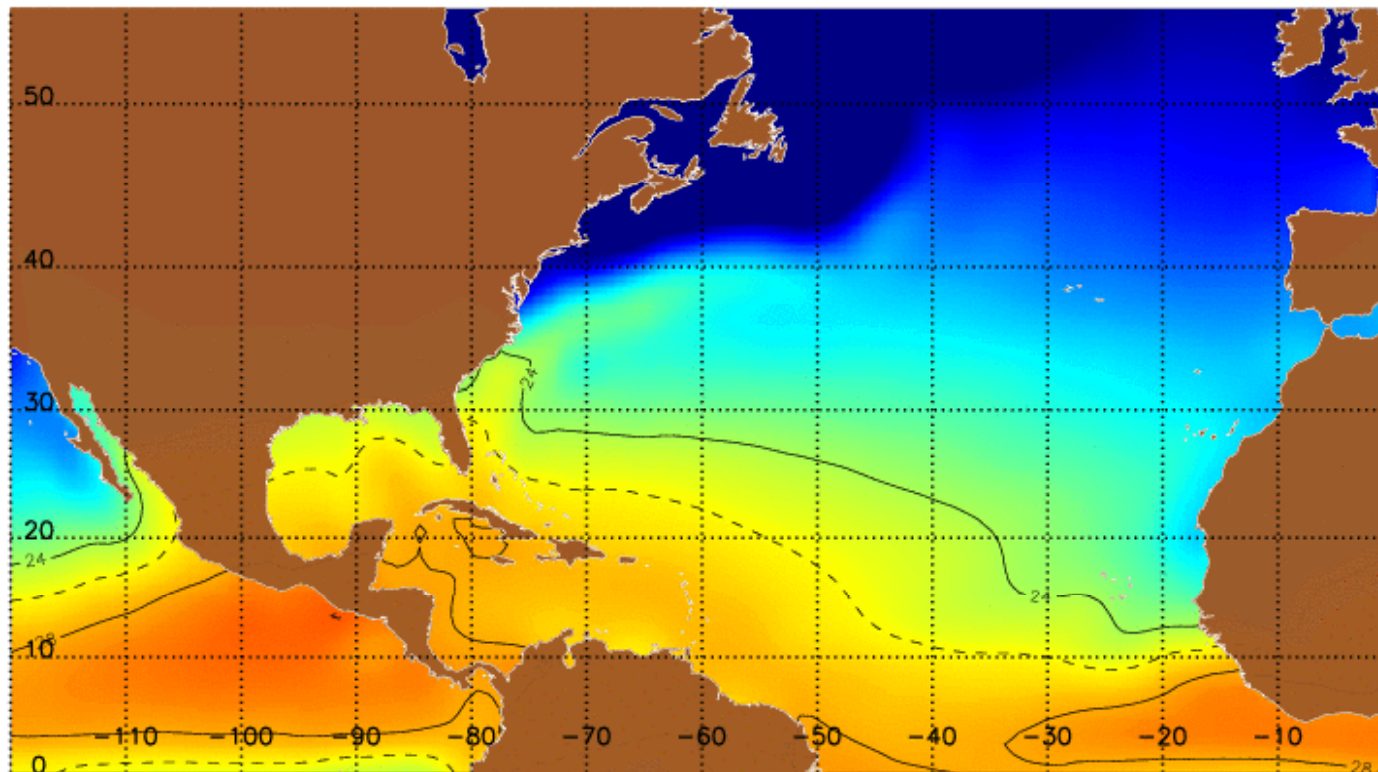
Standardized 5-yr Running Mean Anomalies



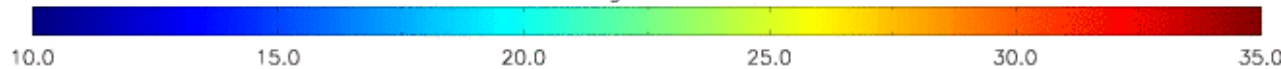


Average Sea Surface Temps - May

National Hurricane Center (NCEP/NWS/NOAA)



(1971–2000) Reynolds SST monthly mean for MAY
degrees °C

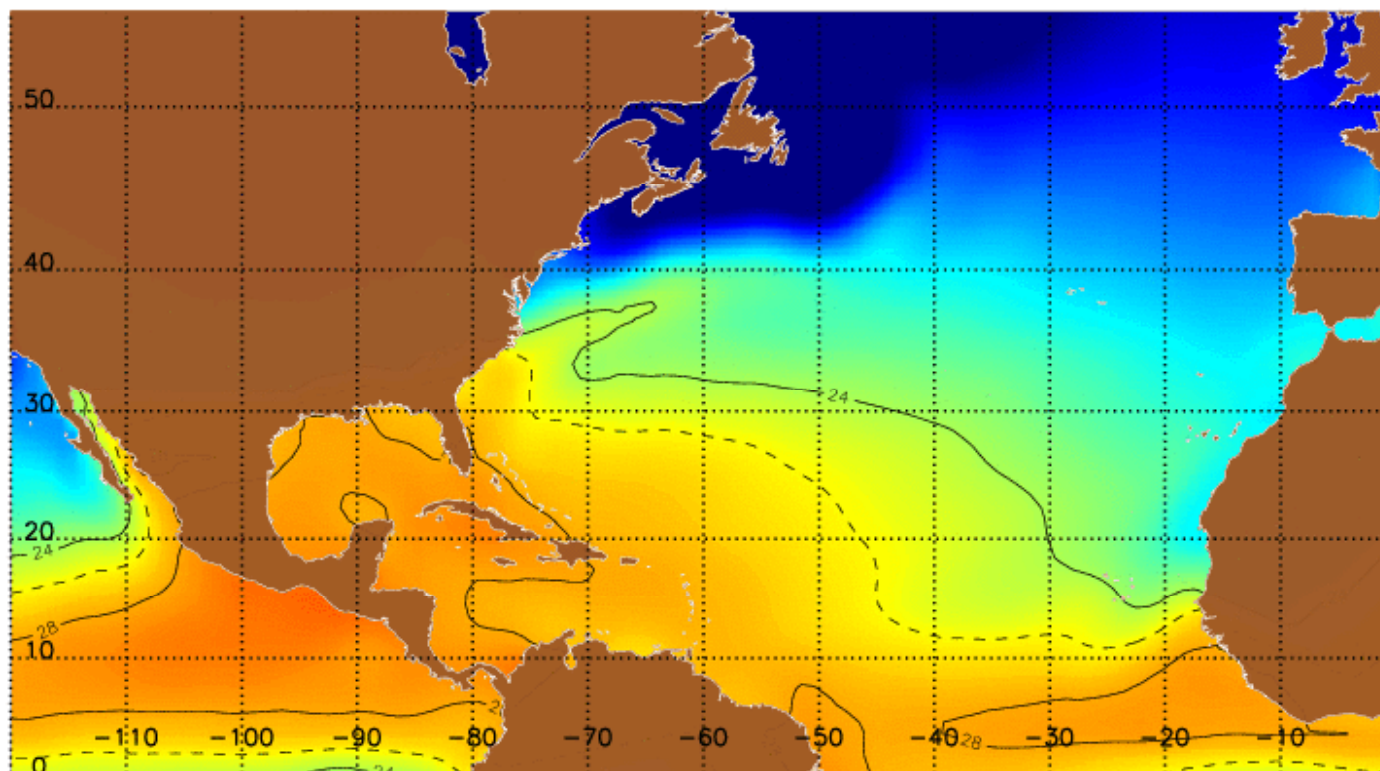


source: CPC/NCEP/NOAA



Average Sea Surface Temps - June

National Hurricane Center (NCEP/NWS/NOAA)



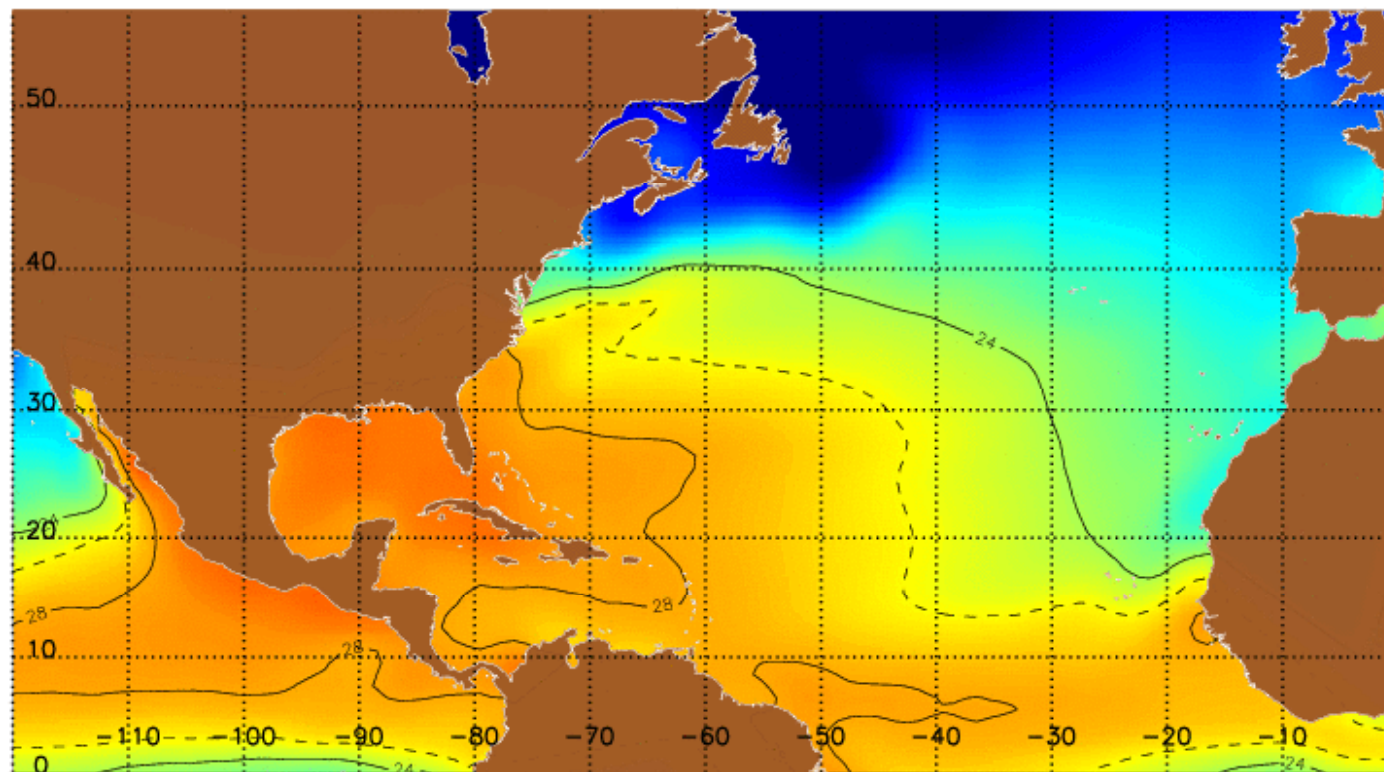
(1971–2000) Reynolds SST monthly mean for JUNE
degrees °C





Average Sea Surface Temps - July

National Hurricane Center (NCEP/NWS/NOAA)



(1971–2000) Reynolds SST monthly mean for JULY
degrees °C



Multi-Decadal Cycles



1905-32
28 years
47 Majors
1.68 MH/yr



1933-64
33 years
89 Majors
2.0 MH/yr



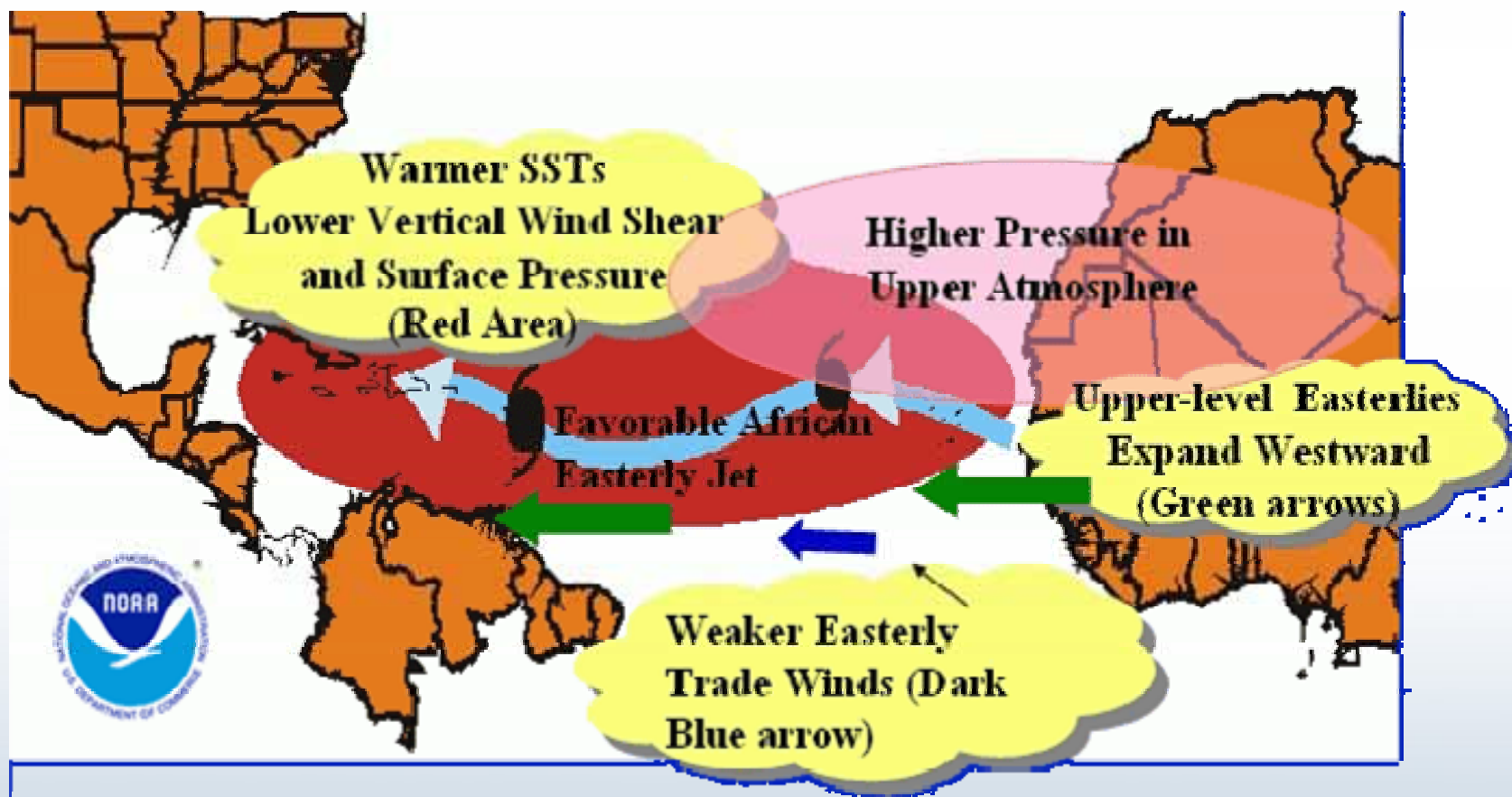
1965-1994
30 years
48 Majors
1.6 MH/yr



1995-2008
14 years
53 Majors
3.8 MH/yr

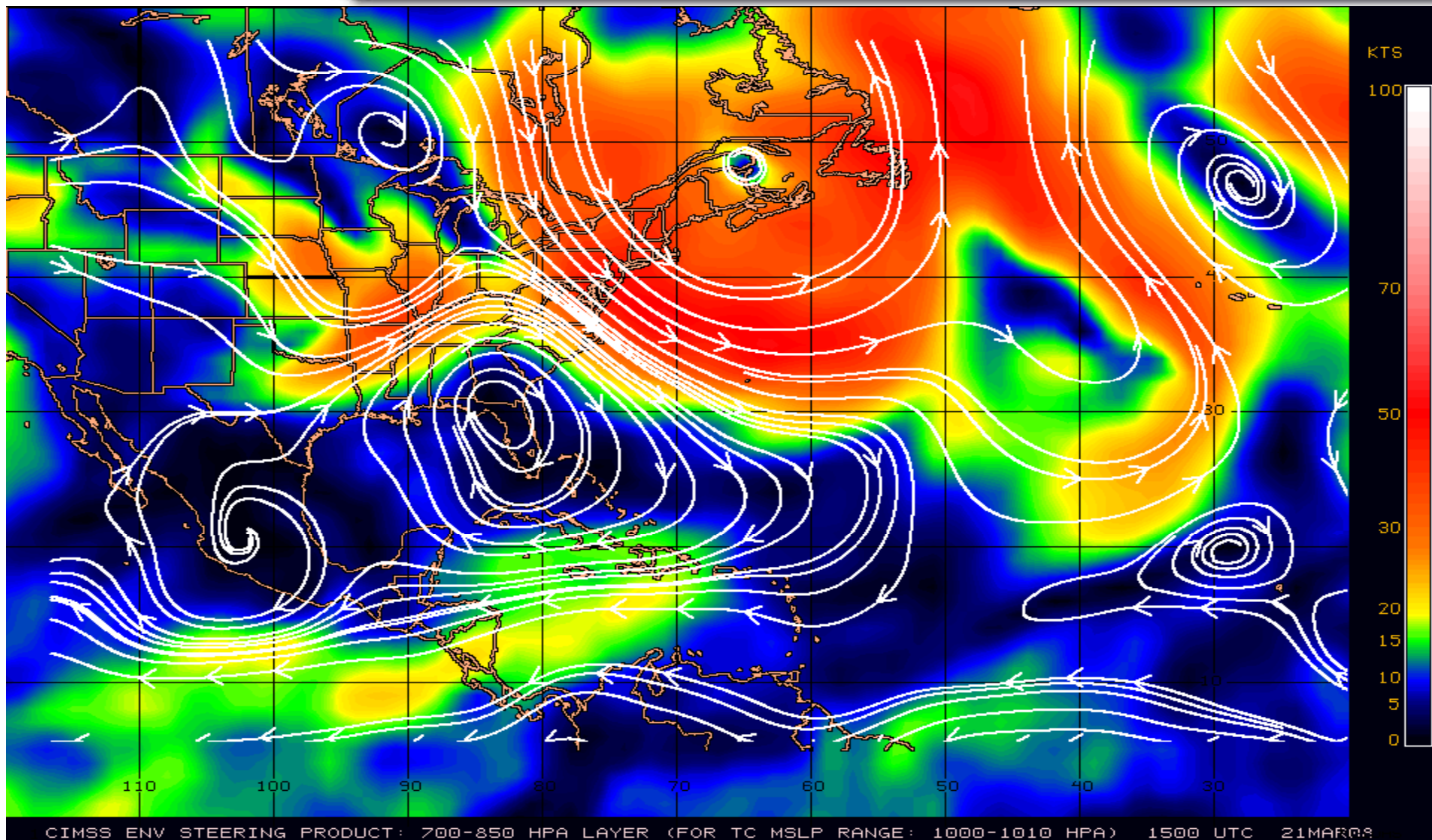


Active Atlantic Multi-decadal Signal





Upper Level Steering Currents





The "Cape Verde" Season – August and September Tracks in the Atlantic





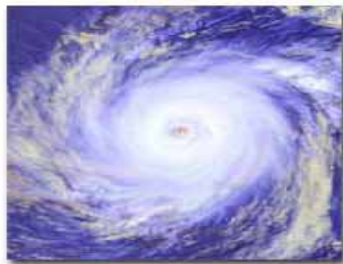
Tropical Cyclone Classifications



- ◆ **Tropical Depression**
(Sustained Winds: below 39 mph)



- ◆ **Tropical Storm**
(Sustained Winds: 39-73 mph)



- ◆ **Hurricane**
(Sustained Winds: 74 mph and higher)

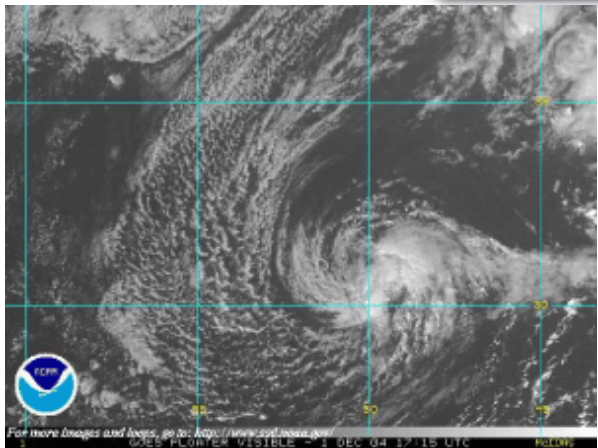


Saffir-Simpson Hurricane Scale

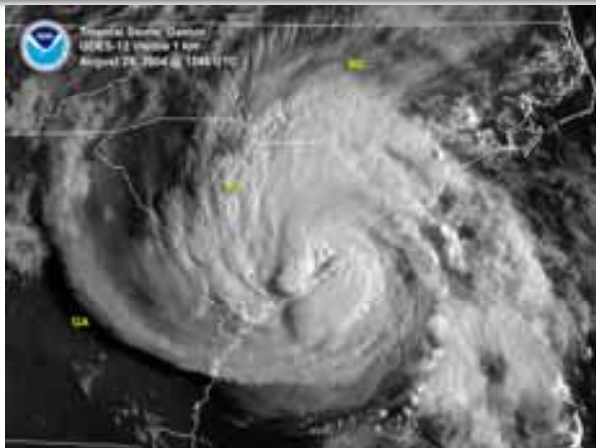
CATEGORY	WIND SPEED (MPH)	DESCRIPTION	
1	74-95	MINIMAL	Irene '99
2	96-110	MODERATE	Frances
3	111-130	MAJOR	Ivan
4	131-155	EXTREME	Charley
5	> 155	CATASTROPHIC	Andrew



Satellite Imagery by Category



Tropical Storm



Category 1



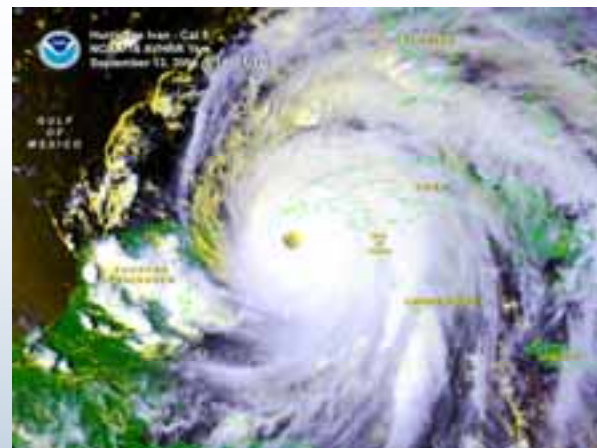
Category 2



Category 3



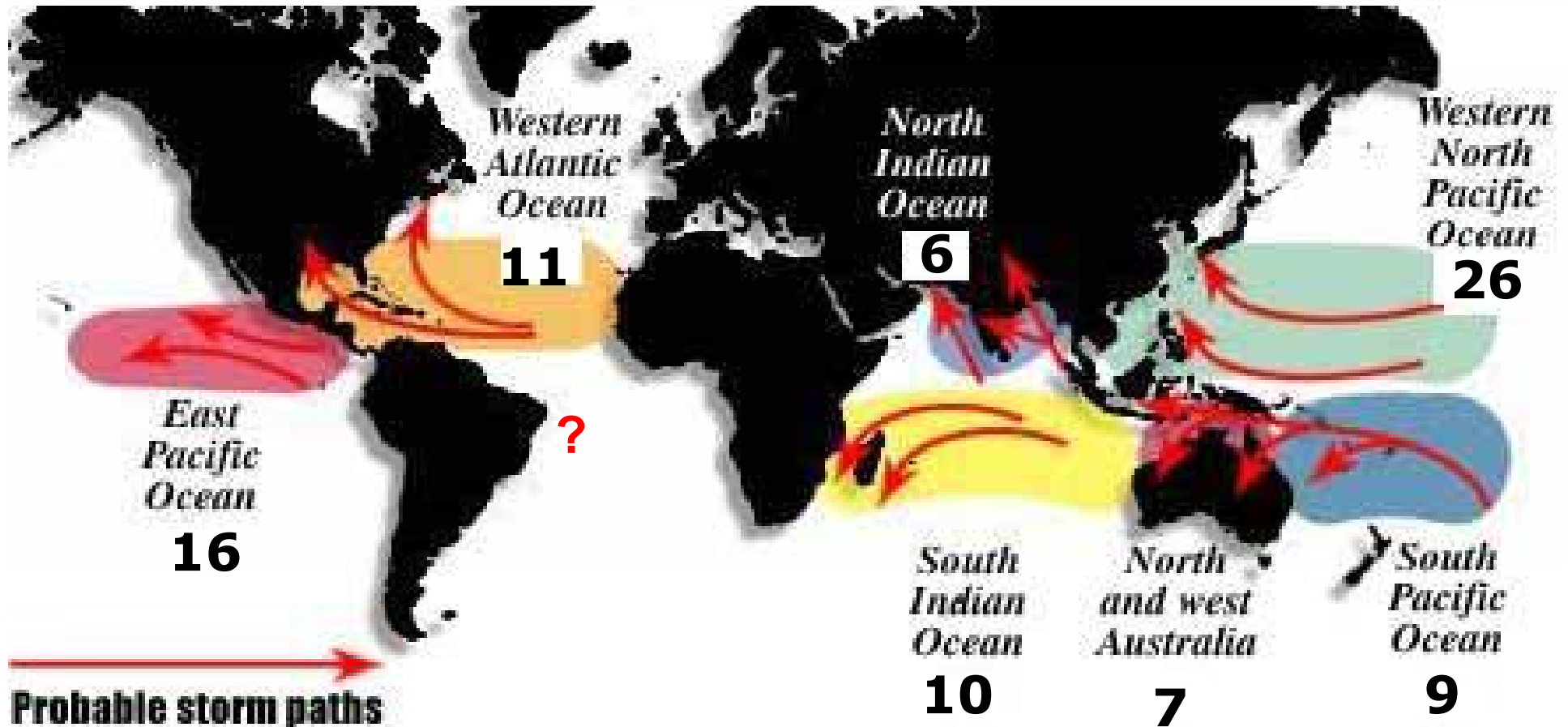
Category 4



Category 5



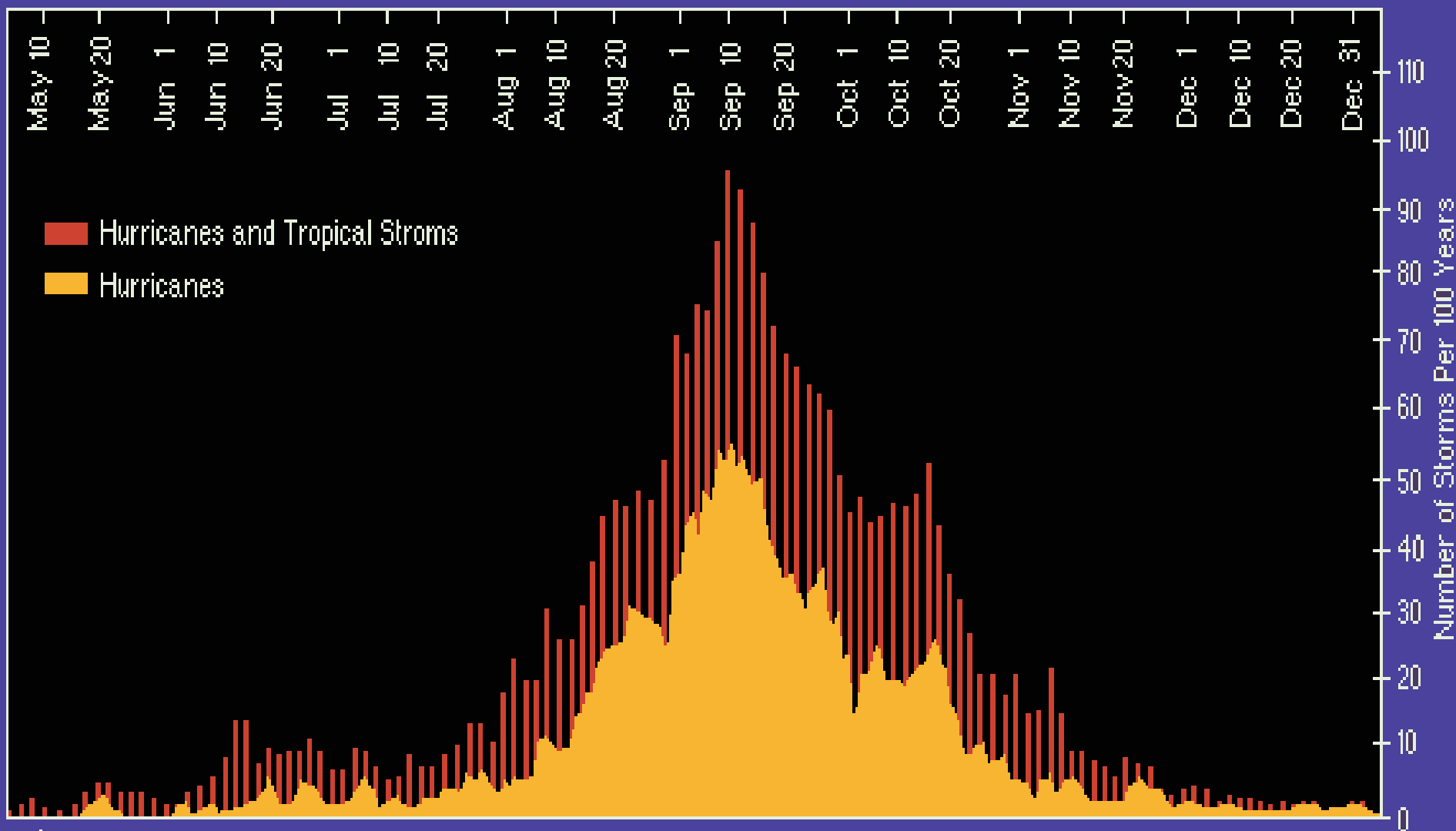
Global Tropical Cyclones



Average: **85** Per Year World Wide



Atlantic Basin Hurricane Climatology

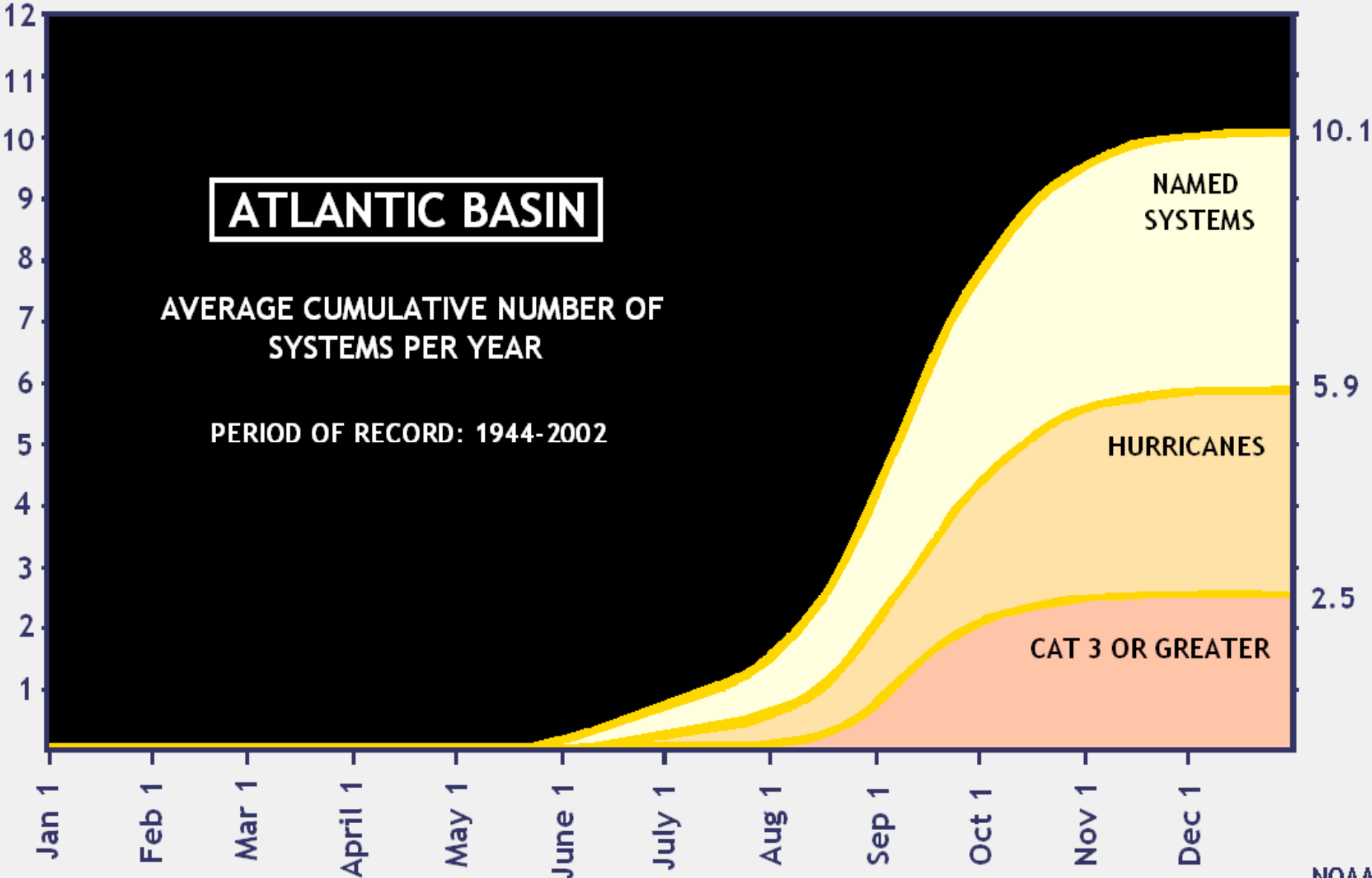




ATLANTIC BASIN

AVERAGE CUMULATIVE NUMBER OF SYSTEMS PER YEAR

PERIOD OF RECORD: 1944-2002





Tropical Storm and Hurricane Hazards

- ◆ Storm surge
- ◆ Coastal and inland winds
- ◆ Tornadoes
- ◆ Flooding



Remember

Although all hurricanes contain the same hazards...

...all hurricanes are not alike!





FLOYD VS. ANDREW -- A SIZE COMPARISON

Larger storms will generate hazardous conditions over a much greater area

Storm Surge

The greatest potential for loss of life in a hurricane is from the storm surge.

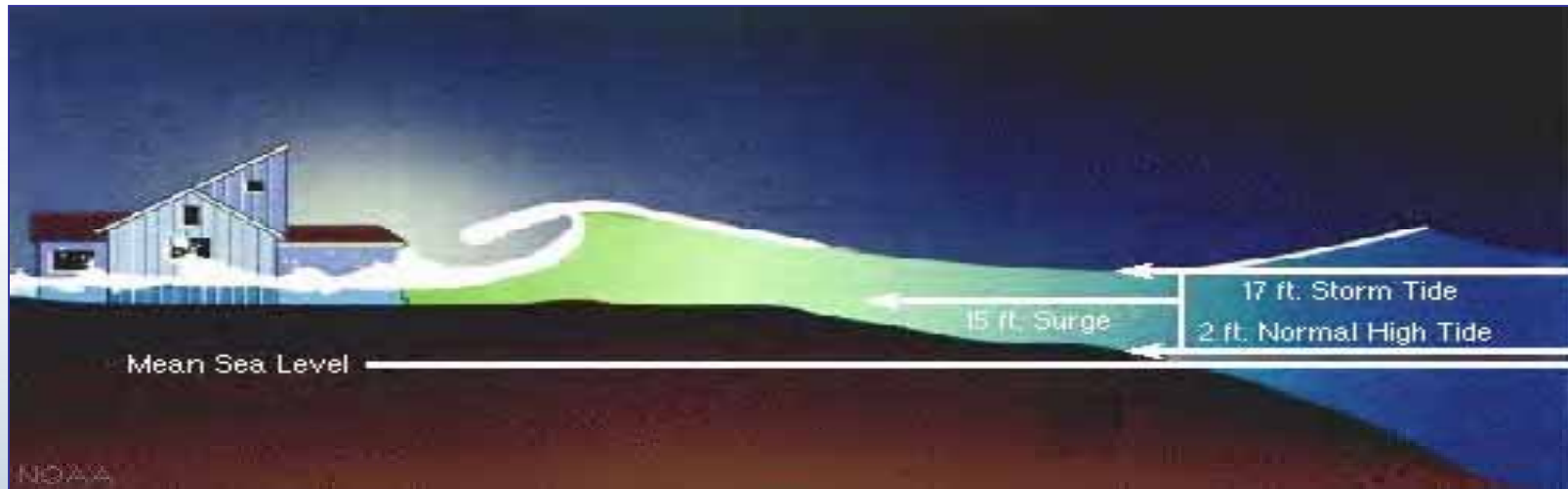
Historically, storm surge has claimed **nine** of **ten** victims in hurricanes.





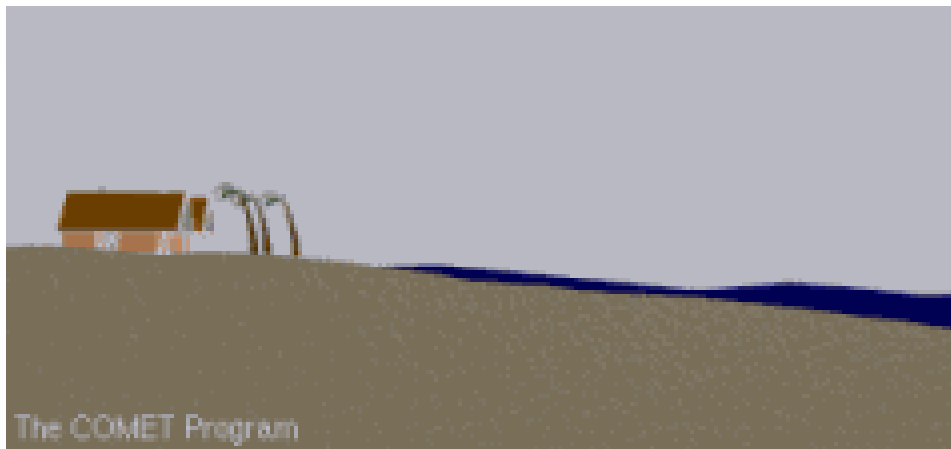
Storm Surge

- ◆ Abnormal rise in water level caused by wind and pressure forces of a hurricane
- ◆ Can sweep 50 to 100 miles wide along coastline





Shallow Slope vs. Steep Slope





Storm Surge

A large dome or mound of water created by

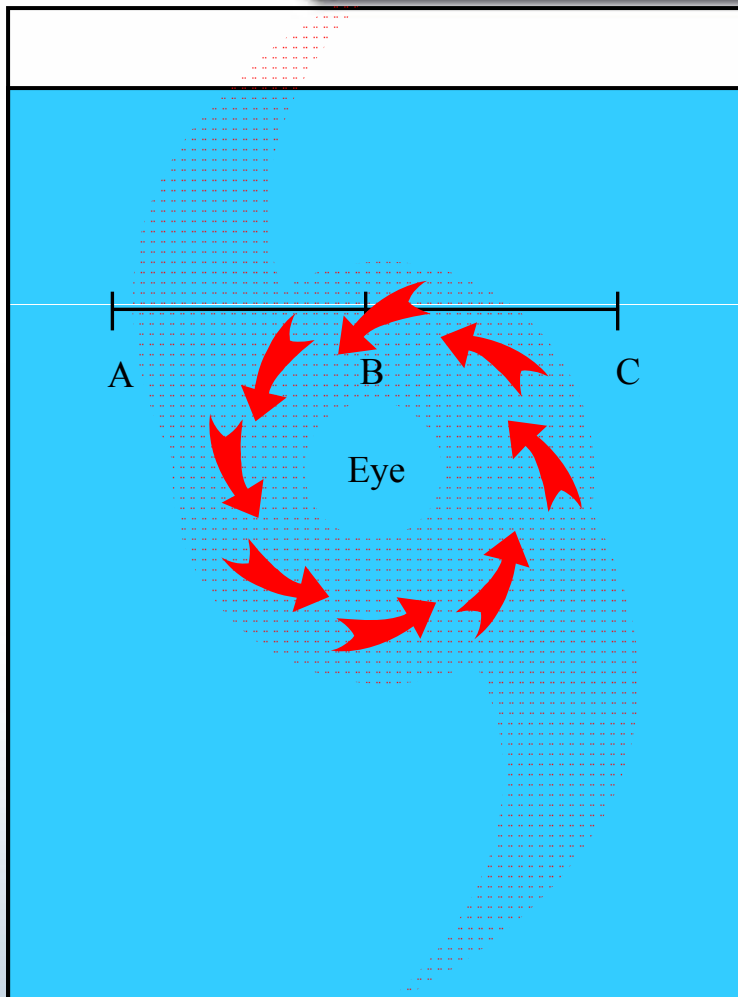
- the force of the wind blowing across a water surface,
- the low atmospheric pressure in or near the eye, and
- the slope of the continental shelf

The main cause of storm surge is wind

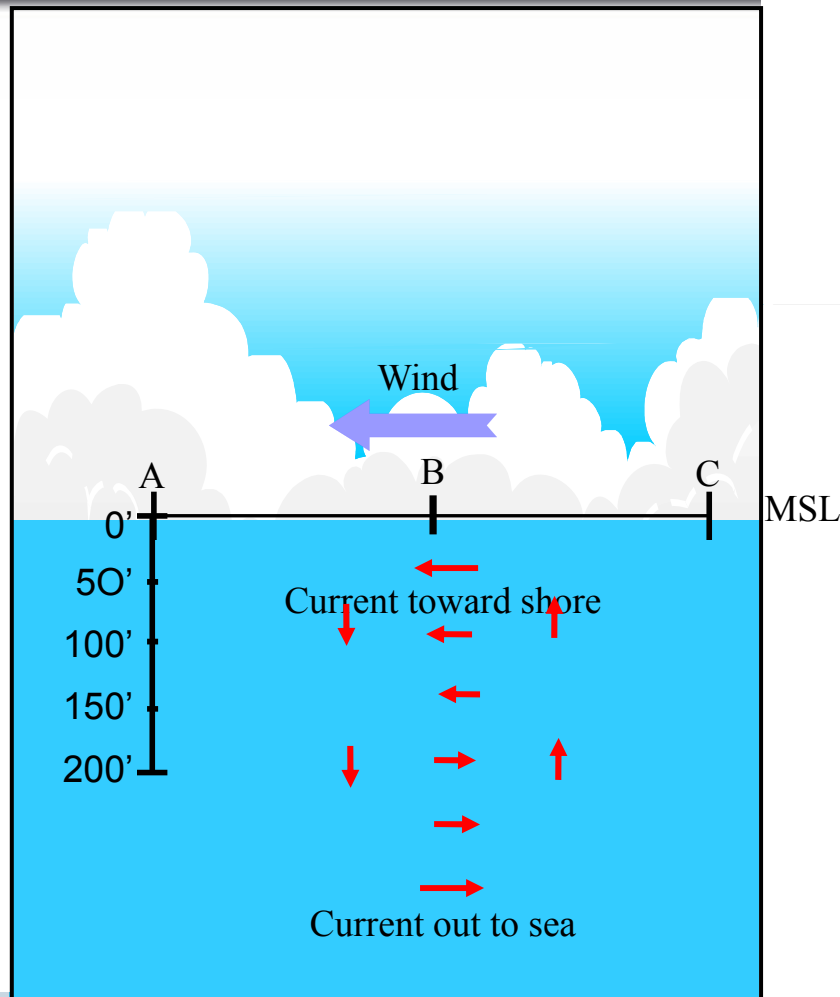




DEEP WATER



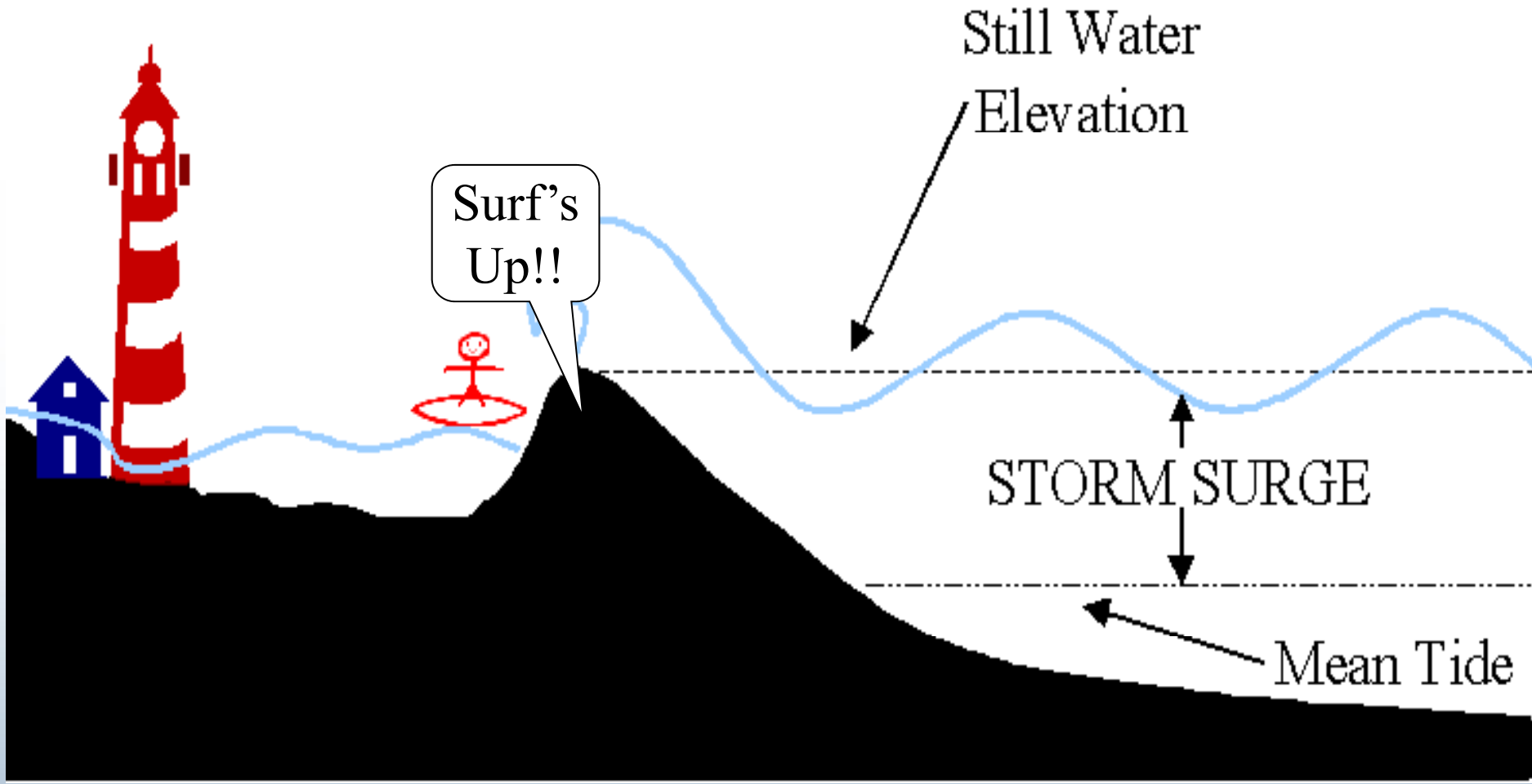
a. Top view of Sea Surface



b. Side view of Cross Section "ABC"

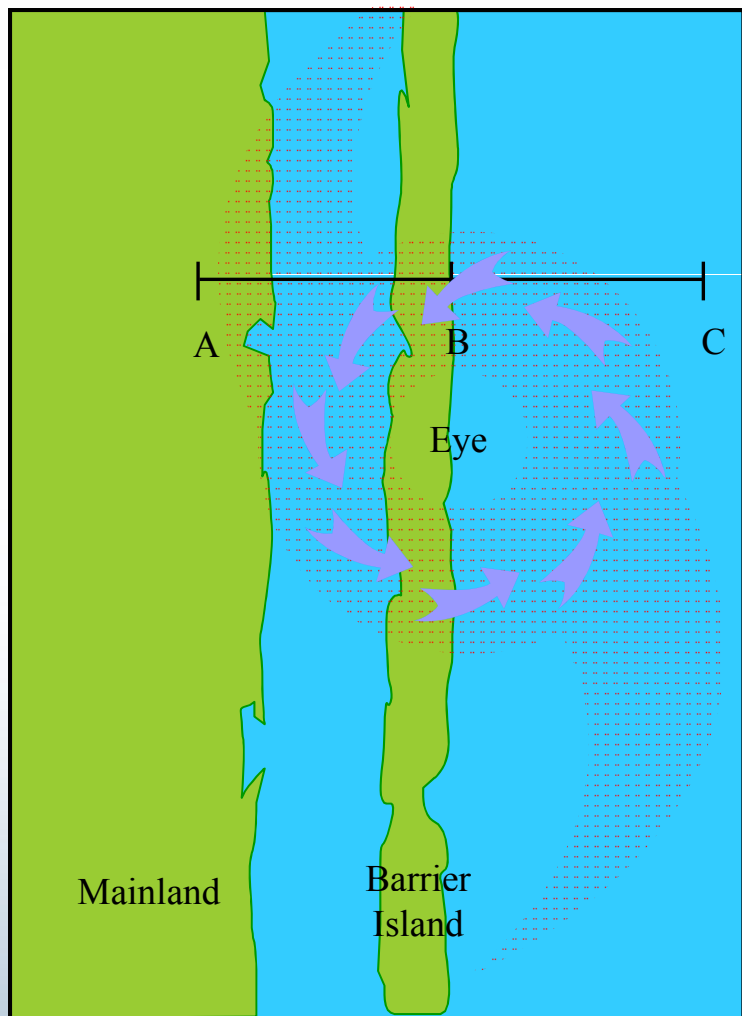


Still Water

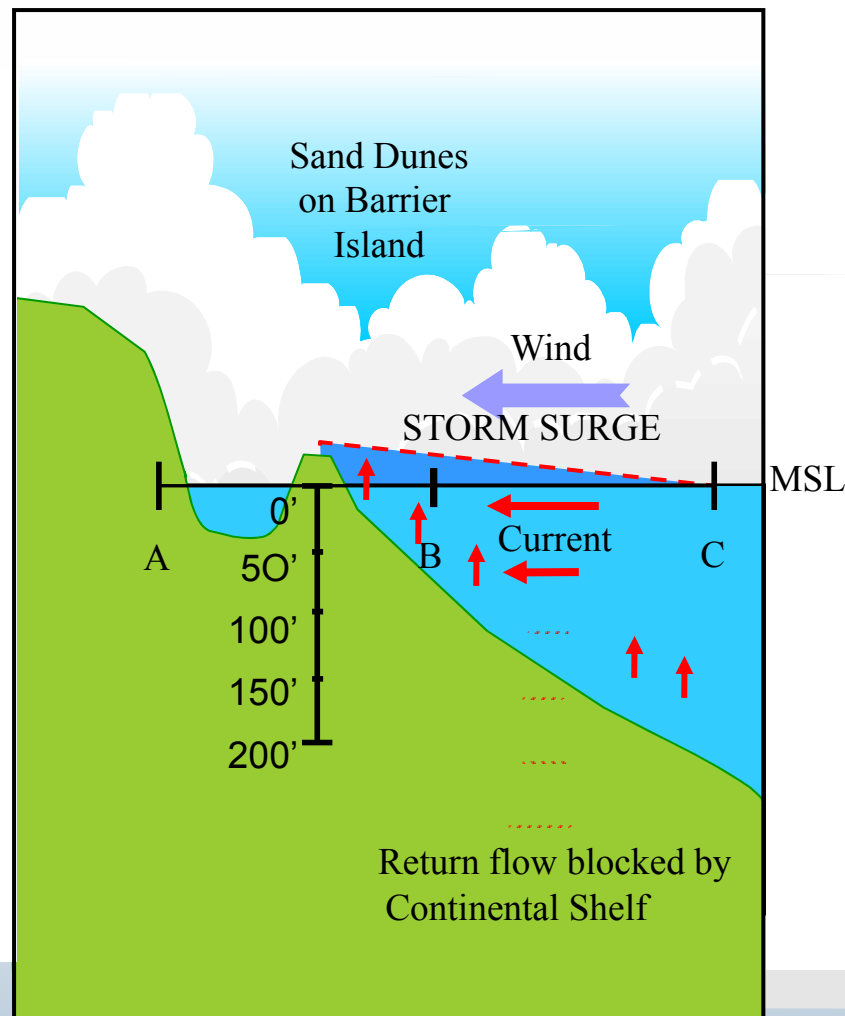




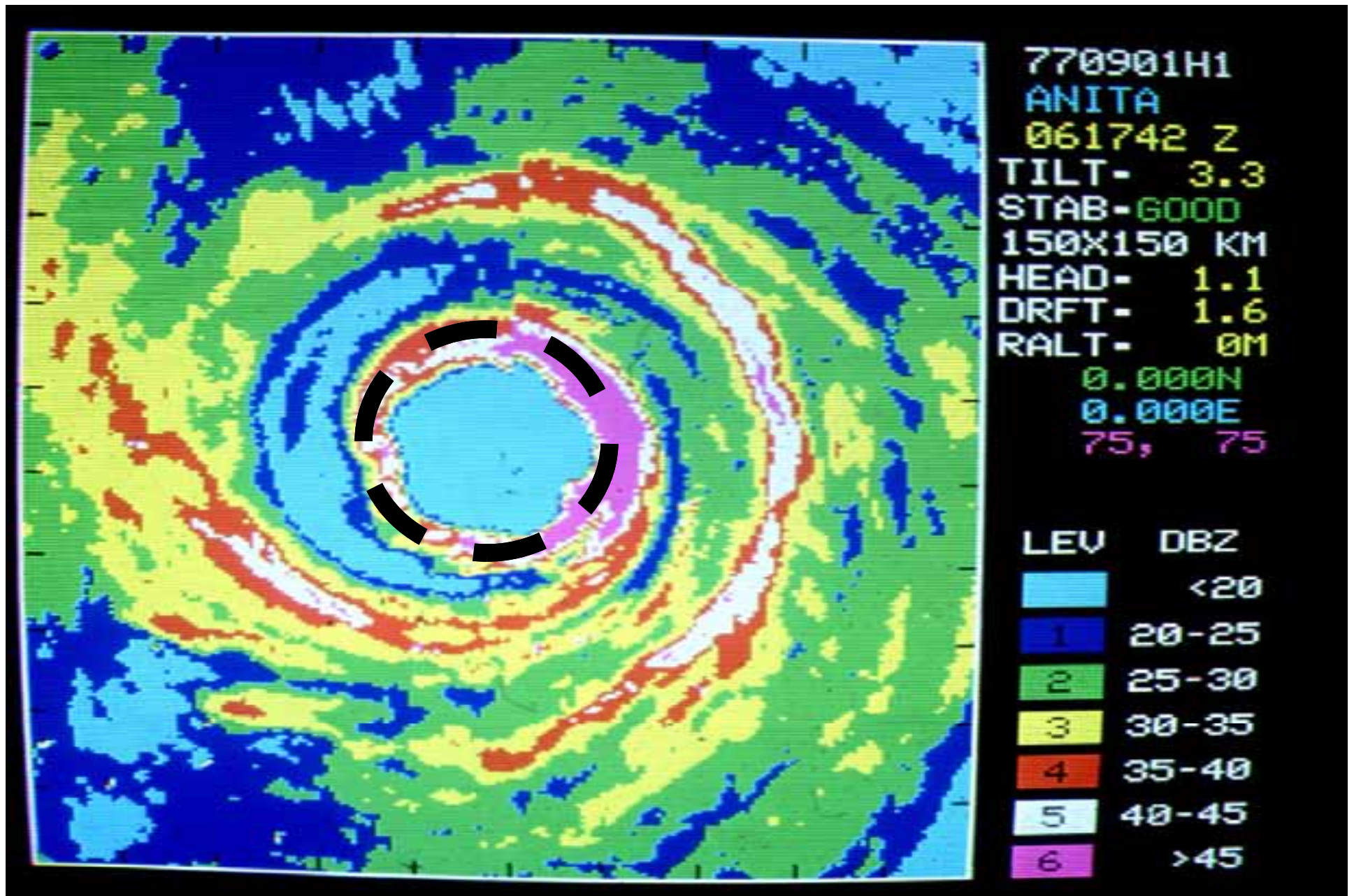
LANDFALL



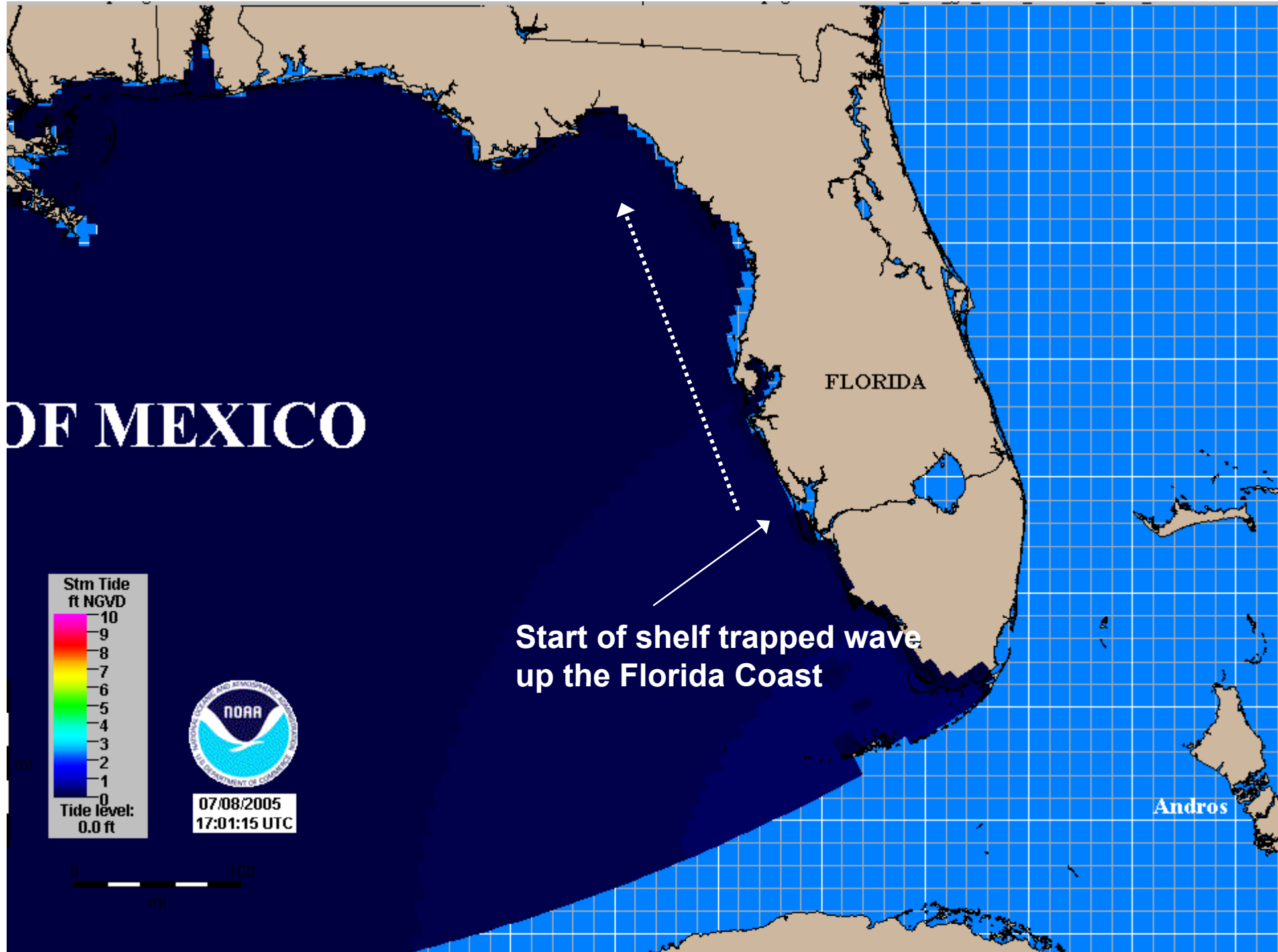
a. Top view of Sea Surface and Land



b. Side view of Cross Section "ABC"



The “Radius of Maximum Winds” or RMW is found in the eyewall and is critical data for properly initializing storm surge models.





Hurricane Dennis Hits Even Where It Doesn't

by [Abacquer](#) at 07:00AM (EDT) on July 13, 2005 | [Permanent Link](#)

Imagine you live in a small fishing village and you're watching the coverage of that nasty hurricane which is slamming into some poor folks about 200 miles

24-Hour News NATIONAL

Flooding surprises village far from Dennis

By **BRENT KALLESTAD**, Associated Press Writer

*Last Updated 7:51 pm PDT
Monday, July 11, 2005*

ST. MARKS, Fla. (AP) - This small fishing village on the picturesque St. Marks River received a nasty surprise from Hurricane Dennis: Although it came ashore some 175 miles west, Dennis pushed an 8-foot storm surge down the mouth of the river, flooding businesses and homes with chest-deep water.



Jeff Kramer shovels junk from a boat ramp in St. Marks, Fla. Monday, July 11, 2005 after Hurricane Dennis forced waters from nearby rivers to flood the town.

AP Photo/J. PAT CARTER

Posted on Tue, Jul. 12, 2005

Towns flooded far from Dennis' eye

The New York Times

ST. MARKS, Fla. - The water began rising in the streets early Sunday morning as Hurricane Dennis was bearing down on Pensacola, about 200 miles to the west, and no one thought much about it.

Damage from Hurricane Dennis stretches far from the beaten path

Tuesday, July 12, 2005
Allen G. Breed - The Associated Press

Storm's effects being felt far from battered Gulf Coast.

NAVARRE BEACH, Fla. -- The first hard look at the spot where Hurricane Dennis rolled ashore revealed beachfront homes scoured to their pilings, roofs torn off, buckled roads and washed-out beaches -- damage that was mercifully isolated.

But distant flooded villages and rural towns also suffered pockets of destruction, and they provided a glimpse of the



1 Gallon of Water Weighs 8 Pounds

1 cubic yard of water
weighs 1,700 pounds!





Before Hurricane Katrina 2005



The Carter House, Pass Christian, Mississippi



After Hurricane Katrina 2005



The Carter House, Pass Christian, Mississippi



Before Hurricane Katrina 2005



The Dantzler House, Biloxi, Mississippi



After Hurricane Katrina 2005



The Dantzler House, Biloxi, Mississippi



2008 Hurricane Ike – Bolivar, TX

September 15, 2008



USGS



2004 Hurricane Ivan Damage



What will happen
to our highways
and causeways?



Hurricane Dennis Storm Tide

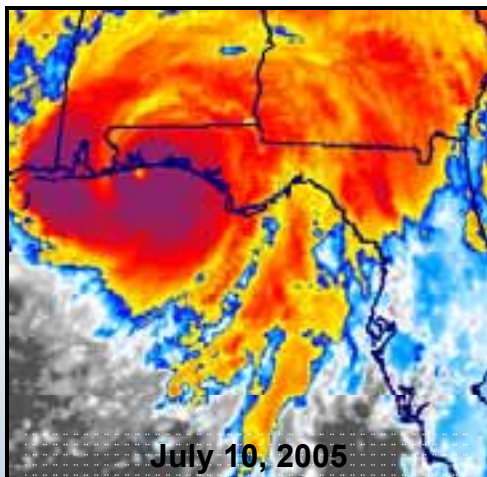


Dog Island, *Orlando Sentinel*



Lost 6 ft of sand

Navarre Beach, NOAA



July 10, 2005



FEMA Hurricane Readiness – Coastal Communities



Navarre Beach, NOAA



Coastal and Inland Winds

Wind damage may include:

- ◆ Homes and businesses
- ◆ Trees along roadways
- ◆ Electric and telephone lines
- ◆ Signs and traffic control devices
- ◆ Water lines and underground utilities
- ◆ Radio and television towers





Wind Damage

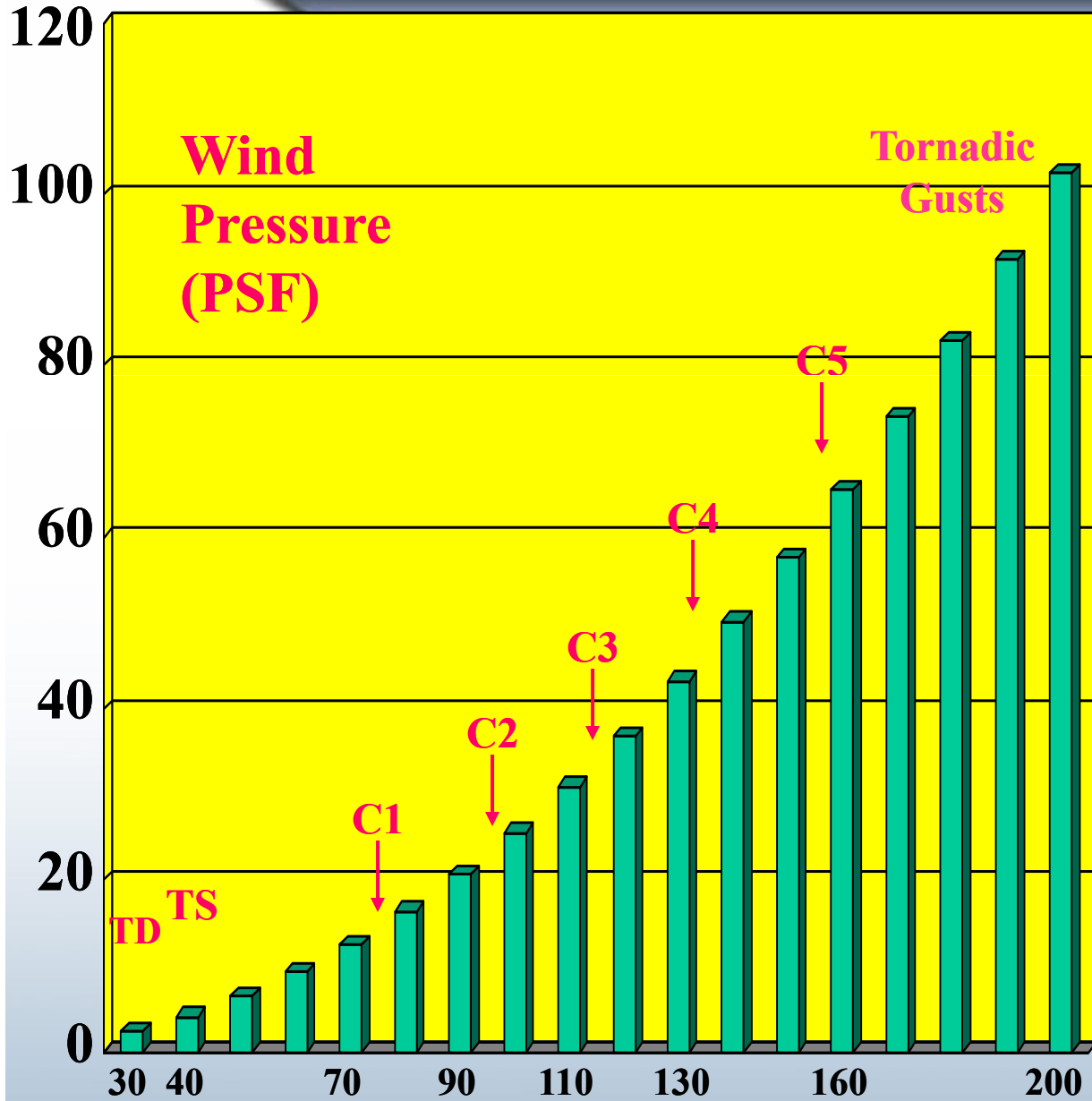
Emergency Managers should anticipate damage to:

- ◆ Homes and businesses
- ◆ Trees along roadways
- ◆ Electric and telephone lines
- ◆ Signs and traffic control devices
- ◆ Water line and underground utilities
- ◆ Radio and television towers





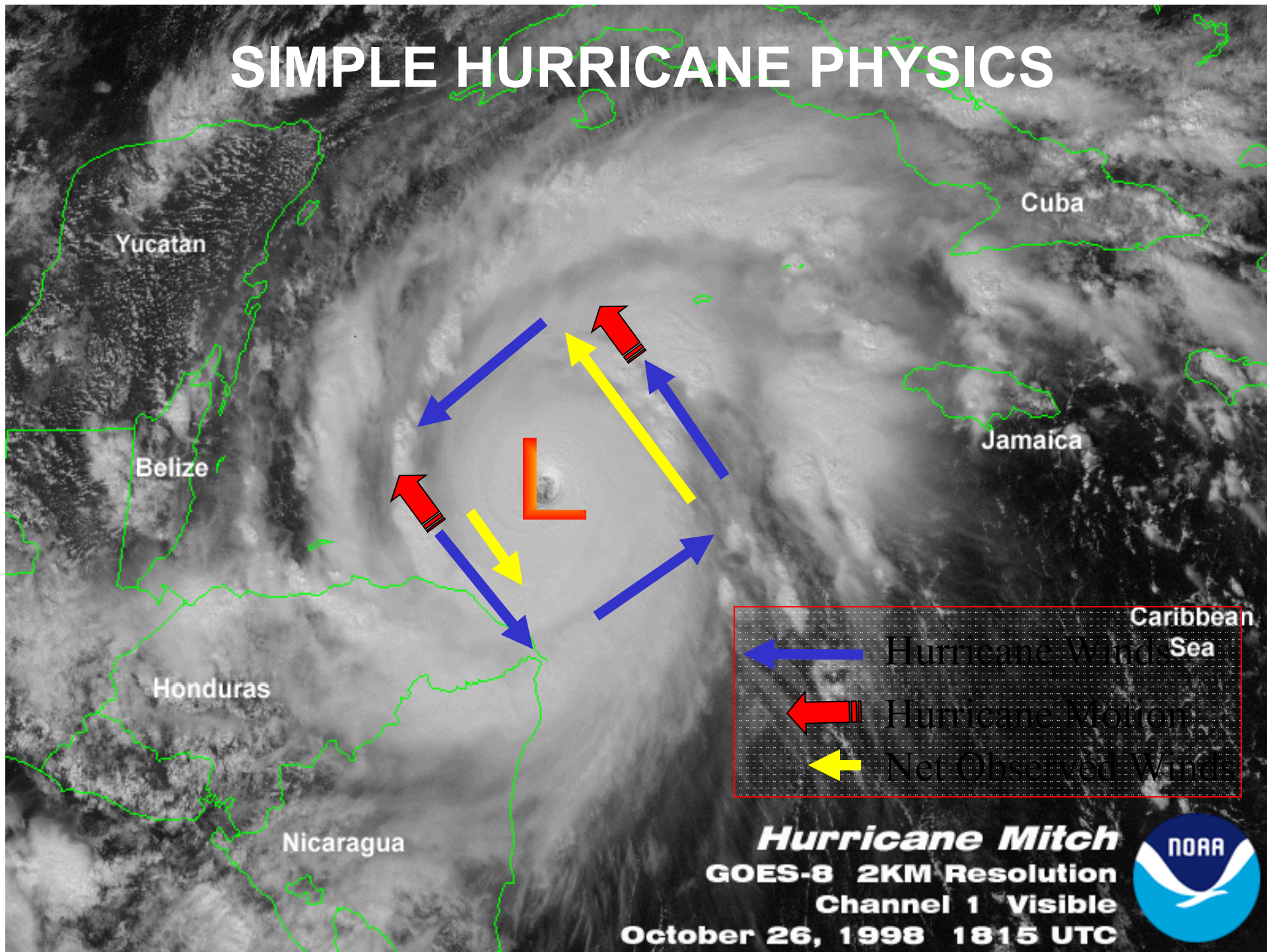
Credit: NHC



86% of TC wind damage is caused by major hurricanes (Cat 3, 4 & 5)

3-49
Wind Speed (mph)

SIMPLE HURRICANE PHYSICS



Caribbean Sea

← Hurricane Wind Field

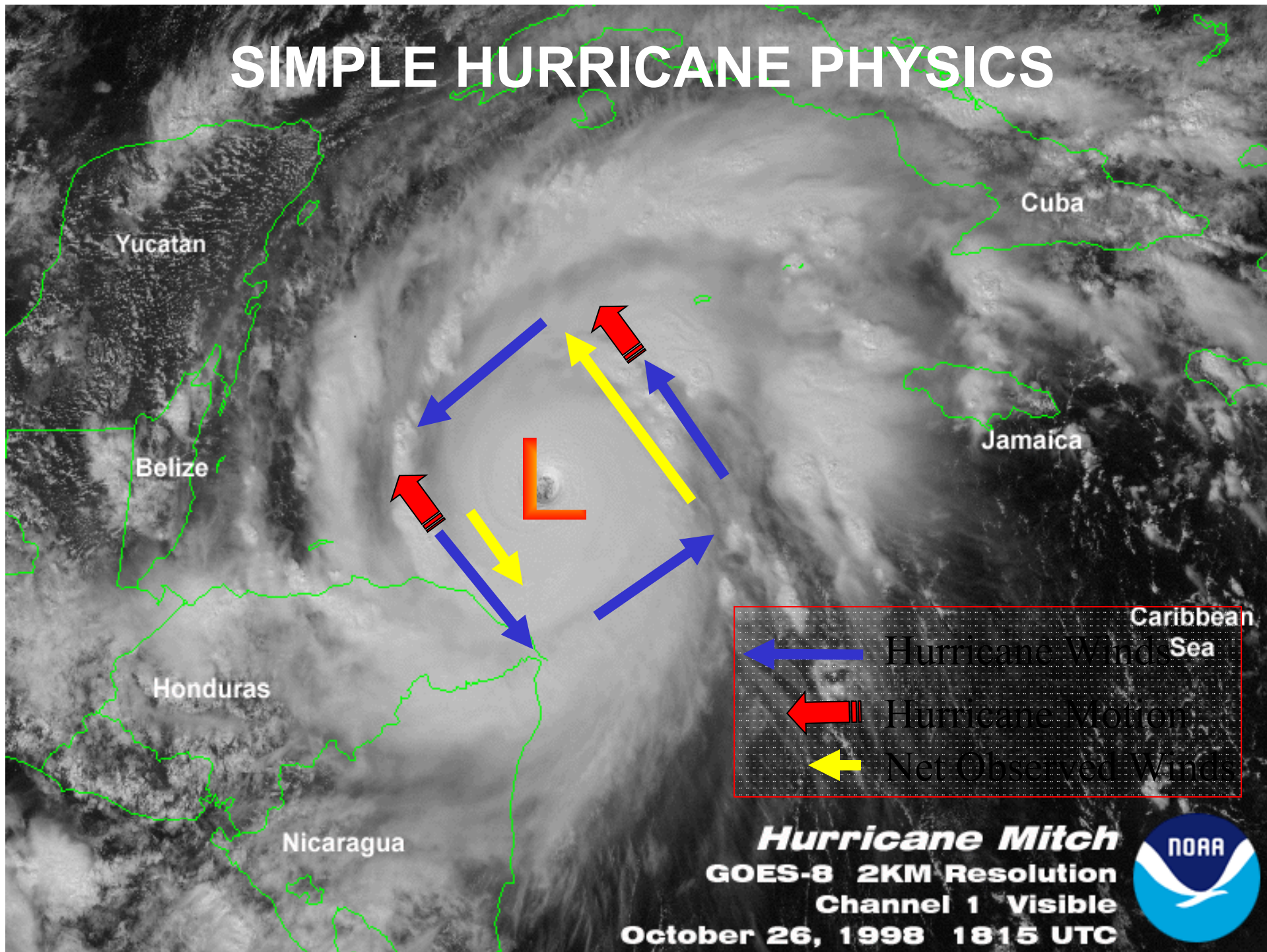
← Hurricane Rotation

← Net Observed Wind

Hurricane Mitch
GOES-8 2KM Resolution
Channel 1 Visible
October 26, 1998 1815 UTC



SIMPLE HURRICANE PHYSICS



Yucatan

Cuba

Belize

Jamaica

Honduras

Nicaragua

Caribbean Sea

Hurricane Wind

Hurricane Bottom

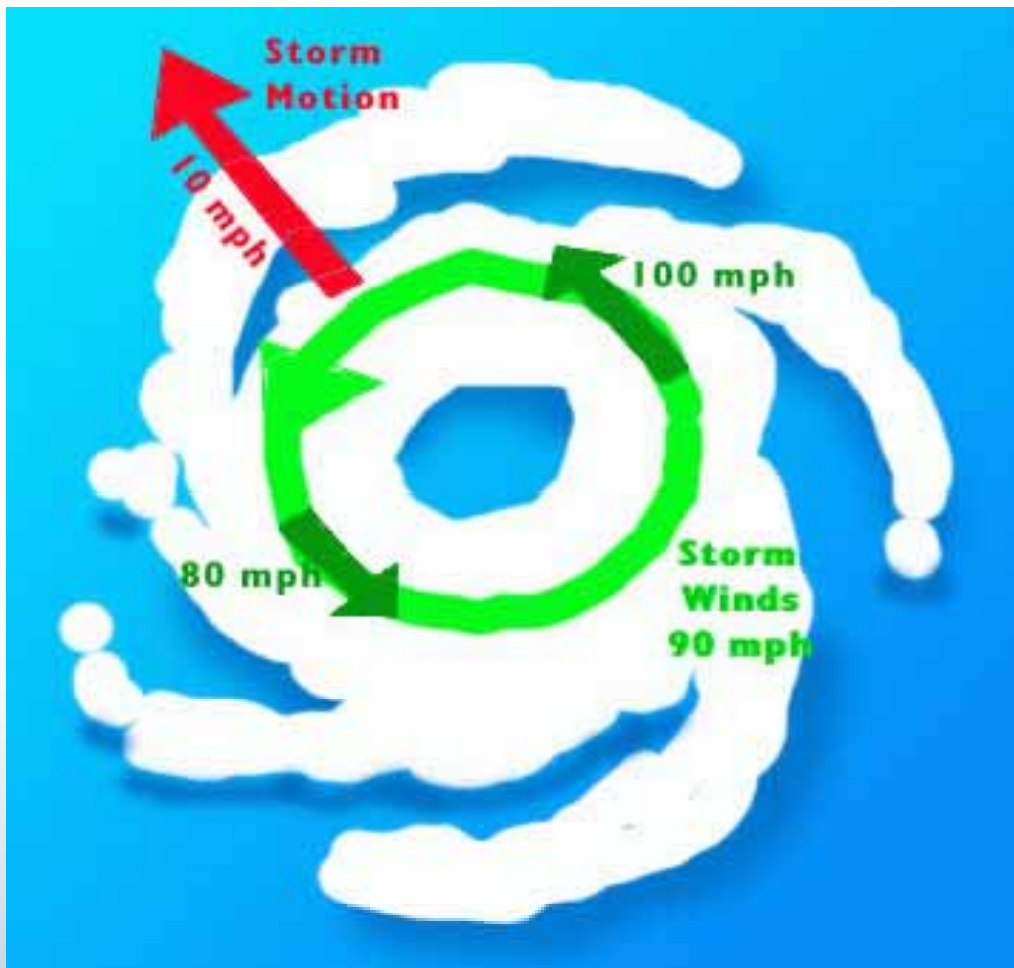
Net Observed Wind

Hurricane Mitch
GOES-8 2KM Resolution
Channel 1 Visible
October 26, 1998 1815 UTC





Tropical Cyclone Wind Structure





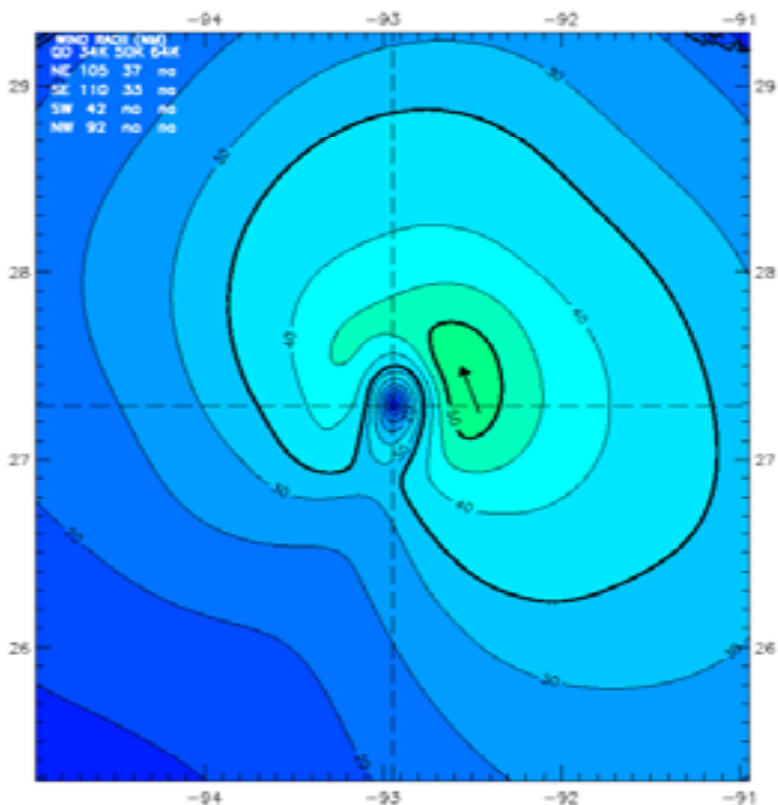
Experimental Analyses Hurricane Research Division (HRD)

Tropical Storm Claudette 1930 UTC 14 Jul 2003

Max 1-min sustained surface winds (kt) for marine exposure

Analysis based on: NOAA FLT adj. to surface from mean height 5813 m from 1831 - 1900 z;
SHIP from 1209 - 1750 z; GOES from 1602 - 1302 z; MOORED_BUOY from 1209 - 1750 z;
AFRES from 1106 - 1137 z; GPSSONDE_SFC from 1106 - 1520 z; CMAN from 1800 - 1805 z;
GPSSONDE_WL150 from 1106 - 1513 z; BACKGROUND from 1930 - 1930 z

1930 z position extrapolated from 1753 z User wind center using 340 deg @ 8 kts; mslp = 991.0 mb



Observed Max. Surface Wind: 55 kts, 34 nm SE of center based on 1513 z GPSSONDE_WL150 sfc measurement
Analyzed Max. Wind: 55 kts, 25 nm NE of center
Experimental research product of:

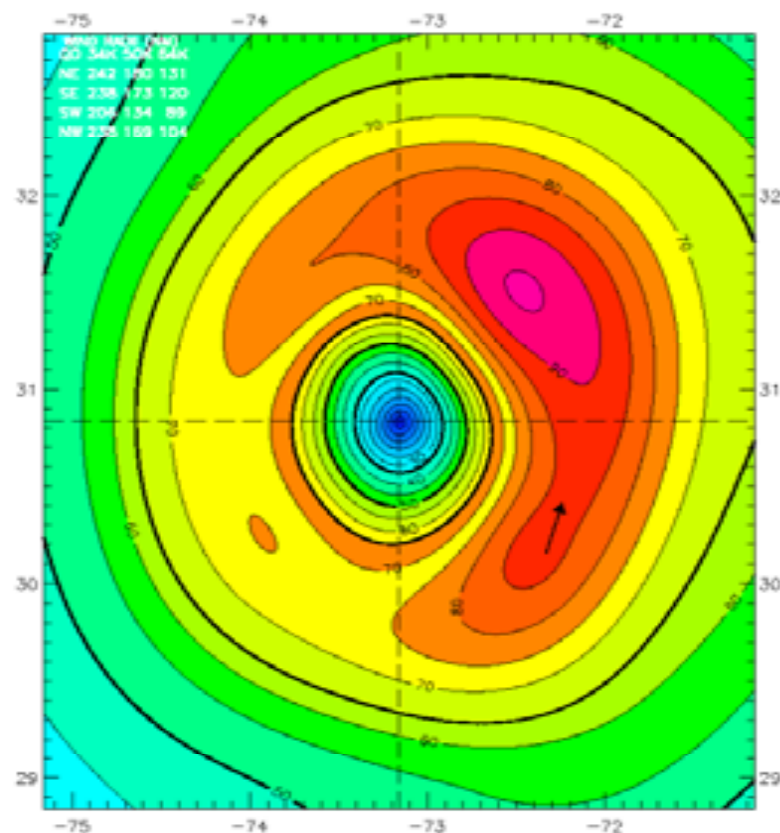
NOAA / AOML / Hurricane Research Division

Hurricane Isabel 1930 UTC 17 Sep 2003

Max 1-min sustained surface winds (kt) for marine exposure

Analysis based on: MOORED_BUOY from 1820 - 1430 z; GPSSONDE_SFC from 1840 - 1511 z;
BACKGROUND from 1930 - 1930 z; SHIP from 1818 - 1818 z; AFRES from 1831 - 1530 z;
TOWER_LD_TO from 1600 - 1600 z; GPSSONDE_WL150 from 1824 - 1511 z;
DRIFTING_BUOY from 0000 - 0000 z; GOES from 1339 - 1339 z; CMAN from 1700 - 1700 z

1930 z position extrapolated from 1800 z ATCF wind center using 330 deg @ 11 kts; mslp = 956.0 mb



Observed Max. Surface Wind: 96 kts, 59 nm SE of center based on 1737 z AFRES sfc measurement
Analyzed Max. Wind: 96 kts, 58 nm NE of center
Experimental research product of:

NOAA / AOML / Hurricane Research Division



Manufactured Homes – Evacuate!



FEMA Hurricane Readiness – Coastal Communities



3-55



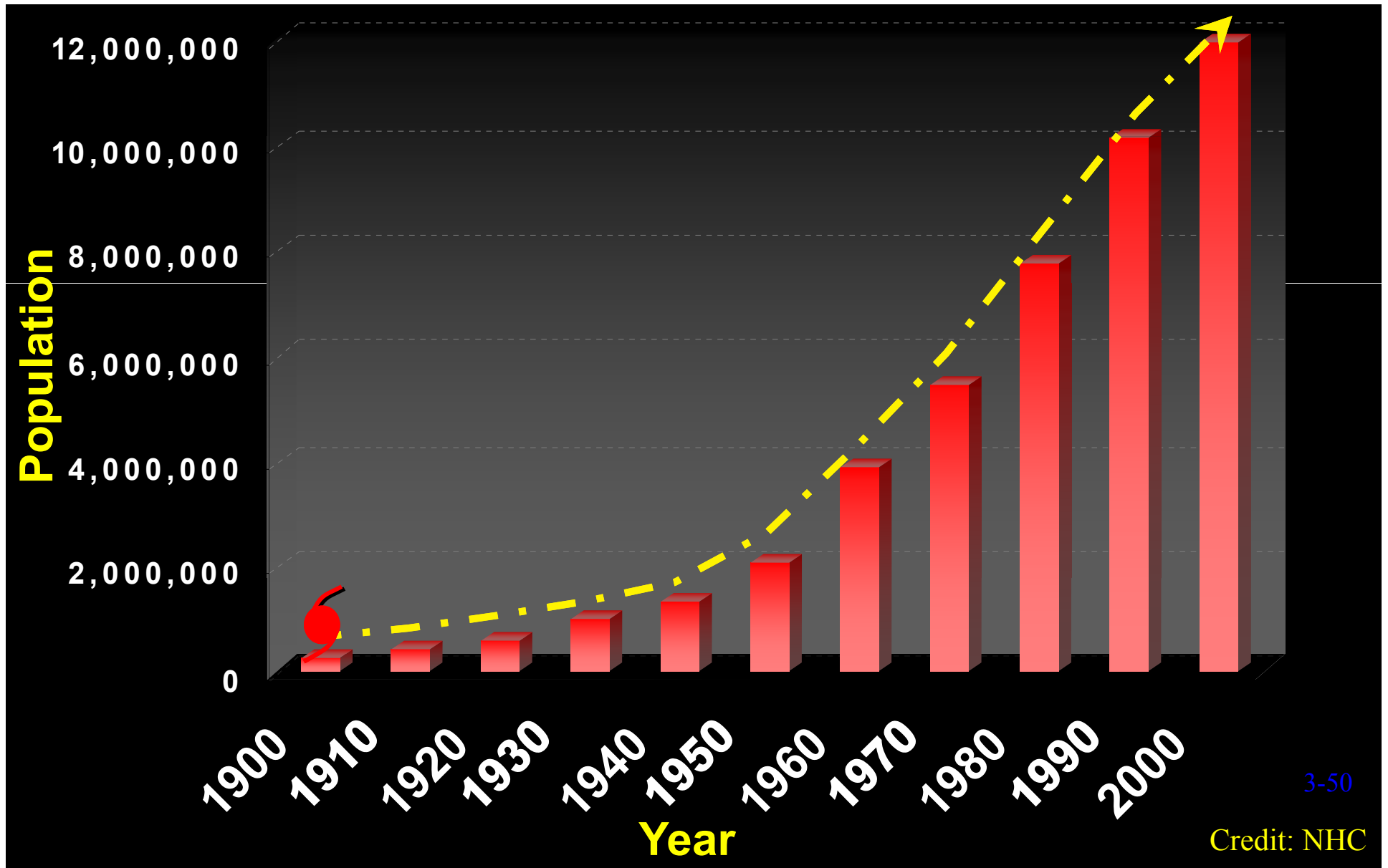
What is the biggest difference along the U.S. coast between 1940 and today?



Miami Beach



Florida Coastal County Population 1900 - 2000





Tornadoes



Tornadoes with tropical cyclones:

- Nearly 60% of hurricanes that made landfall (1948 to 1986) spawned at least one tornado
- In general, tornadoes associated with hurricanes are less intense than those that occur in the Great Plains.
- However, tropical cyclones allow for the potential of a significant outbreak of tornadoes.





Tornadoes add to the storm's destructive power!

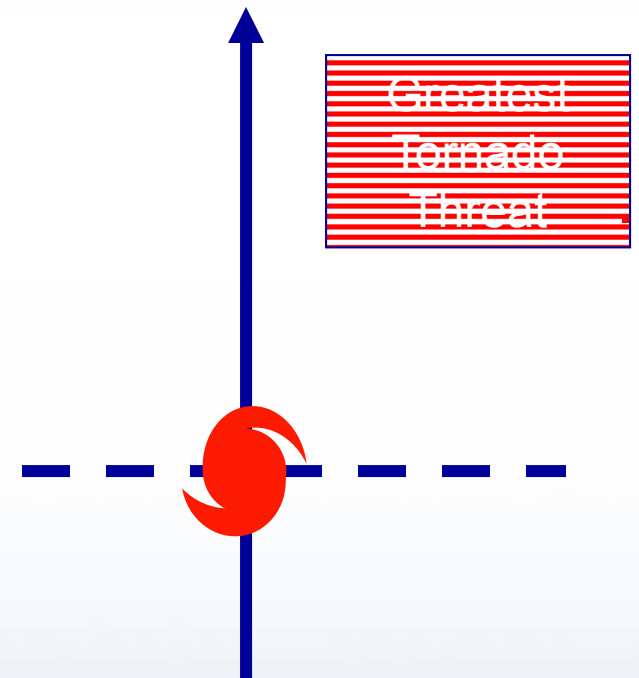
- ◆ Tornadoes are most likely to occur in the **right-front** quadrant of the hurricane.
- ◆ Tornadoes are also often found elsewhere **embedded in the rainbands**, well away from the center of the hurricane. This makes them very hard to detect.
- ◆ Tornadoes associated with tropical cyclones can form ***with little or no warning*** and dissipate just as fast because tornado-producing circulations in hurricane supercells tend to be smaller and shorter-lived





Where Do Most Tornadoes Occur?

- More than 90% of all Tropical Cyclone induced tornadoes occur in the right front quadrant of the storm relative to the storm motion
- Most develop more than 100 miles away from the center of the storm





Tornadoes in Hurricane Dennis

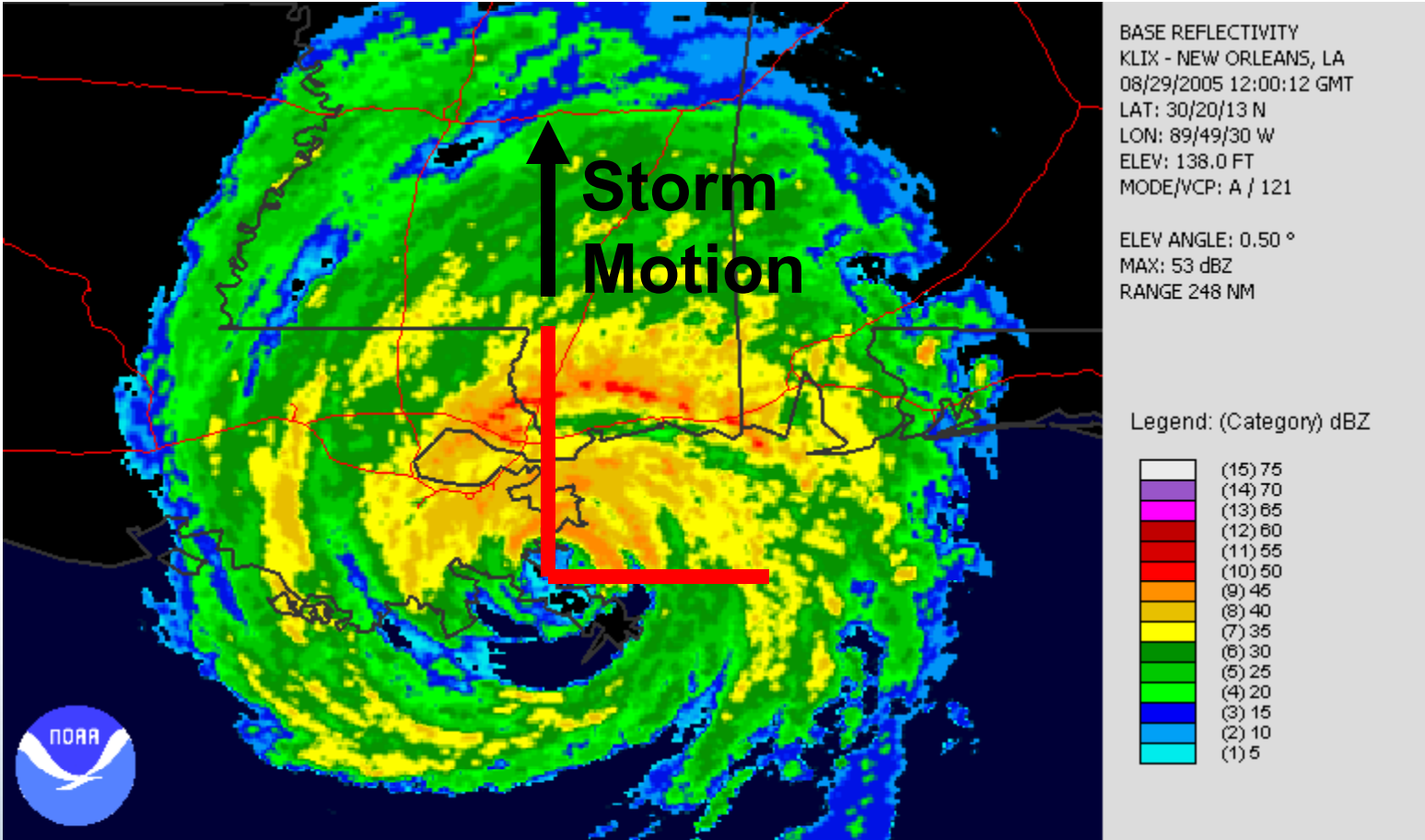


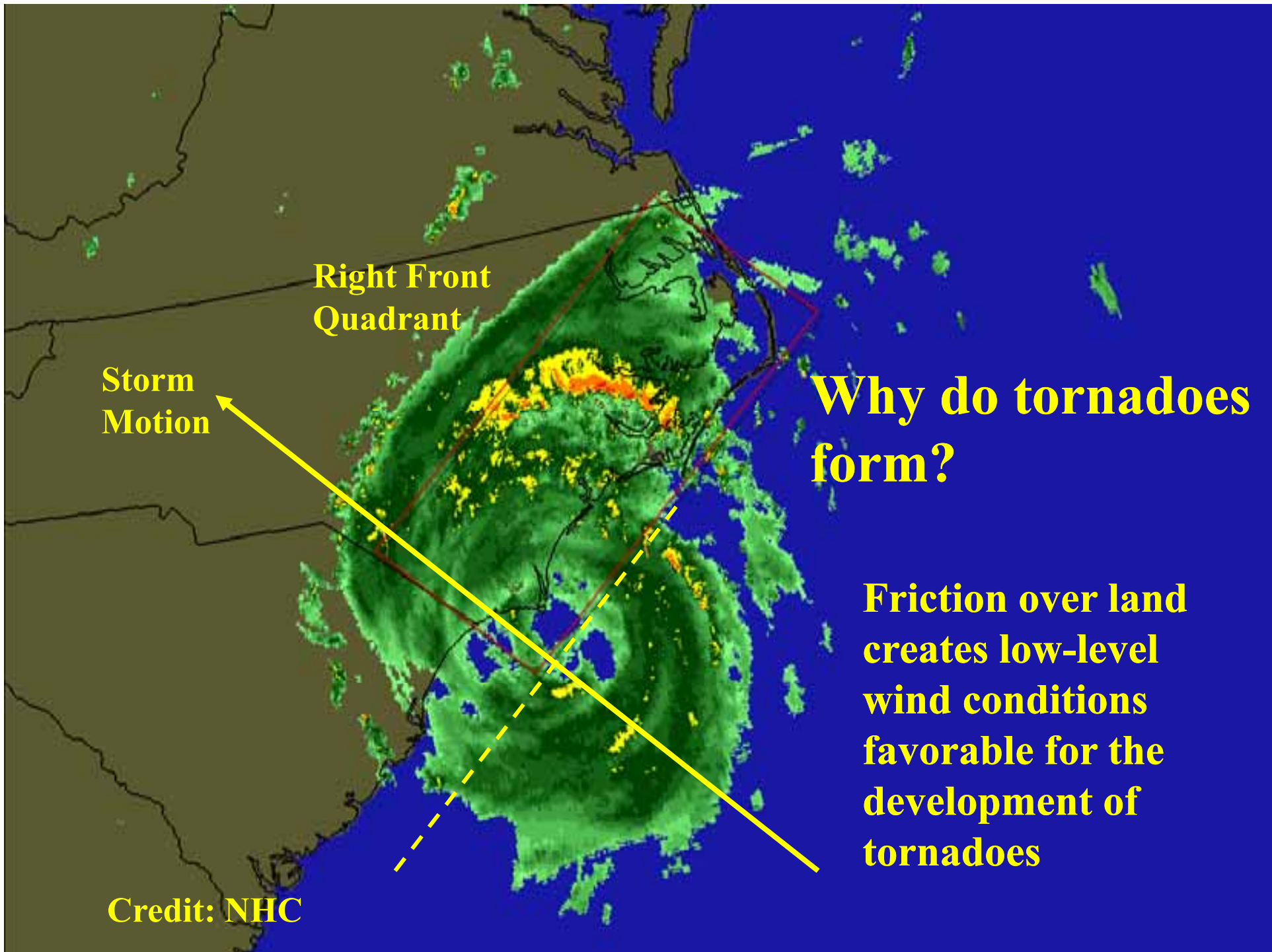
Tornado damage in Brandon





Right Front Quadrant







Tornadoes in Hurricane Dennis



Tornado damage in
Brandon, FL



Hurricane/Tornado Meteorology

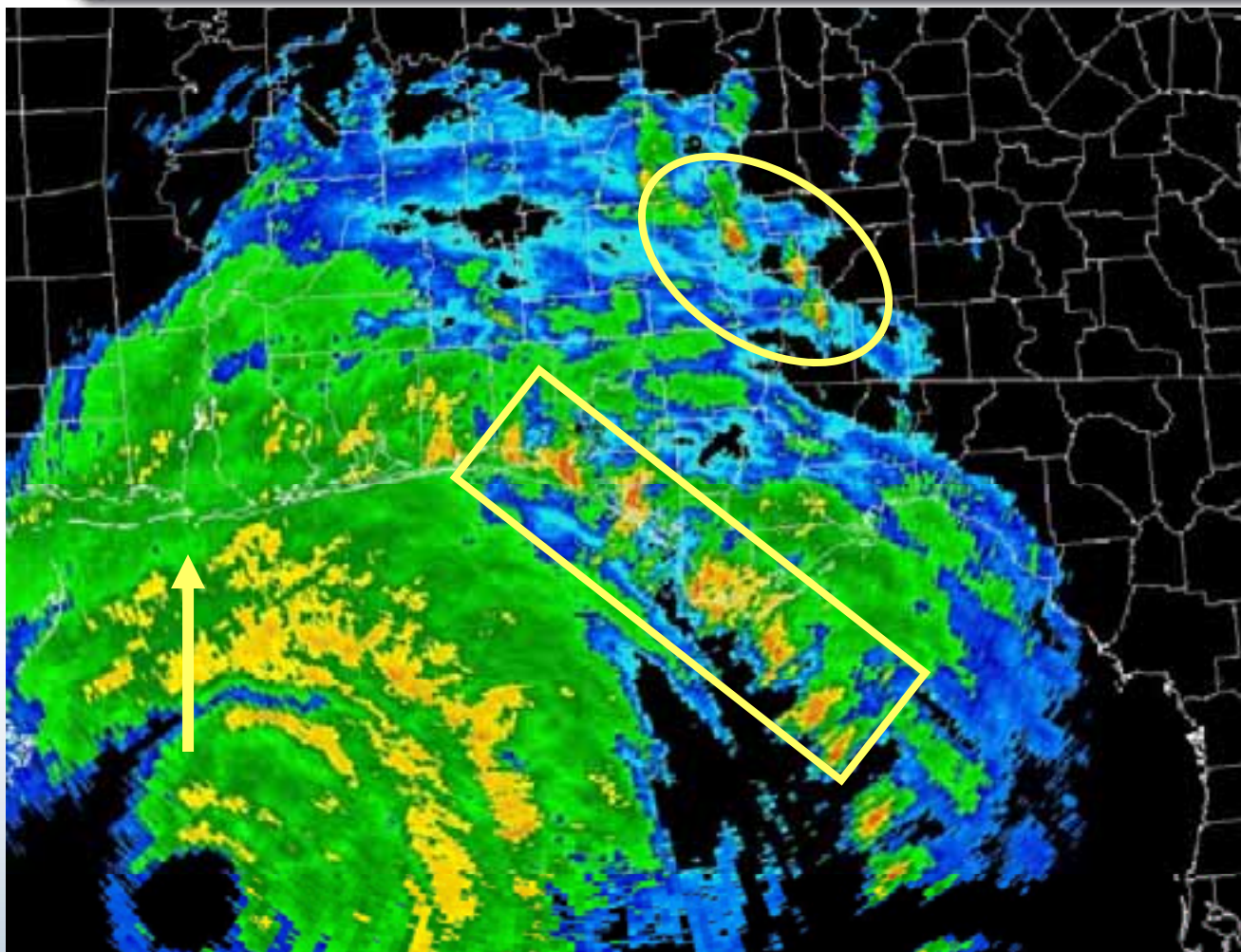
What is happening to make tornadoes develop?

- ◆ In the right front quadrant, the orientation and speed of the winds create **vertical wind shear profiles** somewhat resembling those of the Great Plains supercell thunderstorms - the shear being in a shallower layer but often stronger.
- ◆ Occasionally a tornado will happen in the inner bands as well, but the large majority still form *outside* the hurricane force wind zone.
- ◆ Because tornado-producing circulations in hurricane supercells tend to be smaller and shorter-lived than their Midwest counterparts, they are harder to detect.





Tornadoes far from the Center





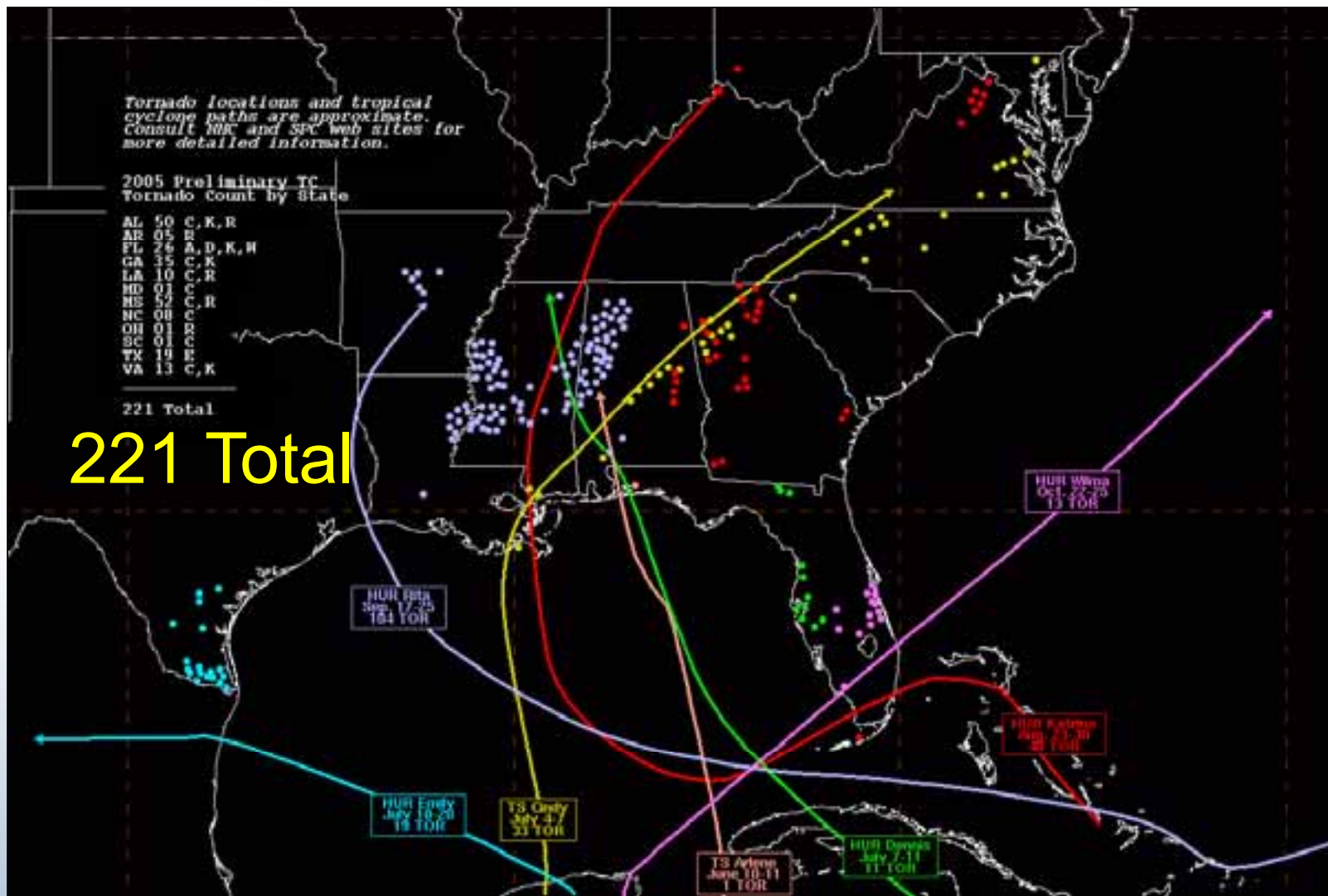
Monitoring Tornado Threats

- ◆ A tornado watch is usually issued when tropical cyclone rain bands are about to move onshore. The watch box is generally to the right of the tropical cyclones path.
- ◆ The Storm Prediction Center issues outlooks (1-3 days) and watches (~6 hrs) for severe weather including tornadoes
- ◆ Tornado Watch information is coordinated and re-distributed through the local National Weather Services offices





2005 Tropical Cyclone Tornadoes





Flooding

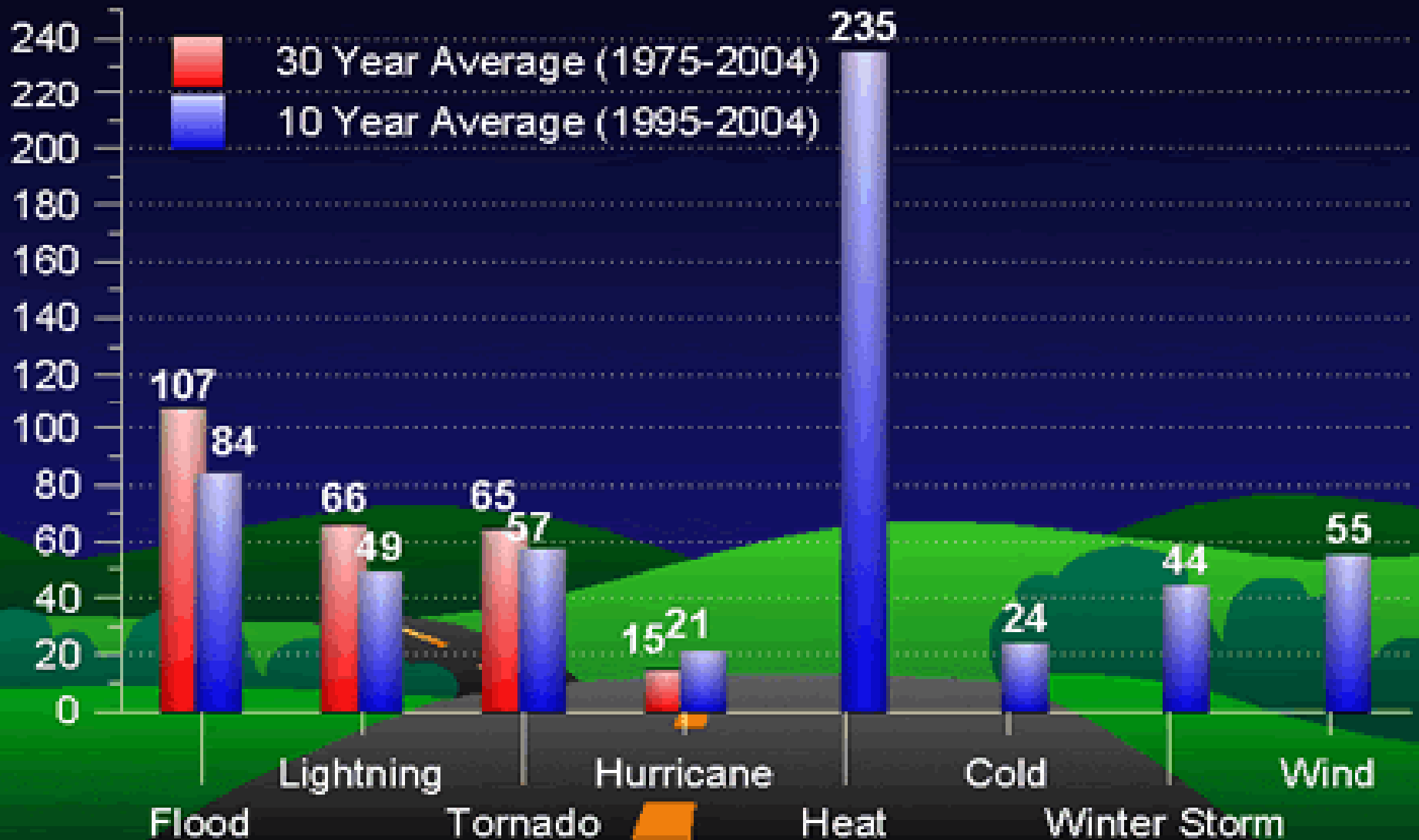


- ◆ Hurricanes typically can produce 6 to 12 inches of rain...or more!
- ◆ Inland flooding has been the primary cause of tropical cyclone-related fatalities over the past 30 years
- ◆ The risk from flooding depends on a number of factors:
 - Storm speed
 - Storm interactions with other weather systems
 - Terrain
 - Ground saturation





Weather Fatalities





Precipitation Efficiency



- 💧 **Ocean-Atmosphere Interaction**
 - 💧 **Instability and Lift**
- 💧 **Tropical Environment Favorable for Raindrop Formation**

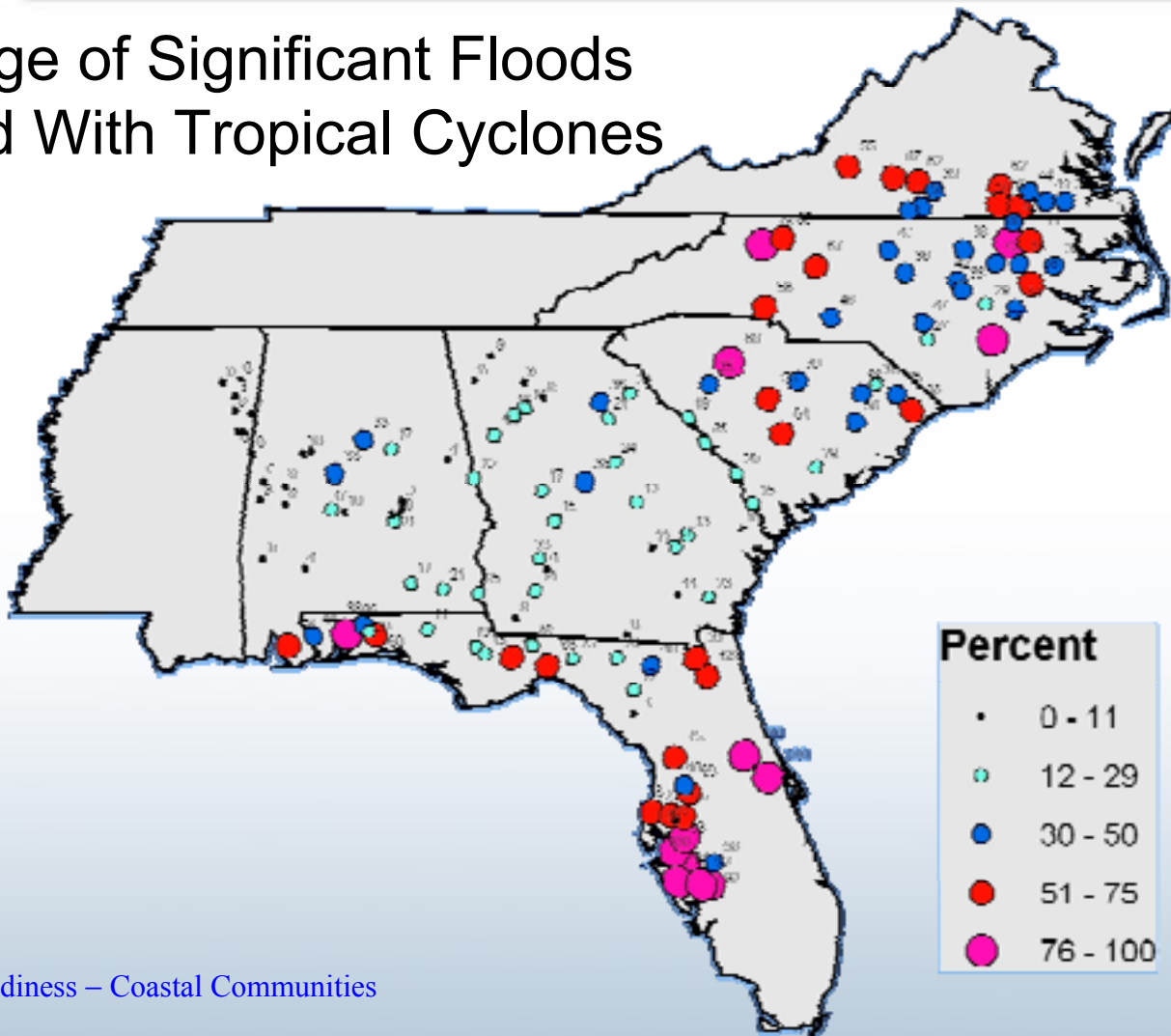


Tropical Cyclones form in an environment primed for precipitation and they transport that environment to landmasses





Percentage of Significant Floods Associated With Tropical Cyclones





Some Notable Flood-Producing Storms

1972

HURRICANE AGNES **122 DEATHS**

Agnes produced floods in the Northeast U.S. contributing to \$6.4 billion in damages.

TROPICAL STORM ALBERTO **33 DEATHS**

Alberto drifted over the Southeastern U.S. producing torrential rainfall and drowning 33 people. Damages exceeded \$750 million.

1994

1999

HURRICANE FLOYD **56 DEATHS**

Floyd brought intense rain and record flooding to the Eastern U.S. Of those who perished, 50 drowned from inland flooding.

TROPICAL STORM ALLISON **44 DEATHS**

Allison flooded the coastal sections from the Gulf Coast to New England. More than 3 feet of rain was reported along the Gulf Coast.

2001

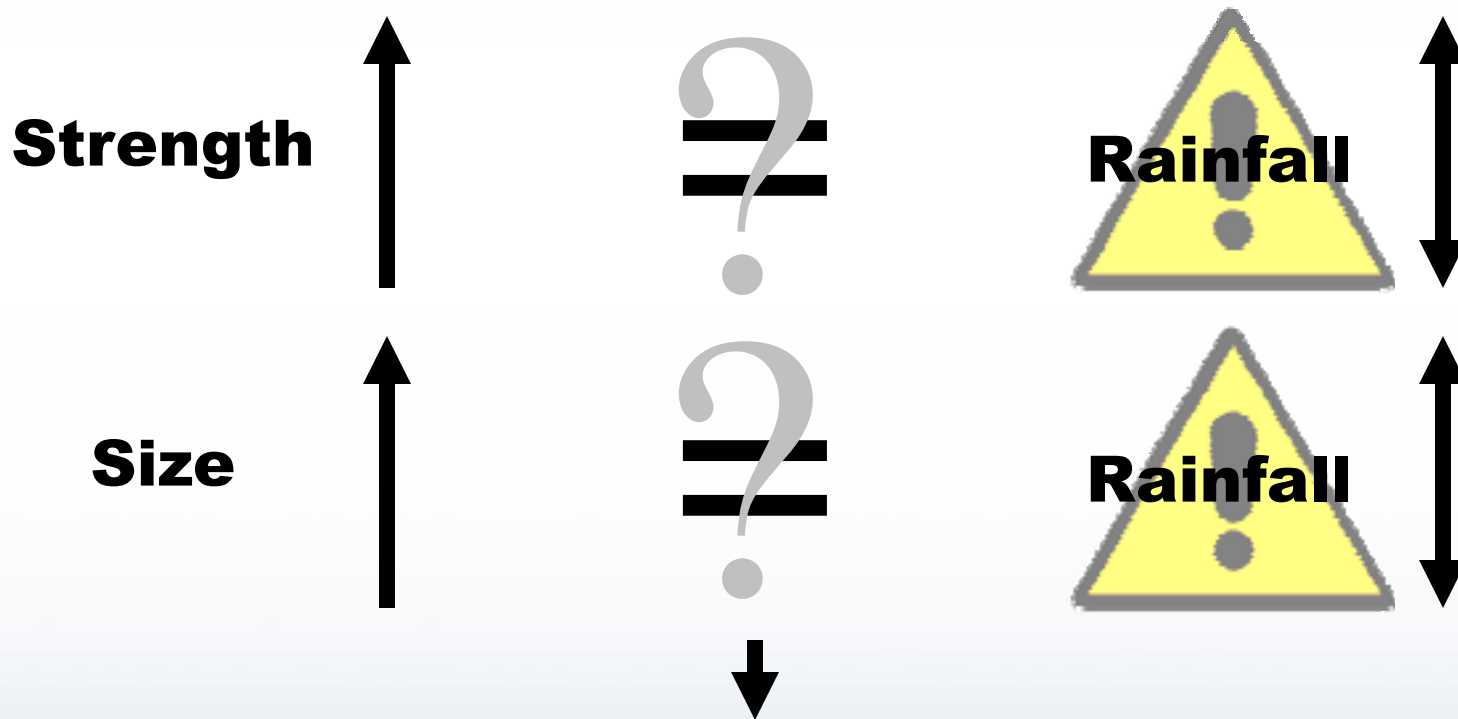


A Spectrum of Flooding





Size and Strength



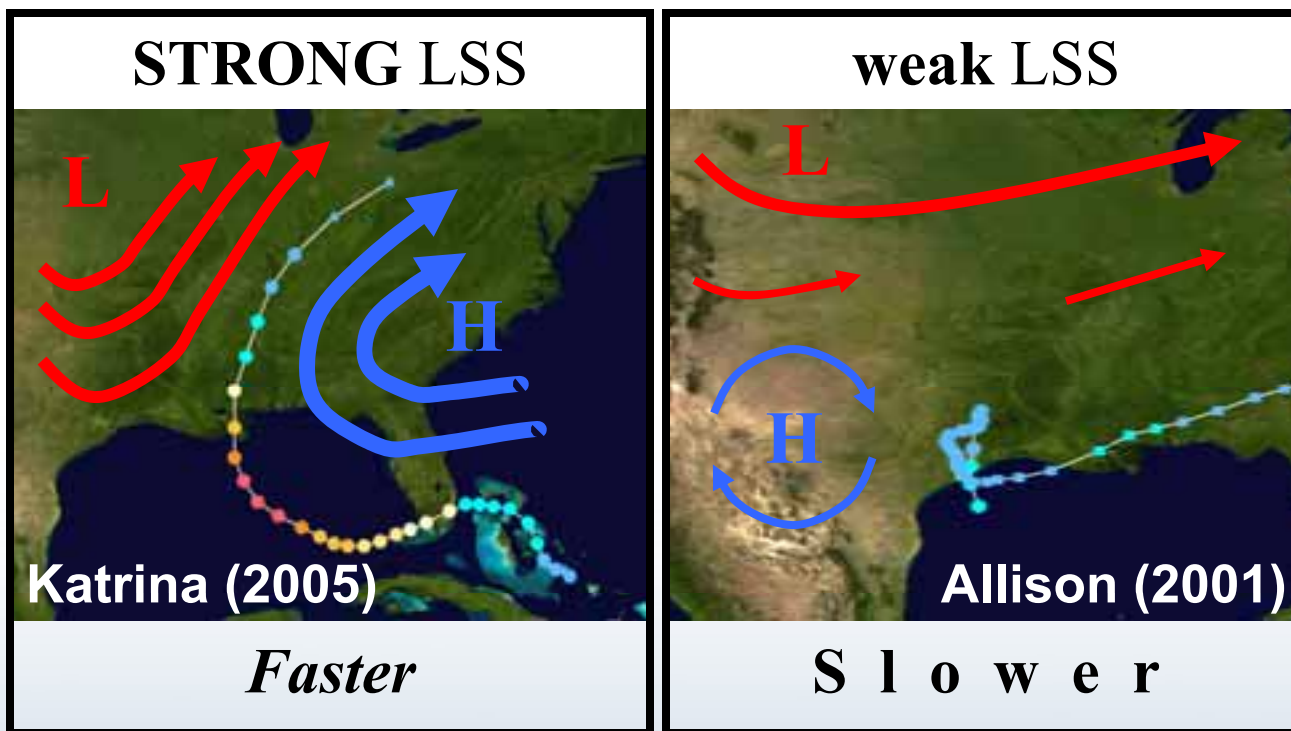
Storm size and strength are not reliable indicators of the heavy rainfall potential in your area





Storm Speed

Cyclones are steered by winds in large-scale weather systems (LSS)

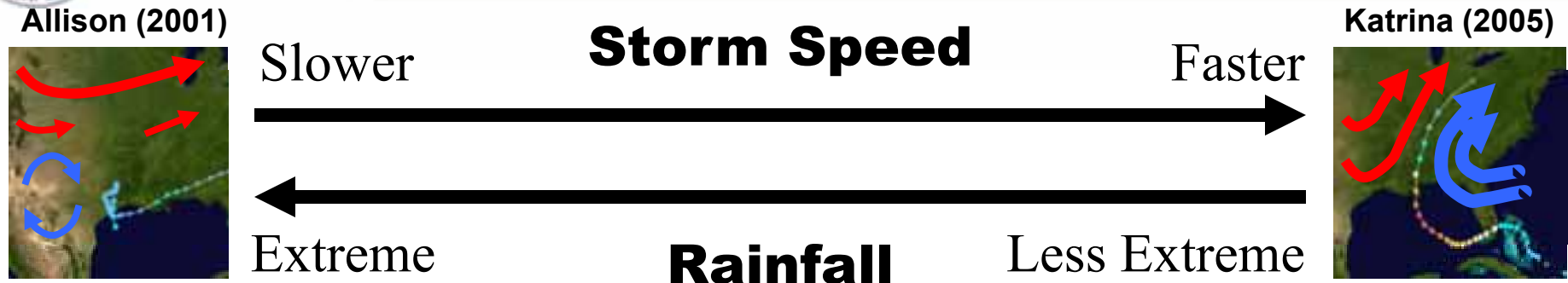


💧 **What is the relationship between speed/direction and rainfall?** 💧





Storm Speed



*Storm speed **may** impact heavy rainfall potential but there are **many other potential factors** to consider.*

? Non-Cyclone Features

? Persistent Rain Bands

? Erratic Cyclone Motion

? Terrain Impacts





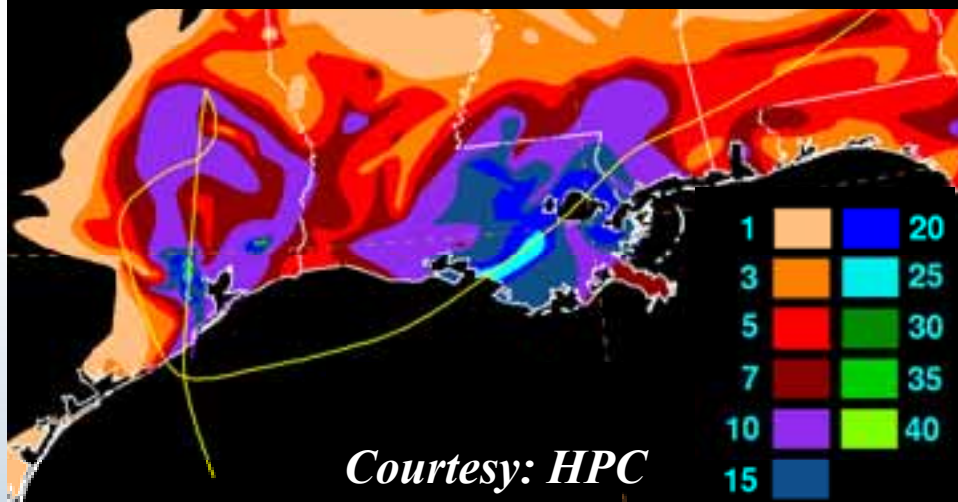
Erratic Cyclone Motion

Tropical Storm Allison

June 4-17, 2001

Storm-Total Rainfall

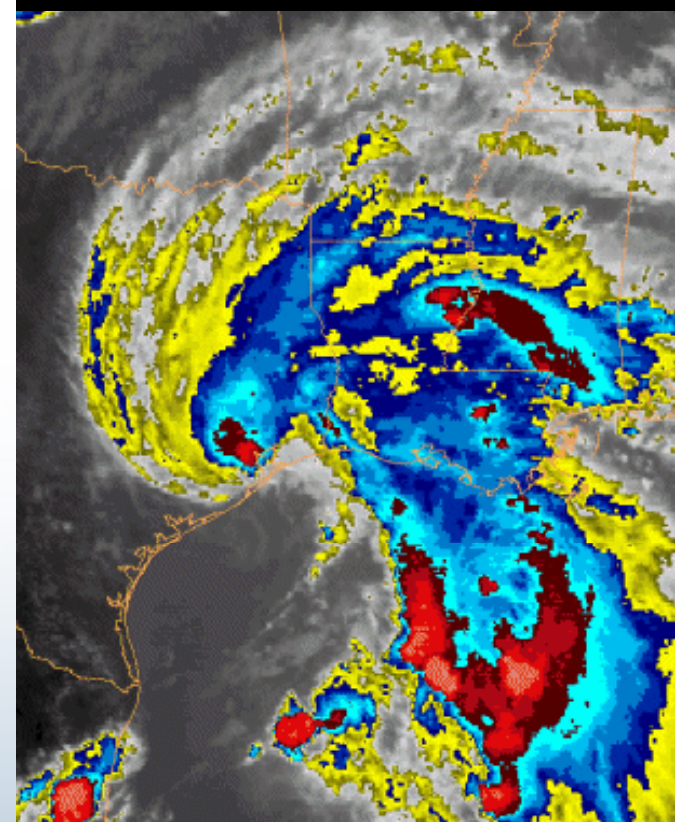
Slow; Erratic Motion Led to Record Rainfall



Courtesy: HPC

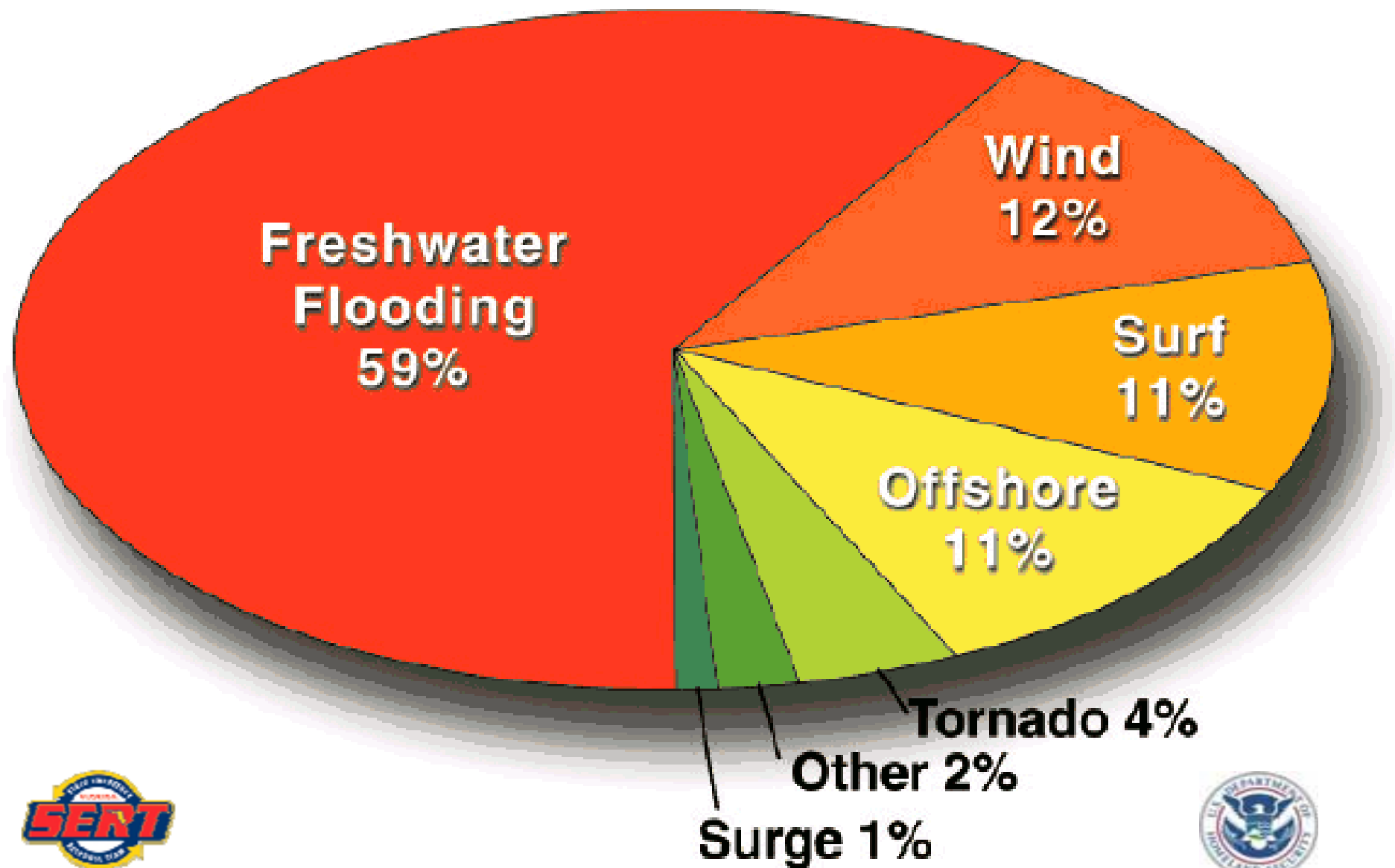
FEMA Hurricane Readiness – Coastal Communities

June 5-6, 2001



Courtesy: NWSWFO HGX

Leading Causes of Tropical Cyclone Deaths in the U.S 1970-1999



Source: Edward Rappaport—Chief, Technical Support Branch, Tropical Prediction Center

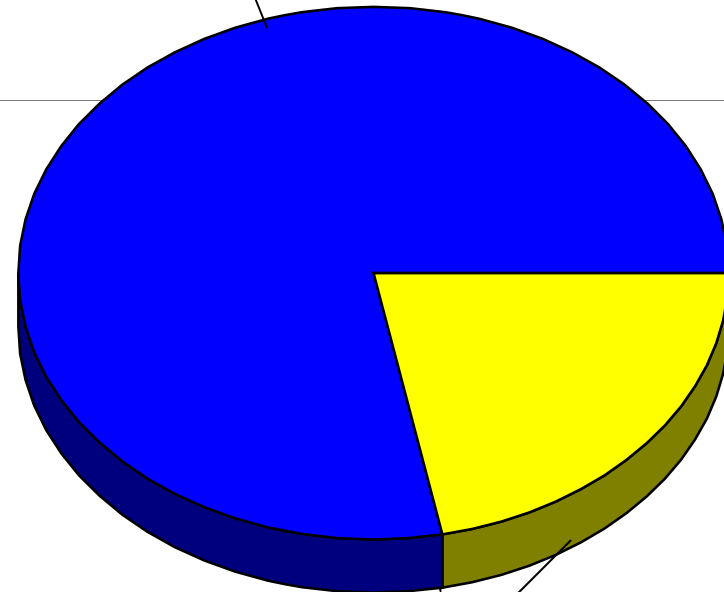
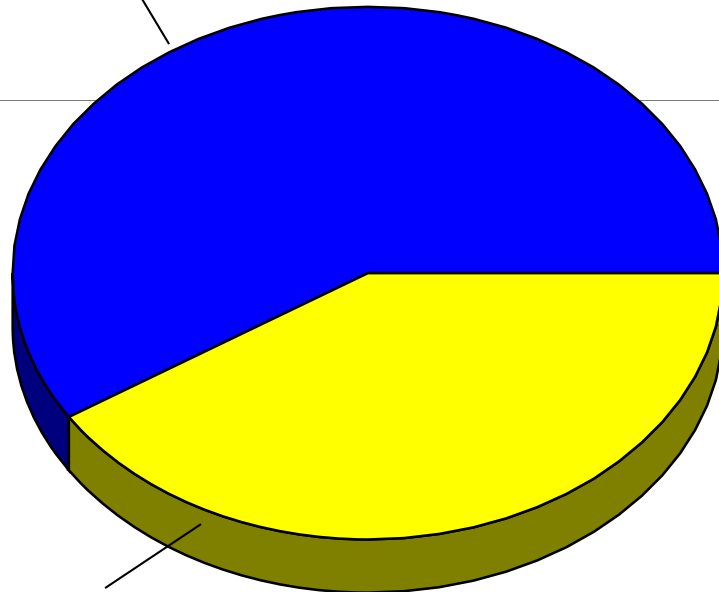
1970-99 U. S. TROPICAL CYCLONE DEATHS

ALL PEOPLE

CHILDREN (UNDER AGE 13)

FRESHWATER FLOOD 59%

FRESHWATER FLOOD 78%



OTHER 41%

OTHER 22%



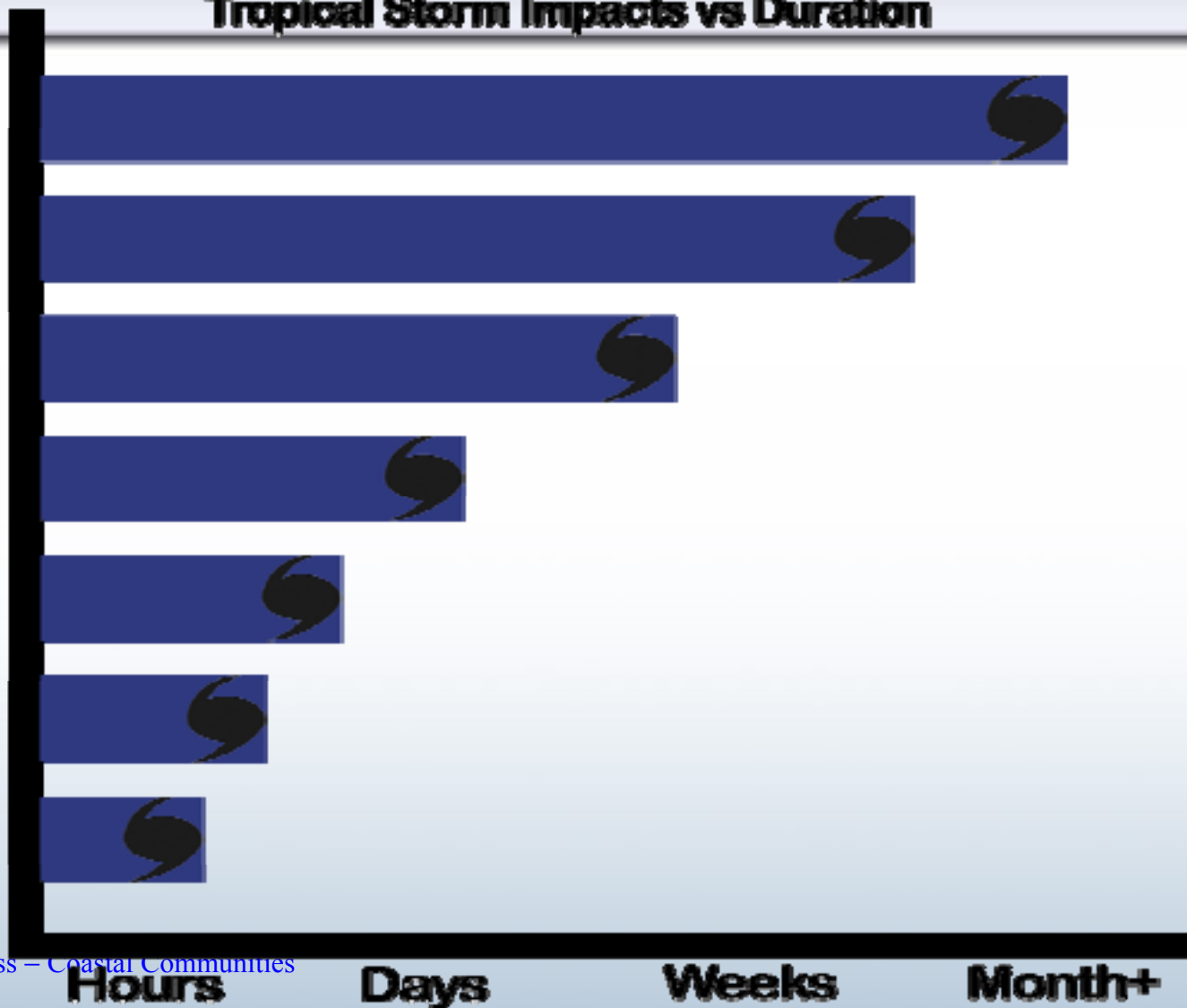


Duration of Flooding

Tropical Storm Impacts vs Duration



- Closed Basin Flooding**
- Traditional River Flooding**
- Coastal Plain Ponding**
- Fast Responding Headwaters**
- Urban & Small Stream**
- Storm Surge**
- Flash Floods & Mudslides along Higher Elevations**



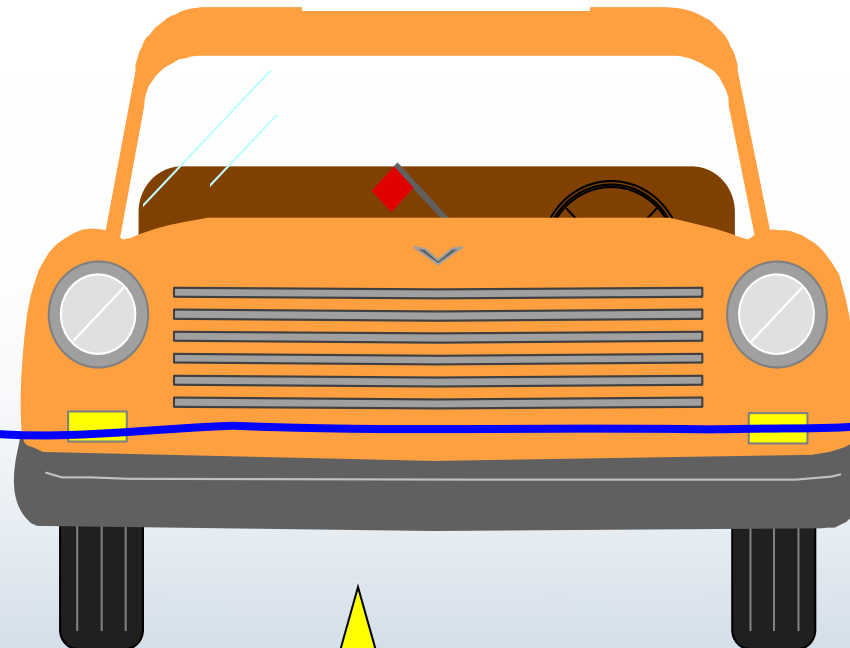


Forces on Vehicles Crossing Streams

**FLOODING AHEAD
TURN AROUND
DON'T DROWN**

The car will float downstream when:
 $\text{Stream Force} > \text{Friction Force}$

Vehicle Weight



Stream Force



Friction Force



Buoyancy Force



Activity 3:1 Assessing Hurricane Hazards

- ◆ What is the potential storm surge in your jurisdiction?
- ◆ What areas are prone to flooding if you receive 6 to 12 inches of rain?
- ◆ What areas are most susceptible to high-wind damage?





Lessons Learned

- ◆ What lessons have been learned as a result of a hurricane or a tropical storm in your county / municipality?
- ◆ What can be improved in the identification of the hazards within the your jurisdiction?





Unit 4: Pre-Season Readiness

- ◆ Evaluate plans
- ◆ Test/update tools and equipment
- ◆ NWS coordination
- ◆ Conduct training
- ◆ Public awareness
- ◆ Activity 4:1—Hurricane Readiness Checklist for Public Education and Awareness
- ◆ Lessons Learned





Effective Pre-Season Decision-Making

Effective decision-making greatly depends on pre-season preparedness and coordination.





Pre-Season Readiness Decision-Making

- ◆ A well-informed public has a greater chance of survival from tropical cyclones
- ◆ A comprehensive public education and awareness program improves the response and survivability of the affected public
- ◆ Creativity is needed in developing a public education program and soliciting assistance from other governmental agencies and private organizations





Evaluate Plan

- ◆ Review local hurricane plans and annexes with staff and Emergency Support Function agencies
- ◆ Assess jurisdictions capability and resources
- ◆ Conduct exercises/drills





Test/Update Tools and Equipment

- ◆ Update decision assistance tools to current application HURREVAC, SLOSH, or others?
- ◆ Emergency Alert Systems
- ◆ NOAA Weather Radios
- ◆ Generators
- ◆ Highway message boards and signage
- ◆ Other equipment?





Hurricane Awareness Study

The study showed that homeowners:

- ◆ Perceive a low level of hurricane risk
- ◆ Think they are well prepared for hurricanes, but they are not
- ◆ For the most part, have taken no action to protect their homes from hurricanes
- ◆ Lack a thorough knowledge of hurricanes
- ◆ Think it is too expensive to take preventive actions, but lack awareness of how much preventive actions cost





NWS Coordination



- ◆ Meet with Weather Forecast Office (WFO) staff before a storm threatens
- ◆ Locate contact information for the National Hurricane Center, River Forecast Centers, other NWS resources
- ◆ Understand local WFO operations and advisory products
- ◆ Accessing advisory information: websites, conference calls, etc.
- ◆ *Other resources to consider?*





Conduct Training

- ◆ Staff
- ◆ Elected officials
- ◆ Primary and Secondary ESF personnel
 - Mass care
 - Evacuation/transportation officials
 - Law enforcement
 - Local volunteers
 - Others?





Public Education and Awareness

- ◆ Use of Media for Communication
 - Devise a strategy that will be effective in your jurisdiction. For example, you will need to consider:
 - Media effectiveness
 - Language and literacy issues
 - Computer literacy and access
 - Special populations

What other considerations would you include?





Published Materials

How published materials can be used for public awareness and education:

- ◆ Publish a special section in your local newspaper with emergency information on hurricanes
- ◆ Publish a preparedness booklet for public distribution
- ◆ Develop a CD-ROM learning program or instructional video targeting schoolchildren or other groups
- ◆ Create preparedness displays for area malls or public buildings
- ◆ *Other ideas for using print materials?*





Television, Radio, and the Internet

How TV, radio, and the Internet can be used for public awareness and education:

- ◆ Produce a television special for broadcast on a local cable channel
- ◆ Produce a public service announcement for broadcast on a local radio station
- ◆ Post preparedness information on the Internet, and create links from other websites to yours
- ◆ *Other ideas for using TV, radio, and the Internet?*





Public Forums

How public forums can be used for public awareness and education:

- ◆ Give a presentation at a school board or PTA meeting
- ◆ Set up a booth at a community safety fair or other public event
- ◆ Teach a workshop at a local conference or civic meeting
- ◆ *Other ideas for using public forums?*





Partner Organizations

Partner organizations that might assist with public awareness and education:

- ◆ Law enforcement
- ◆ Schools and other educational institutions
- ◆ Volunteer agencies
- ◆ Civic organizations
- ◆ *Other ideas for partner organizations in your community?*





Activity 4:1—Pre-season Actions for Public Education and Awareness

- ◆ Present a sampling of strategies for public education and awareness





Lessons Learned

- ◆ What regional/local media capability and public awareness material does your community have?
- ◆ How is this media capability utilized and when?
- ◆ How does pre-season awareness differ from operational public information?
- ◆ How effective are your mitigation procedures and processes?





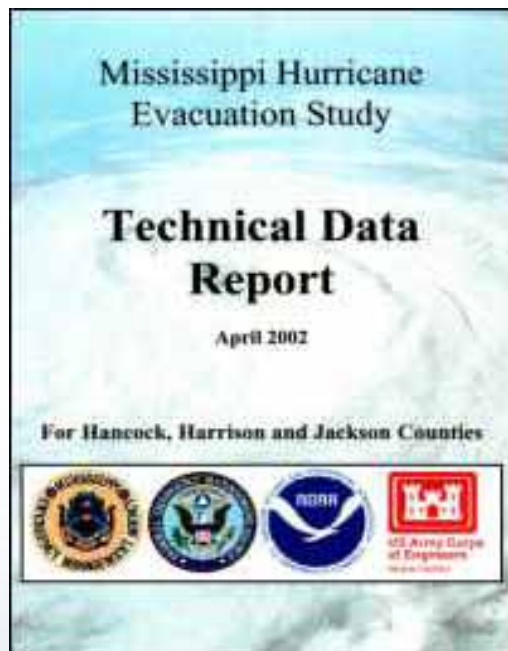
Unit 5: Hurricane Evacuation Studies

- ◆ The Hurricane Evacuation Study (HES) Overview
- ◆ Components
- ◆ Products: Surge Atlas, HURREVAC, Decision Arc, Technical Data Reports.
- ◆ Post-Storm Hurricane Assessment
- ◆ Activity 5:1—Using HES Products
- ◆ Lessons Learned





HES Partnerships



- Federal Emergency Management Agency
- Army Corps of Engineers
- NOAA: National Weather Service & Coastal Services Center
- State & Local Emergency Management
- Regional Planning Councils
- Volunteer Organizations Active in Disasters
- Others????





HES Study Purpose

To provide emergency management officials information that will assist them in hurricane evacuation decision-making





As well as...

- ◆ Several key success points and purpose of the update to the HES:
- ◆ Ensuring consistency of format and methodology
- ◆ Allowing continuity of *critical* information
- ◆ Promoting unified preparedness and response activities during regional or statewide disaster operations
- ◆ Obtaining current demographic analysis by county, including those people not easily captured by Census data
 - Completed and will be published – Spring of 2009
 - Will be provided to all local governments, regional planning councils, and emergency managers
 - Will be used to enhance data for Florida's Catastrophic Planning project
 - Will be used to support revisions to the Statewide Shelter Plan and provide solid, documented source of population data critical to calculating shelter demand





11 Regional Planning Councils

<p>Apalachee Regional Planning Council www.thearpc.com Counties: Calhoun, Franklin, Gadsden, Gulf, Jackson, Jefferson, Leon, Liberty, Wakulla Primary Contact: Chris Rietow - (850) 488-6211 chris.rietow@thearpc.com</p>		
<p>East Central Florida Regional Planning Council www.ecfrpc.com Counties: Brevard, Lake, Orange, Osceola, Seminole, Volusia Primary Contact: Tara McCue - (407) 623-1075 tara@ecfrpc.org</p>	<p>Northeast Florida Regional Council www.nefrc.org Counties: Baker, Clay, Duval, Flagler, Nassau, Putnam, St. Johns Primary Contact: Steve McMikle (904) 279-0885 X149 smcmikle@nefrc.org</p>	<p>Statewide Program Manager: Jeffrey Alexander Lead Agency: Northeast Florida Regional Council Contact: (904) 279-0885 X134 jalexander@nefrc.org www.nefrc.org</p>
<p>West Florida Regional Planning Council www.wfrpc.dst.fl.us Counties: Bay, Escambia, Holmes, Okaloosa, Santa Rosa, Walton, Washington Primary Contact: Jim Crumlish (850) 332-7976 X215 crumlish@wfrpc.dst.fl.us</p>	<p>North Central Florida Regional Council www.ncfrc.org Counties: Alachua, Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Madison, Suwannee, Taylor, Union Primary Contact: Dwayne Mundy (352) 955-2200 X108 dundy@ncfrc.org</p>	
<p>Withlacoochee Regional Planning Council www.wrpc.cc Counties: Hernando, Levy, Marion, Sumter Primary Contact: Bruce Day (352) 732-1315 X230 bday@wrpc.cc</p>	<p>Tampa Bay Regional Planning Council www.tbrc.org Counties: Hillsborough, Manatee, Pasco, Pinellas Primary Contact: Betti Johnson (727) 570-5151 X39 betti@tbrc.org</p>	
<p>Central Florida Regional Planning Council www.cfrpc.org Counties: De Soto, Hardee, Highland, Okeechobee, Polk Primary Contact: Chuck Carter (863) 534-7130 X107 ccarter@cfrpc.org</p>	<p>Southwest Florida Regional Planning Council www.swfrpc.org Counties: Charlotte, Collier, Glades, Hendry, Lee, Sarasota Primary Contact: Dan Trescott - (941) 656-7720 dtrescott@swfrpc.org</p>	
<p>Treasure Coast Regional Planning Council www.trpc.org Counties: Indian River, Martin, Palm Beach, St. Lucie Primary Contact: Terry Hess - (772) 221-4060 thess@trpc.org</p>	<p>South Florida Regional Planning Council www.sfrpc.com Counties: Broward, Miami-Dade, Monroe Primary Contact: Dick Ogburn - (954) 985-4416 rogburn@sfrpc.org</p>	

STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

**Statewide Regional Evacuation Study Program
 PRIMARY CONTACTS**

October 2007



Florida Catastrophic Planning

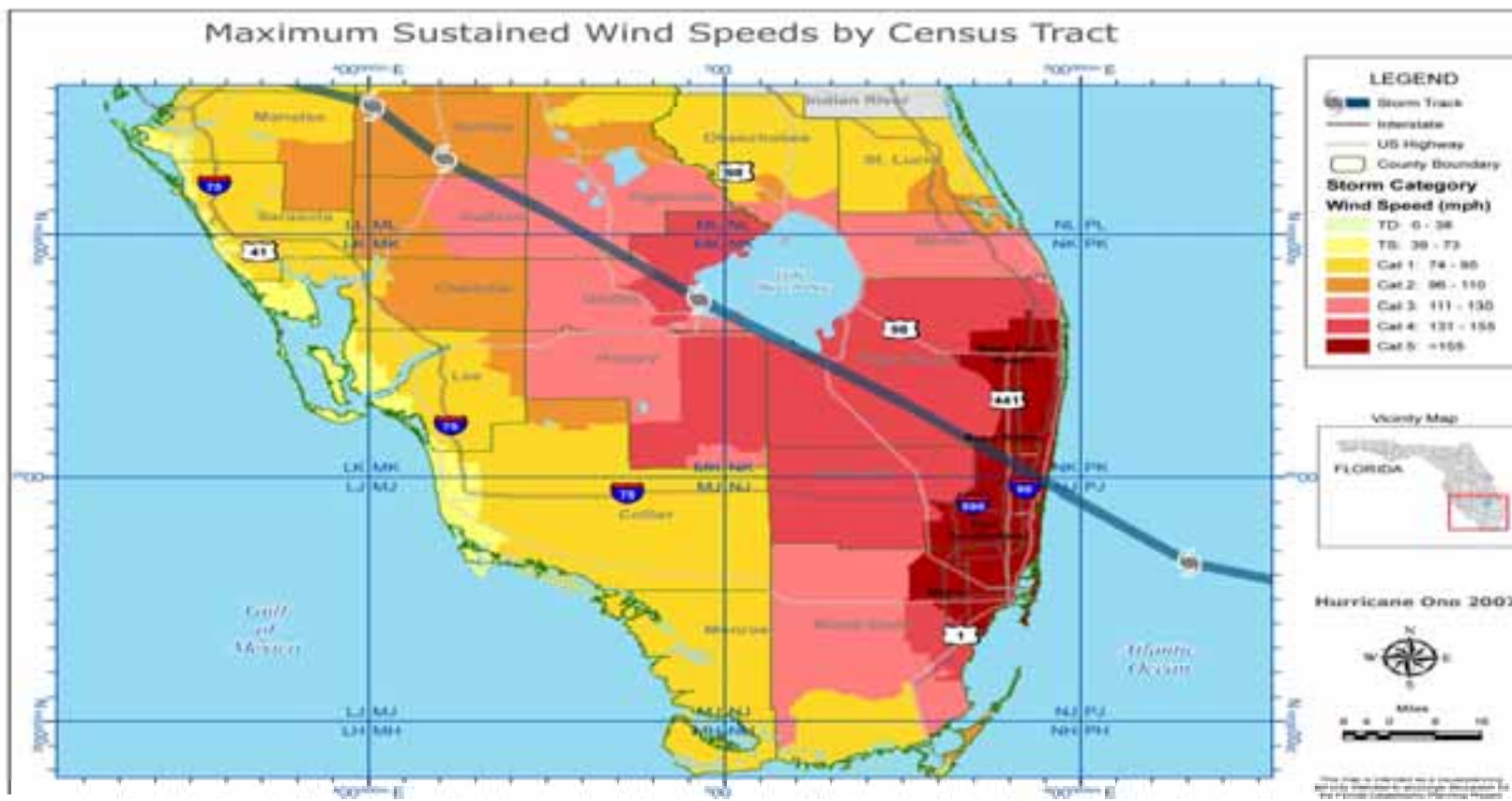
Florida Catastrophic Planning:

- Engages local, state & federal planners and subject-matter experts across all disciplines.
- Is a Local UP approach critical to comprehensive preparedness response.
- Involves all stakeholders and disciplines including faith-based, non-profit and private enterprises.
- Results in decision tools that can be used across all hazards regardless of size or geographic location.
- Results in an all hazards/ all discipline Catastrophic Plan.





Catastrophic Planning continued...





Catastrophic Planning continued...





HES Products

1. Technical Data Report

Comprehensive analysis for coastal counties concerning key factors impacting an evacuation.

2. Storm Surge Maps & Evacuation Zones

Illustrating storm surge inundation areas based on intensity.

3. Evacuation Clearance Times

Estimates time required to evacuate at-risk storm surge vulnerable areas based on the arrival of tropical storm force winds.

4. Decision Assistance Tools

HURREVAC, SLOSH, ETIS & Future ARC IMS programs



FEMA Hurricane Readiness – Coastal Communities

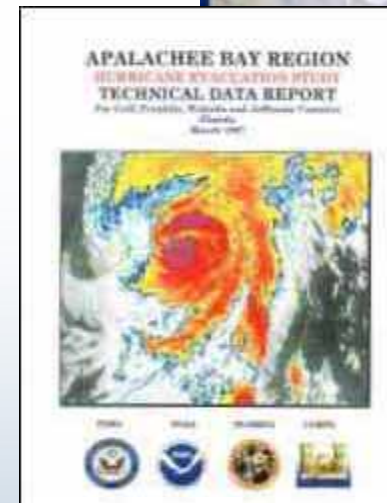


5-9



1. Technical Data Reports

- Hazards Analysis
- Vulnerability Analysis
- Behavioral Surveys
- Shelter Analysis
- Transportation Analysis





Hazards Analysis

**Wind
Storm Surge
Flooding**





Hazards Analysis

- Storm surge has the highest potential for death and damage
- Storm surge is the main reason we evacuate the coast
- HES Studies utilize SLOSH for storm surge estimation



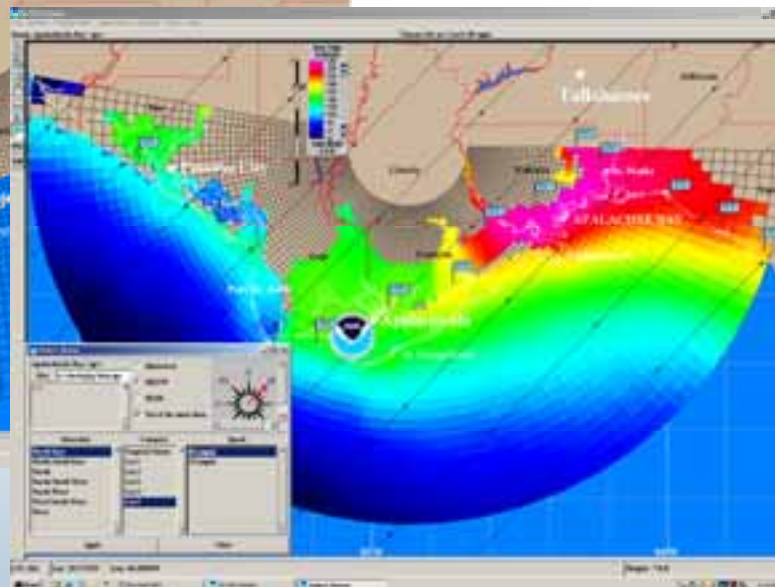
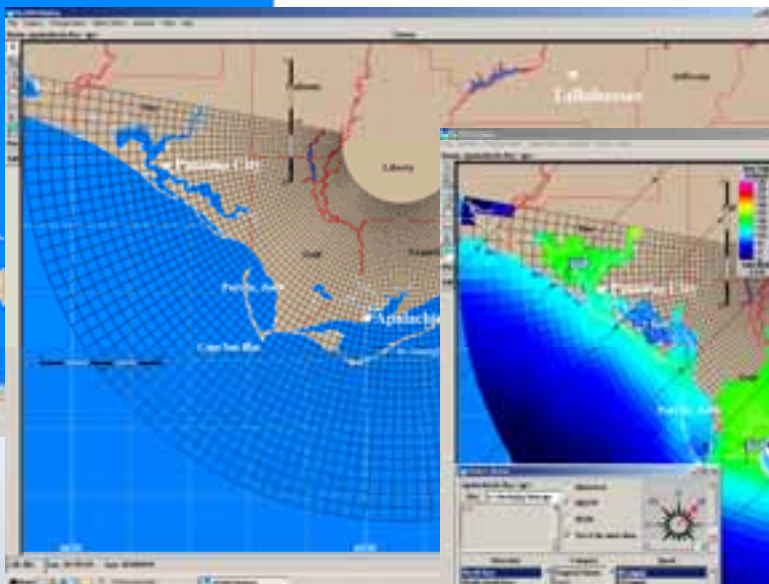
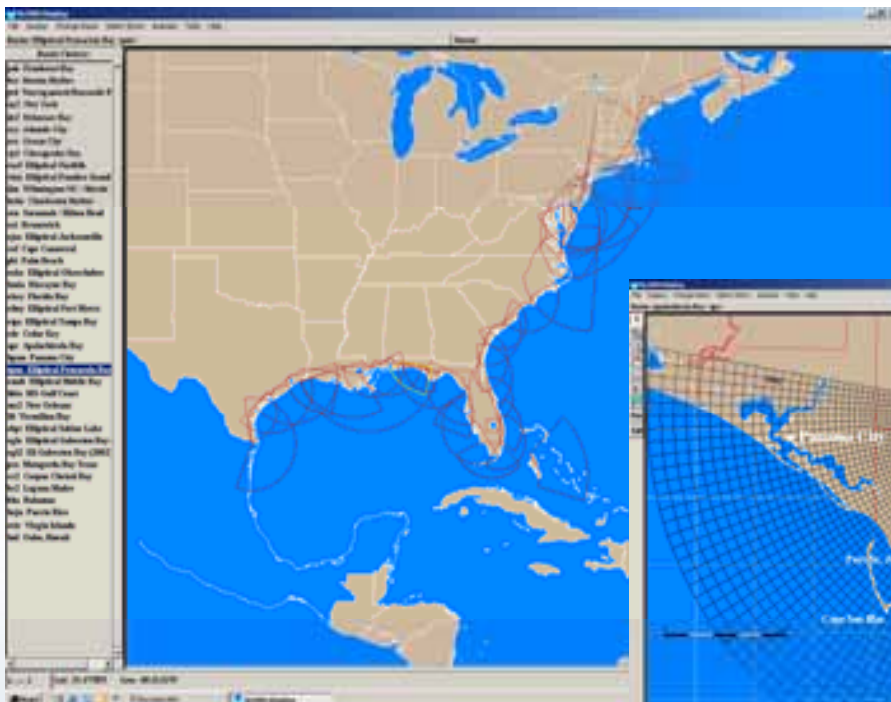
Did you know: The SLOSH model is the official forecast tool of the National Hurricane Center





Hazards Analysis

SLOSH – Sea, Lake, Overland, Surge, from Hurricanes:



FEMA Hurricane Readiness – Coastal Communities

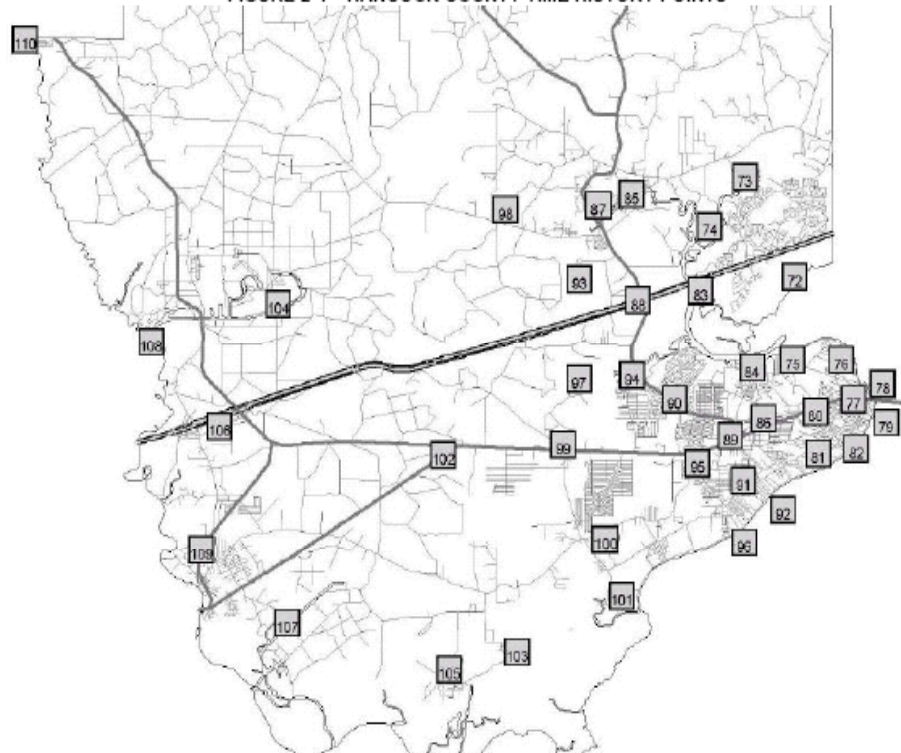


Hazards Analysis

Storm Surge Time History Points:

TABLE 2-6
HANCOCK COUNTY TIME HISTORY POINTS

FIGURE 2-4 HANCOCK COUNTY TIME HISTORY POINTS



Point#	Time History Point Name	Surge Elevation in Feet NGVD				
		CAT 1	CAT 2	CAT 3	CAT 4	CAT 5
72	Diamond Head Yacht Club	8.3	14.3	20.5	26.3	31.3
73	Fenton	8.5	14.7	21.3	28.9	33.8
74	Rotten Bayou	8.1	14.6	21.1	28.1	33.3
75	Casino Magic	7.7	13.8	19.8	25.4	30.3
76	North Bay Elem. - Dunbar Village N.H.	8.1	13.6	19.7	25.2	29.9
77	Notre Dame De La Mer Retirement Apts	8.1	13.5	19.8	25.2	29.8
78	Us 90 Bridge, West End	8.1	13.6	19.9	25.1	29.8
79	Hotel Reed Nursing Home	8.3	14.0	19.9	25.1	29.7
80	Hancock Medical Center	8.3	14.0	19.7	25.1	29.8
81	Fire & Police Dept; Senior Citizen's Ctr	8.3	14.0	19.7	25.2	29.7
82	St. Stanislaus/ Oia	8.3	14.0	19.9	25.0	29.4
83	Jourdan River Bridge, Interstate 10	8.0	14.4	20.7	27.1	32.2
84	Blue Meadow	7.8	13.8	19.8	25.6	30.6
85	Jourdan River Shores	7.9	14.2	21.4	28.1	33.6
86	Civic Center	7.8	13.8	19.7	25.0	30.0
87	Highway 603 At Jourdan River	7.8	13.9	21.4	28.1	33.5
88	Interstate 10 & Hwy 603	8.1	14.5	20.8	27.2	32.6
89	US 90 & Hwy 603; Walmart	7.8	13.7	19.6	25.0	29.9
90	Kiln Cutoff & Hwy 603	7.7	13.8	19.8	25.4	30.5
91	Waveland Elementary School	8.3	14.0	19.4	24.8	29.3
92	Downtown Waveland	8.3	14.2	19.6	24.5	29.0
93	Hancock H. S. - Stennis Int'l Airport	8.1	14.5	20.9	27.4	32.9
94	Hwy 43 & 603@ Bayou La Croix	7.8	14.1	20.2	25.9	31.2
95	Waveland Avenue & US 90	8.2	13.8	19.4	24.8	29.6
96	Buccaneer Park; Gulfside Assembly	8.2	14.1	19.4	24.3	28.6
97	Harbor Drive	8.0	14.1	20.1	26.1	31.2
98	Mccloud	7.8	13.5	21.6	27.7	33.0
99	Lakeshore & US 90	8.0	13.9	19.6	25.3	30.3
100	Gulf View Elementary	7.2	14.3	19.2	24.2	28.7



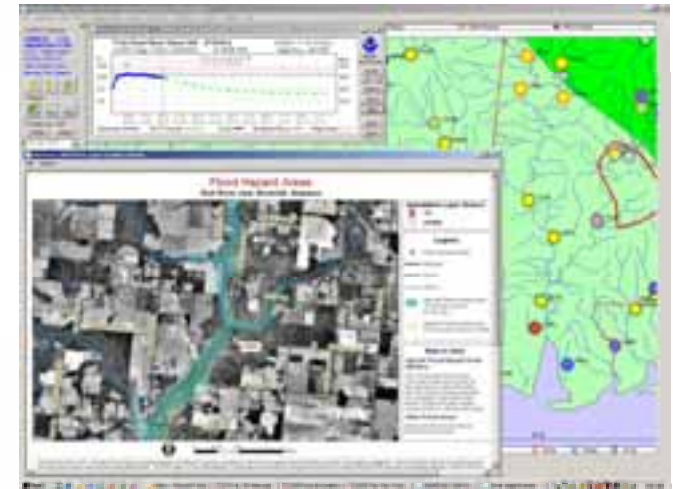




Hazards Analysis

Understanding Tropical Cyclone Flood Potential:

- Develop components within HURREVAC to monitor threat
- Utilize FEMA Mitigation data to identify coastal flood inundation areas (100/500 year zones)



Did you Know: Between 1970 and 1999 approximately 59% of all tropical cyclone death occurred from freshwater flooding.



FEMA Hurricane Readiness – Coastal Communities



Vulnerability Analysis

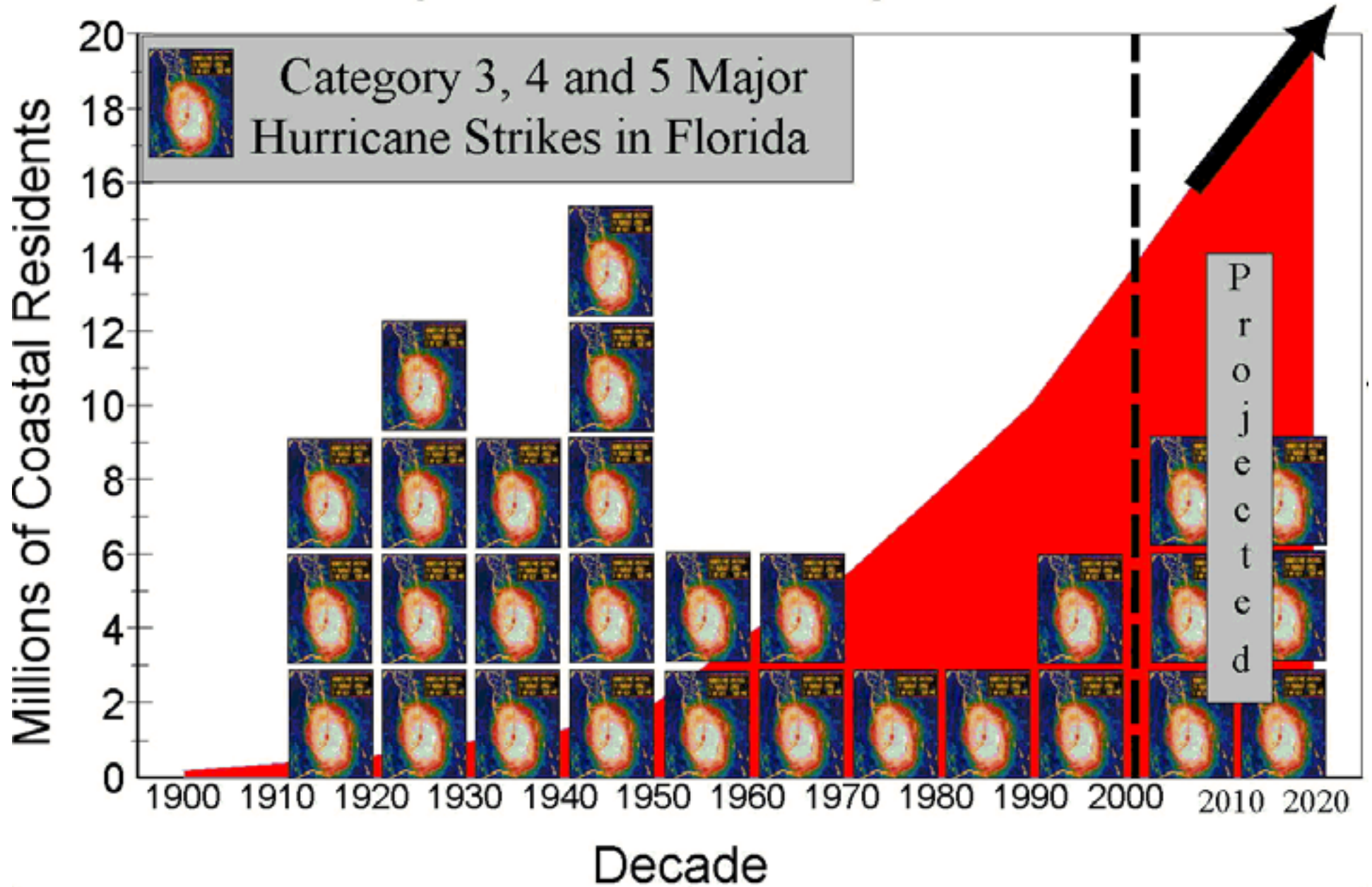
- In 2003, 32 million people lived in coastal counties from TX to ME (from 18 million in 1970)
- \$150 billion in 2004 & 2005 sustained in damages
- Average Annual physical damages \$10-\$11 Billion
- 1995-2005 was the 2nd most damaging decade in history
- If the 1926 Miami Hurricane hit today it would cost - \$157 Billion
- 85% of total damages are caused by Major Hurricanes during 1926-2005.



FEMA Hurricane Readiness – Coastal Communities



Florida Population and Major Hurricanes





Vulnerability Analysis

- **Identifies who/what will be impacted?**
 - **Citizens residing in storm surge areas**
 - **Critical facilities**
 - **Mobile/Manufactured home communities**
 - **Vulnerable Shelters**
 - **Roadway network, bridges, etc**
 - **Other areas to be considered?**





Vulnerability Analysis

**VULNERABLE
POPULATION BY
EVACUATION ZONE
(BASED ON THE YEAR
2000 POPULATION
ESTIMATES)**

County Evacuation Zones	Mobile Home Population	Permanent Population	Non-Mobile Home Population	Total Mobile Home Population	100 Percent Tourist Population	Vulnerable Population Columns 4+5+6 Total
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
HANCOCK COUNTY						
Total Population	6,132	43,719	37,587	6,132	19,626	63,345
Zone A - Cat. 1-2	3,093	21,129	18,036	6,132	13,284	37,452
Zone B - Cat. 3	4,305	29,721	25,416	6,132	15,777	47,325
Zone C - Cat. 4-5	4,956	36,450	31,494	6,132	18,624	56,250
HARRISON COUNTY						
Total Population	18,596	187,098	168,502	18,596	46,980	234,078
Zone A - Cat. 1-2	5,695	58,349	52,654	18,596	20,202	91,452
Zone B - Cat. 3	8,363	91,624	83,261	18,596	32,727	134,584
Zone C - Cat. 4-5	13,877	154,800	140,923	18,596	43,905	203,424
JACKSON COUNTY						
Total Population	13,664	139,686	126,022	13,664	25,338	165,024
Zone A - Cat. 1-2	6,421	87,084	80,663	13,664	14,808	109,135
Zone B - Cat. 3	8,906	116,881	107,975	13,664	21,267	142,906
Zone C - Cat. 4-5	11,364	129,410	118,046	13,664	23,391	155,101





Behavioral Analysis

Helping coastal decision makers understand how their community will react to a tropical cyclone threat:

- **My house survived Camille... I'll be okay**
- **I hope my house survives the winds.**
- **What about my pets?**
- **A Category 1 isn't too bad.**
- **I don't live on the beach.**
- **I don't have reliable transportation.**
- **I will leave once Hurricane Warnings are issued.**





Behavioral Analysis

What type of data is collected:

- % of the population that will evacuate
- When the evacuating population will leave
- # of vehicles that the evacuating population will use
- Evacuation responses of tourists
- % of the total # of evacuating vehicles which might be towing boats, camper trailers, etc.
- Probable destinations of the evacuating households
- How the threatened population will respond

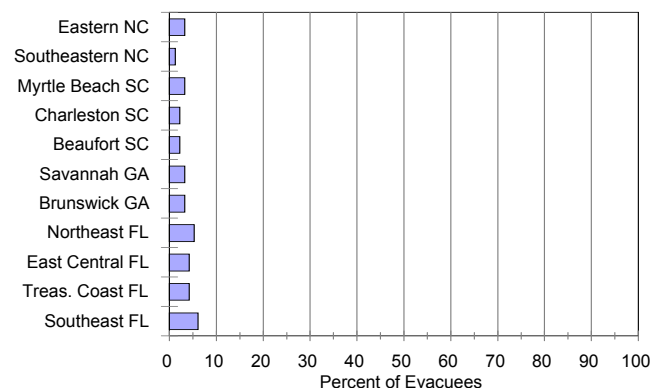




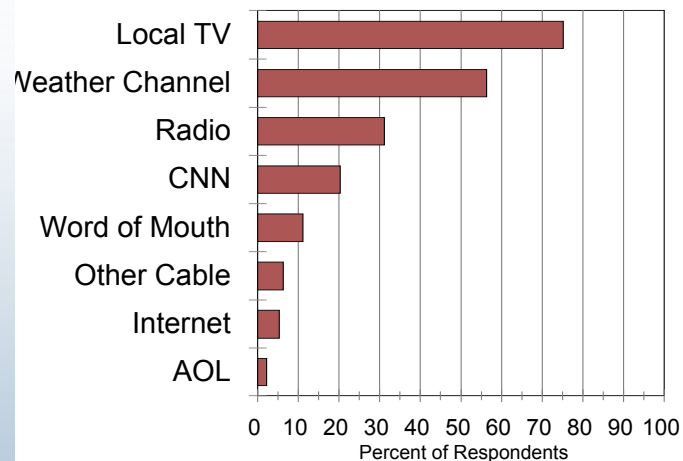
Behavioral Analysis

- 5 to 8% of evacuees will seek public shelter
- 80% is typically the best participation rate expected
- 95% consider watches/warnings important when considering evacuation
- A majority of citizens evacuate from wind and not storm surge
- 75% rely on local news channels for information

Evacuees Going to Public Shelters
Avg. All Zones



Relied on Sources a Great Deal

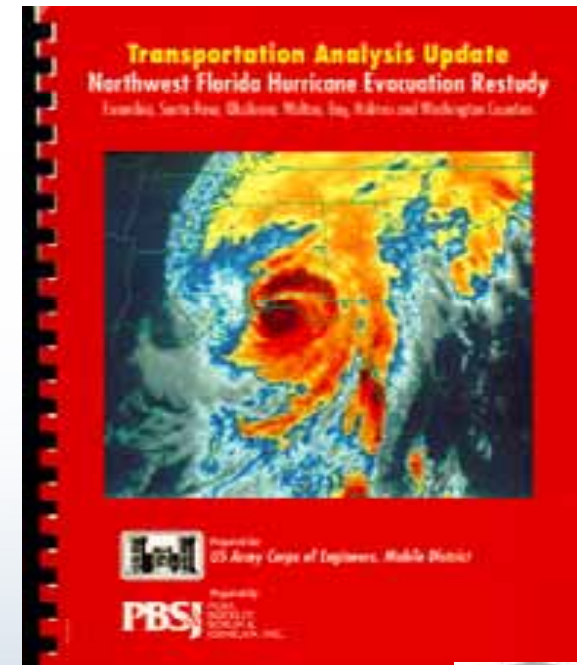




Transportation Analysis

The Transportation Analysis utilizes data produced by the other analysis to determine traffic congestion and clearance times:

- ◆ Demographics
- ◆ Behavioral Assumptions
- ◆ Evacuation Routes
- ◆ Roadway Capacities
- ◆ Travel Patterns
- ◆ Model Results
- ◆ Clearance Times

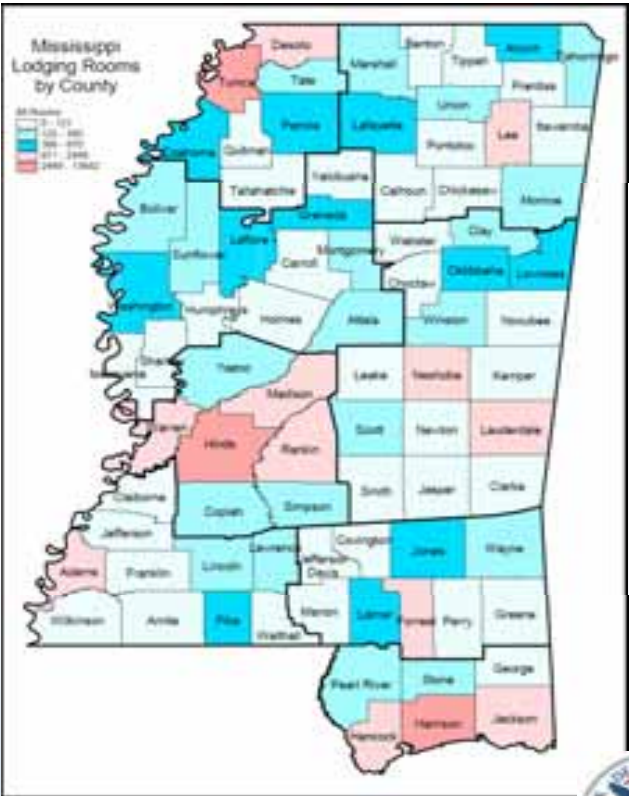




Transportation Analysis

Evaluating Vehicle Table

	Total Evaluating VEHICLES	Vehicles Going to Shelters	Vehicles Going to friends	Vehicles Going to Motel	Vehicles Going out of County
HANCOCK COUNTY					
Low Tourist Occupancy					
Category 1-2	12,832	814	5,195	499	6,224
Category 3	17,152	1,520	5,911	499	9,224
Category 4-5	22,111	2,366	6,142	499	13,104
High Tourist Occupancy					
Category 1-2	98,288	040	5,105	499	9,642
Category 3	21,204	1,507	5,911	499	13,227
Category 4-5	26,233	2,366	6,142	499	17,226
HARRISON COUNTY					
Low Tourist Occupancy					
Category 1-2	30,503	2,068	17,189	1,576	17,782
Category 3	58,963	5,725	21,743	1,576	29,919
Category 4-5	96,177	12,172	30,072	1,576	54,357
High Tourist Occupancy					
Category 1-2	46,554	3,025	17,109	1,576	24,704
Category 3	56,528	5,620	21,743	1,576	30,389
Category 4-5	100,031	12,172	30,072	1,576	54,211
JACKSON COUNTY					
Low Tourist Occupancy					
Category 1-2	48194	3320	22109	2107	20,460
Category 3	52078	5340	23503	2107	20,955
Category 4-5	56704	6029	19720	2107	29,240
High Tourist Occupancy					
Category 1-2	52409	3301	22189	2107	24,871
Category 3	57313	5396	23593	2107	26,137
Category 4-5	72107	8029	19320	2187	44,571





Transportation Analysis

Components & Products of the Transportation Analysis

- Evacuation Routes
- Roadway Capacities
- Participation Rates
- Destinations
- Response Rates





Shelter Analysis

Key Sheltering Issues:

- Location/Identification
- Capacity
- Training
- Structural Integrity
- Response Rates
- Official vs. Good Samaritan





2. Storm Surge Atlas & Evacuation Zones



FEMA Hurricane Readiness – Coastal Communities

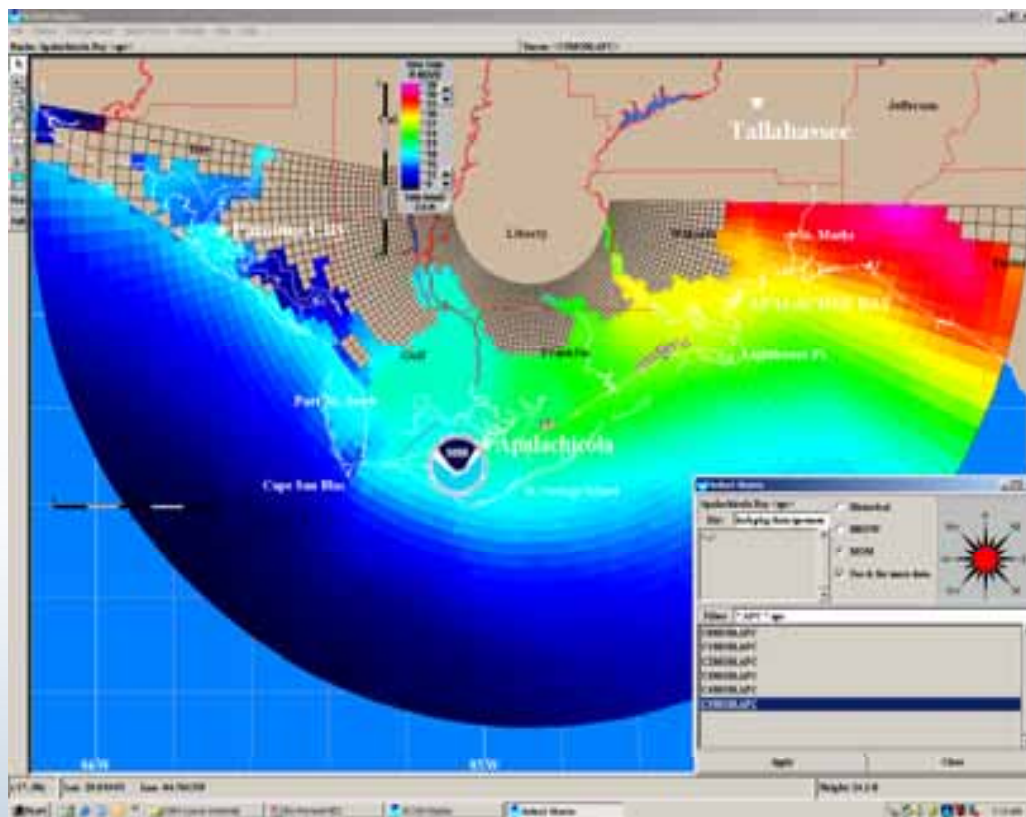


5-29



Storm Surge Atlas

Storm surge maps/atlas are based on MOM storm surge potential



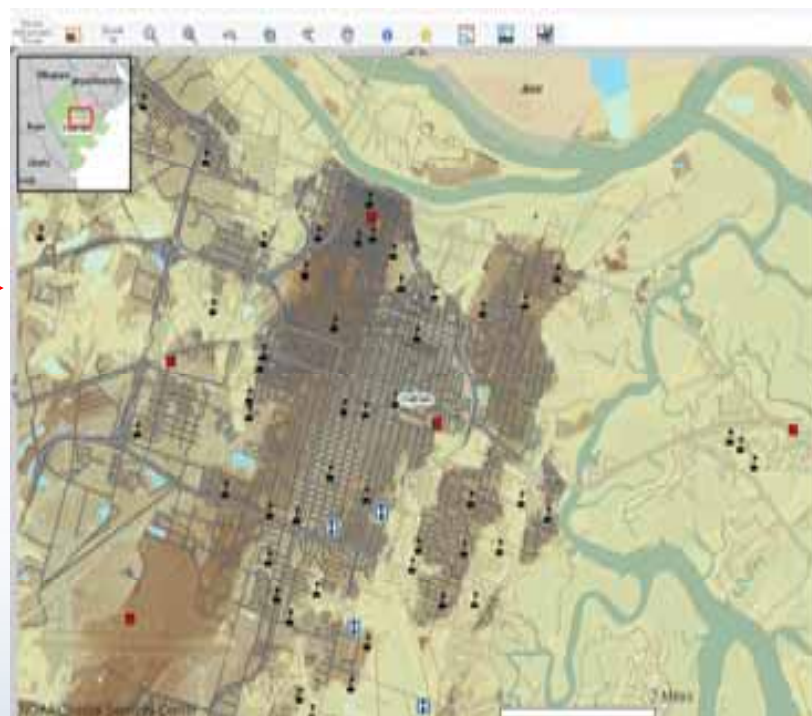
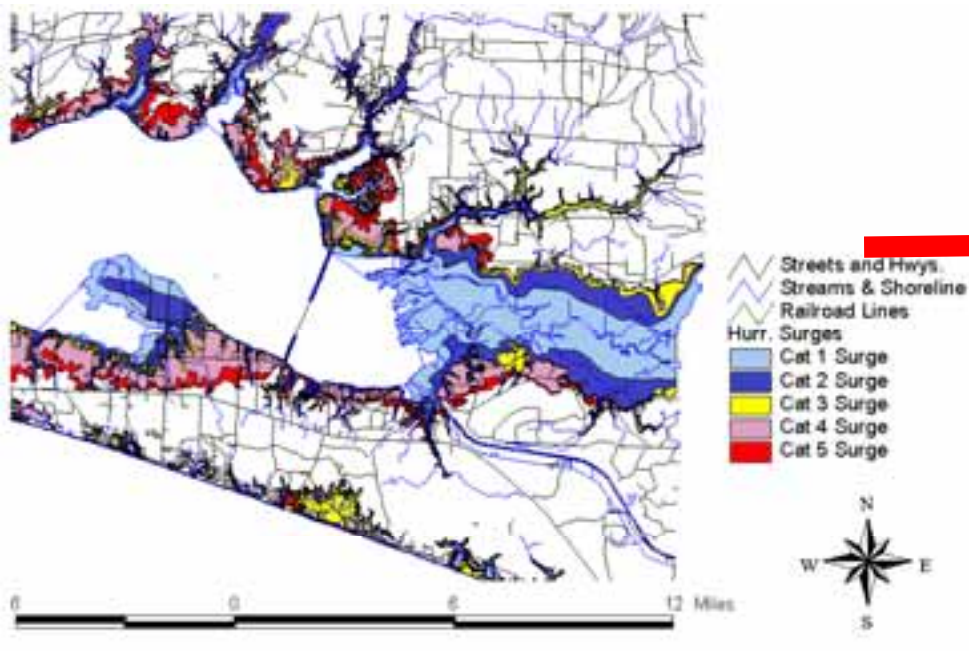
Maximum of Maximum Storm Surge Potential “MOM”

- Consist of thousands of runs
- Different intensities, pressure, angles, forward speed, wind radii, etc.
- One per category





Storm Surge Atlas



MOM Hazard Atlas



Moving from Paper to Digital GIS format



Evacuation Zones

Should be designed to effectively communicate the hazard warning order to the public; best practice considerations:

- ◆ Created by Local, State, and Federal EMA representatives to move people out of hurricane hazard vulnerable areas.
- ◆ Delineated by major geographic features, such as major roads, rivers, political boundaries, etc.
- ◆ Mainly designed to get citizens out of storm surge vulnerable areas.
- ◆ Designed to improve warning order communication and promotes phased evacuations
- ◆ Serve as the foundation for Evacuation Clearance times.





Evacuation Zones

- **Zones must be communicated to citizens through an extensive public awareness outreach campaign.**
- **Turnover at the local level – Zones are often forgotten**
- **In reality, evacuations can be politically driven and not planned.**
- **Zone terms are confused with floodplain terms**
- **Emergency Managers fail to issue evacuations based on the Zones created by the HES.**





3. Evacuation Clearance Times

When the first evacuating vehicle enters the road network, ends when the last vehicle reaches an assumed point of safety - includes travel time and waiting in traffic congestion (does not relate to any one particular vehicle)





HURREVAC
is the final
“end product”
of the HES and
is a software
program that
includes NWS
information and
evacuation data





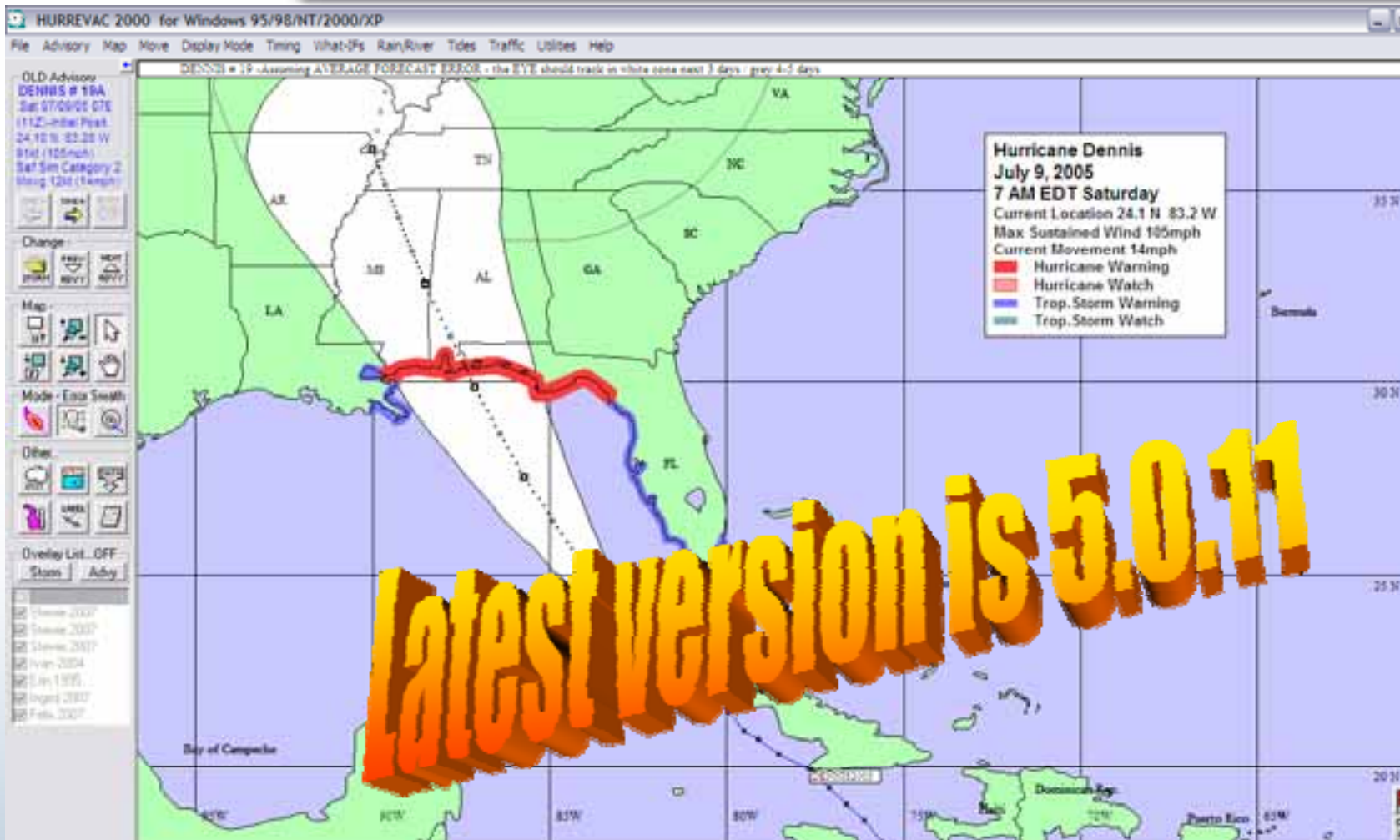
HURREVAC

- ◆ Software program that is a primary decision-making tool for emergency managers.
- ◆ Funded through the FEMA national hurricane program and is free to Government agencies.
- ◆ Website is: www.hurrevac.com.





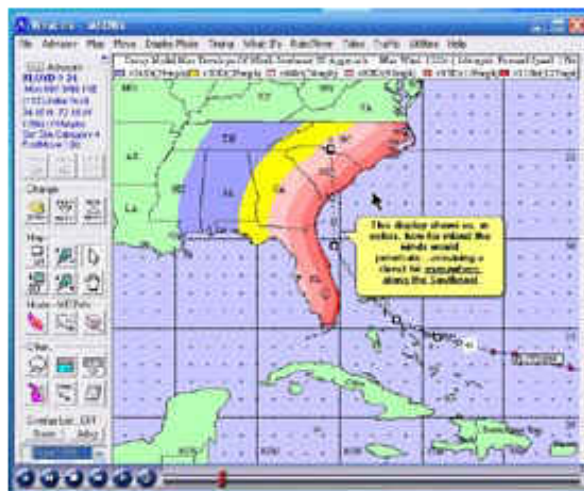
Application of HURREVAC



hurricane.com

a support site maintained by Sea Island Software, Inc.

[register](#) [contact us](#)



What's New

Sea Island Software's **new Multimedia Interactive Training CD** for Hurrevac is now available. See a demo [at our Sea Island Software companion website...](#)

Latest Version (4.0.5) The 2005 update of HURREVAC2000 for Windows(tm), is the latest update available Sept 21, 2005 [more](#).

Need Training on Hurrevac? See our [Training Page](#) for available training materials.

[About HURREVAC](#) [Support Services](#) [Technical Issues](#)

Welcome to the support site for users of the HURREVAC program (Hurrevac2000 for Win95/98/NT/2000/XP).

HURREVAC is a restricted-use computer program used by official government emergency managers since 1988 to track hurricanes and assist in decision-making for their communities.

This web site is maintained by Sea Island Software, Inc., the programmer, to enhance the support services for this program for valid EM users.

We have provided a number of resources to assist with both the use of HURREVAC and with emergency management issues as they relate to hurricanes.

[ABOUT HURREVAC](#) | [SUPPORT SERVICES](#) | [TECHNICAL ISSUES](#)

Questions or problems regarding this web site should be directed to JohnTownsend@hurricane.com, Sea Island Software, Inc.

Last modified: Sunday February 26, 2006.

About HURREVAC

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Registration to use HURREVAC 2000 for Windows95/98/NT/2000/XP

Important Note - Please Read First: You must be an active member of the government Emergency Management community* in order to qualify to use HURREVAC2000 for Windows (tm), a restricted-use program developed by Sea Island Software, Inc for use by FEMA and the Corps of Engineers . **This means that you must be directly involved in hurricane evacuation decision-making for the residents in your state or community** when a hurricane threatens.

* **Examples of eligible users are** hurricane evacuation decision-makers in FEMA, Corps of Engineers, National Weather Service, State Emergency Management Agencies, and County or Parish Emergency Management Agency Offices.

In particular, State and County agencies other than the State Emergency Management Agency and County/Local Emergency Management Agency offices will need confirmation from those EM offices that you indeed do help those offices in hurricane evacuation decision-making and need the program for that purpose. Without such approval and confirmation, registration will be refused.

Eligible users will be sent information by e-mail on how to download, install, and use the program.

<input type="text"/>	Name
<input type="text"/>	GOVERNMENT E-mail Address (mandatory!)
<input type="text"/>	Phone Number
<input type="text"/>	Agency
<input type="text"/>	Street Address
<input type="text"/>	City
<input type="text"/>	State
<input type="text"/>	ZIP

Please describe your job title and emergency management duties as they relate to the hurricane threat.

Hurrevac Tech Note

DOWNLOADING AND ACTIVATING EVACUATION CLEARANCE TIME FILES (PLUG-INS) FOR YOUR AREA...

Print this file out first and follow the instructions carefully!!

STEP 1 - FIND THE FILE YOU NEED

When doing this step, you will be asked for a name and password...use the confidential name and password you were given previously to download Hurrevac. Remember, case of the name and password is important.

Using your internet browser call up http://www.hurrevac.com/_private/evacdata (note the underscore in front of private if you are typing this URL in to your browser).

Once you are in the `_private/evacdata/` directory, using your browser, navigate to (click on) the state directory for your state...example `/sc` for South Carolina , `/evacdata/ga` for Georgia and so on.

In this directory will be a file called `xxEVAC.EXE` , where `xx` stands for the state two-letter id. In order to activate the evac data file plug-ins, you must download and run this file in a specific location.

STEP 2 - DOWNLOAD TO YOUR PC ON THE DRIVE WHERE YOUR HURREVAC2000 PROGRAM IS LOCATED -

To download, right-click on the file name and select `Save File As...` or `Save Link As...` (depending on browser) then **MAKE SURE** you save it on the same drive as your Hurrevac2000 program.

By default, Hurrevac2000 is installed to `c:\ProgramFiles\Hurrevac2000...`but yours may



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Support Services

Support Page

Please check out our [Tech Notes](#) page first. Your problem or request may be covered there.

If you have support needs of a more urgent nature, you may contact our **24/7 Hurrevac support line at (843)-881-0593**. Otherwise, please submit an e-mail using the form below and describe the problem.

E-mail to hurrevac.com tech support

Please fill in all of the information below and provide as much extra information as possible. Make sure that your email address is correct or our reply cannot reach you!

Name

E-mail Address

Phone Number

Program Information:

 Version

Problem:

What happens? Please include any error messages.



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E-mail to hurrevac.com tech support

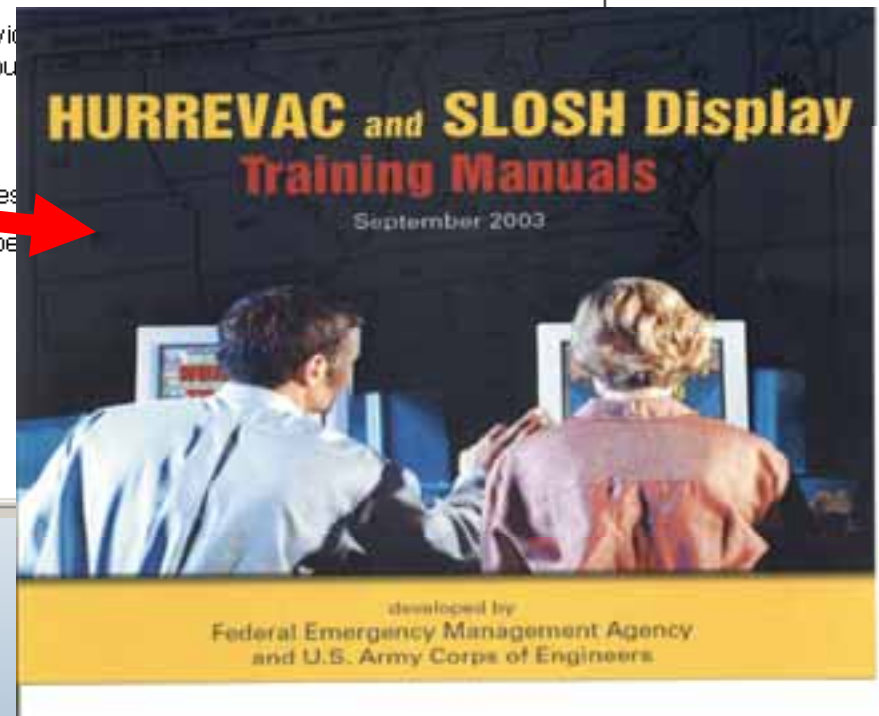
Please fill in all of the information below and provide a description of your problem. Make sure that your email address is correct or our support team will not be able to contact you.

<input type="text"/>	Name
<input type="text"/>	E-mail Address
<input type="text"/>	Phone Number

Program Information:

Select a program... ▾	Version	<input type="text"/>
Select an operating system... ▾		

Problem:





hurrevac.com

a support site maintained by Sea Island Software, Inc.

www.hurrevac.com



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Welcome to the support site for users of the HURREVAC program (Hurrevac2000 for Win95/98/NT/2000/XP).

Evacuation Timing Features

Microsoft's newly issued (Aug 04) Windows XP Service Pack 2 has some FTP issues to note that may affect Hurrevac[see this page](#)

[Latest Version \(3.0.13\)](#) An update of HURREVAC2000 for Windows(tm), is the latest update available Dec 21, 2004 [more](#). Registered users were notified by email of this update when it became available.

This web site is maintained by Sea Island Software, Inc., the programmer, to enhance the support services for this program for valid EM users.

We
HUR
hur

Must download your state Clearance Times to view timing screens

[ABOUT HURREVAC](#) | [SUPPORT SERVICES](#) | [TECHNICAL ISSUES](#)

Questions or problems regarding this web site should be directed to JohnTownsend@hurrevac.com, Sea Island Software, Inc.









Index of /_private/evacdata - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Print View Source

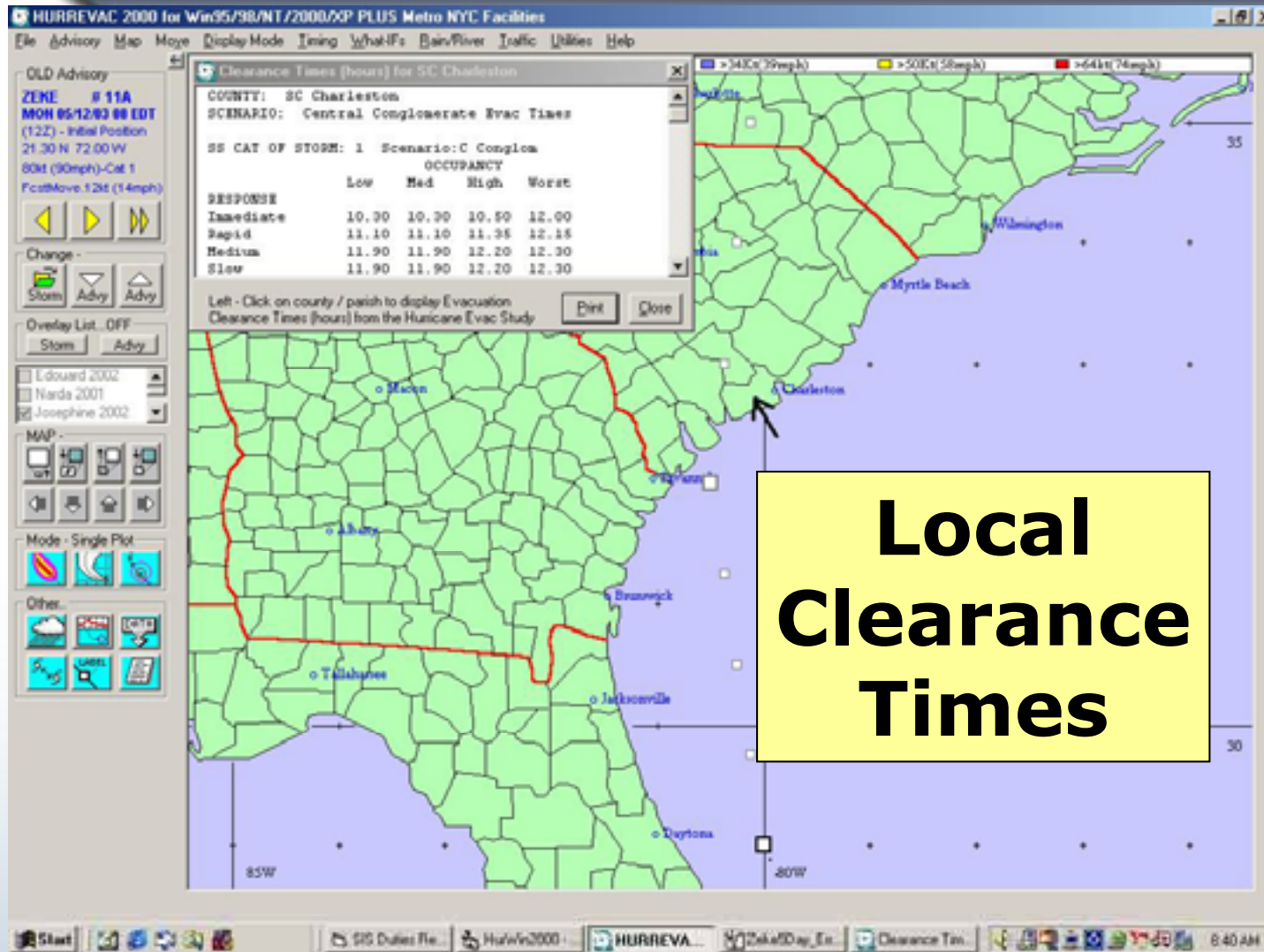
Address http://www.hurrevac.com/_private/evacdata/ Go Links

Index of /_private/evacdata

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 Parent Directory	18-Oct-2002 10:16	-	
 al/	08-Feb-2000 15:41	-	
 ct/	08-Feb-2000 15:41	-	
 de/	08		
 facility/	08		
 fl/	13-Sep-2001 09:17	-	

Done Internet

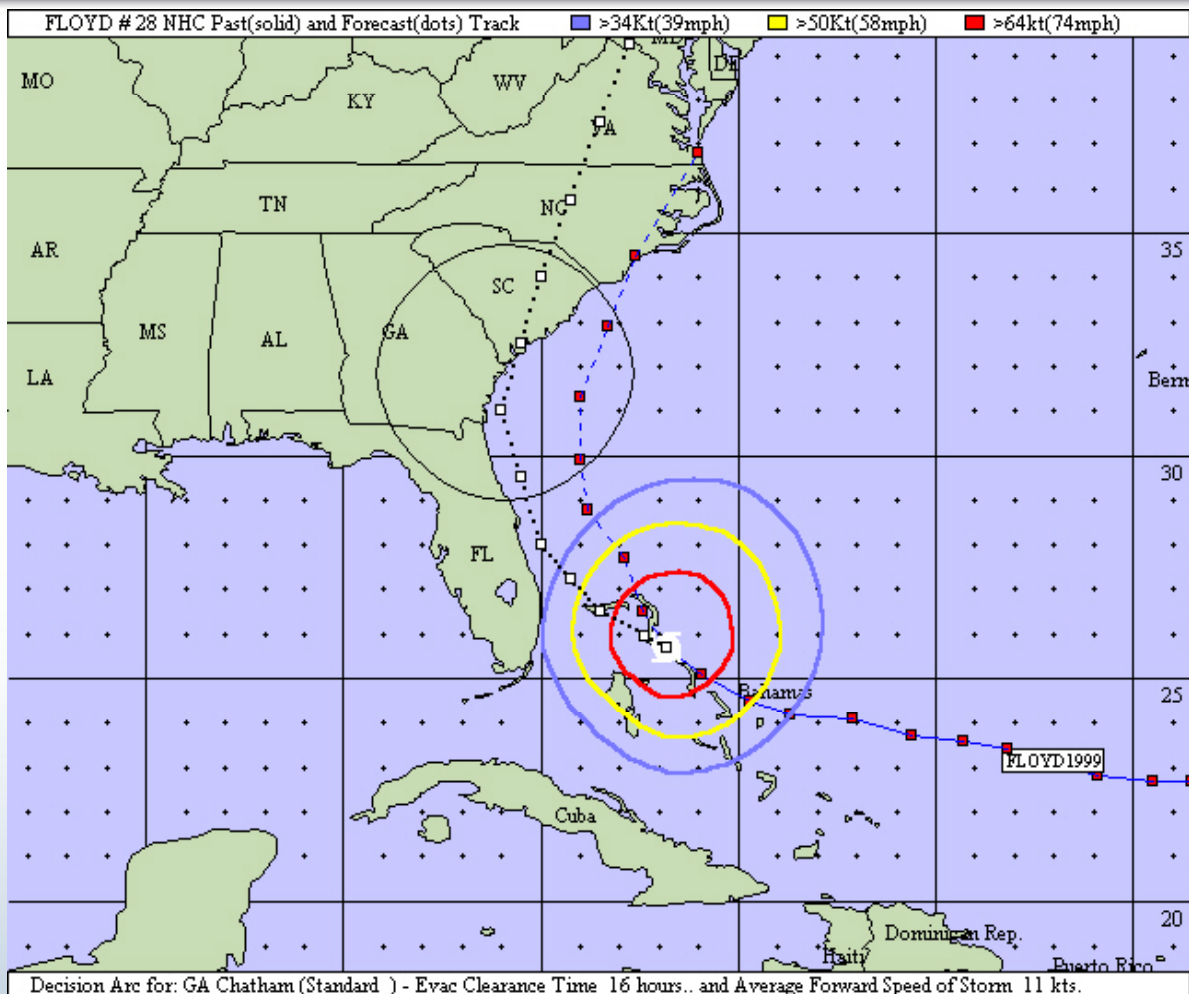
Scroll down to state





Decision Arc Mapping Utility

- ◆ Decision arc mapping utility relates the general time required to evacuate risk areas according to the storm threat
- ◆ *A user must have the correct Clearance Times to use this feature*





Post Storm Assessment

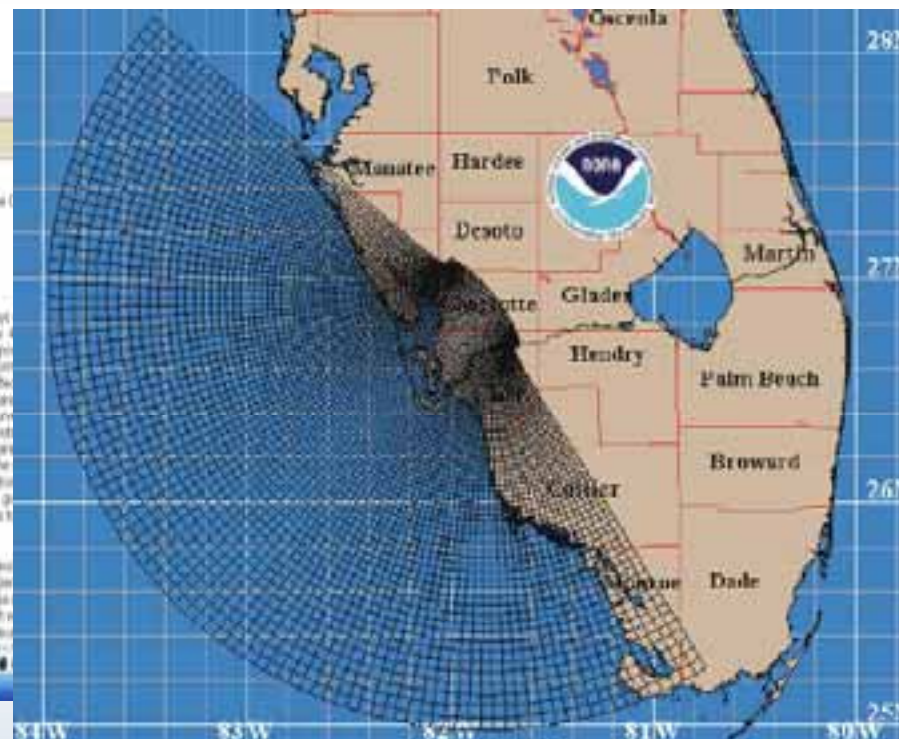


Hurricane Charley SLOSH Model Performance
 Comparison of Observed and SLOSH model computed storm surge for Hurricane Charley in Southwest Florida
 Dec. 31, 2004
 www.nhc.noaa.gov

Introduction

Under an OHS/FEMA requirement, post hurricane Charley high water mark surveys conducted in Southwest Florida and a report (see Appendix A) (ARL Group, Inc. Note: A survey team was instructed to obtain as many Accurate high water marks) as possible include "dry water marks" inside of structures which generally reflect the storm elevation without the effect of waves and "outside debris lines" which generally reflect combined effect of storm surge and wave set up and run up. Debris line elevations are higher than high water marks because of the added wave effects. Out of the 24 survey high water marks the surveys labeled 21 as inside wall water marks, and 3 as debris lines. Overall the coverage of the high water marks is very good. Several of them are one another to show the difference in flooding between the Gulf of Mexico shoreline often have wave effects, and those in the bay or harbor side of the coast. In addition high water marks, 3 site page measurements were also available and were added to the report. The purpose of this report is to compare these observed high water marks to storm surge model calculated values at the same location.

The reference datum used for the high water marks in this study is the National Geodetic Datum of 1929 or NGVD. This is where sea level was in 1929 and this was the datum since 1929 the tide gauges along the Southwest Florida coast have exhibited a rise the average of about 0.7 feet. To take the rise in sea level into account for the high water marks the Charley SLOSH model simulation will include 0.7 feet in the initial water elevation.



FEMA Hurricane Readiness – Coastal Communities



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Post Storm Assessment

High Wind analysis conducted after Charley.



Address: http://hds.com.usace.army.mil/USERS/assessments/2004/2004_hurricane_season_page.htm

2004 Hurricanes [List](#) [Assessments](#) [Data](#) [Case](#) [Map](#) [Assess](#) [Assessment](#) [Data](#)

CHARLEY Report

- Introduction
- Storm Data
- Wind Speed Plot
- NHC Trop. Cyc. Plat
- Evacuations
- Death Performance
- Behavioral Data
- Transmission & Clearance Times
- Shelter Usage
- Interview Results
- Recommendations
- Appendix
- People Interviewed
- Questionnaires
- State/City Interviews
- Glossary
- Acronyms & Abbreviations
- Photo Gallery
- Press Releases

**Post Storm Data Acquisition
Aerial Wind Mapping
Mission
Hurricane Charley - 2004**

October 25th, 2004

Overview
On August 13th, 2004, a rapidly strengthening Hurricane Charley moved ashore in the United States on the southwest Florida coast. In the five hours prior to the late afternoon landfall, the central atmospheric pressure of the tropical cyclone decreased from 965 millibars (MB) / 28.49 inches of mercury to 941 MB / 27.79 inches of mercury.

Landfall occurred at 3:35 pm EDT on the barrier islands of Lee County Florida. Charley produced a 10 to 15 mile wide swath of winds gusting in excess of 100 miles per hour (MPH) as it moved ashore from the Captiva area island toward Punta Gorda, Fort Charlotte, and Arcadia. Winds gusting to hurricane force continued over the area of the coastline during its



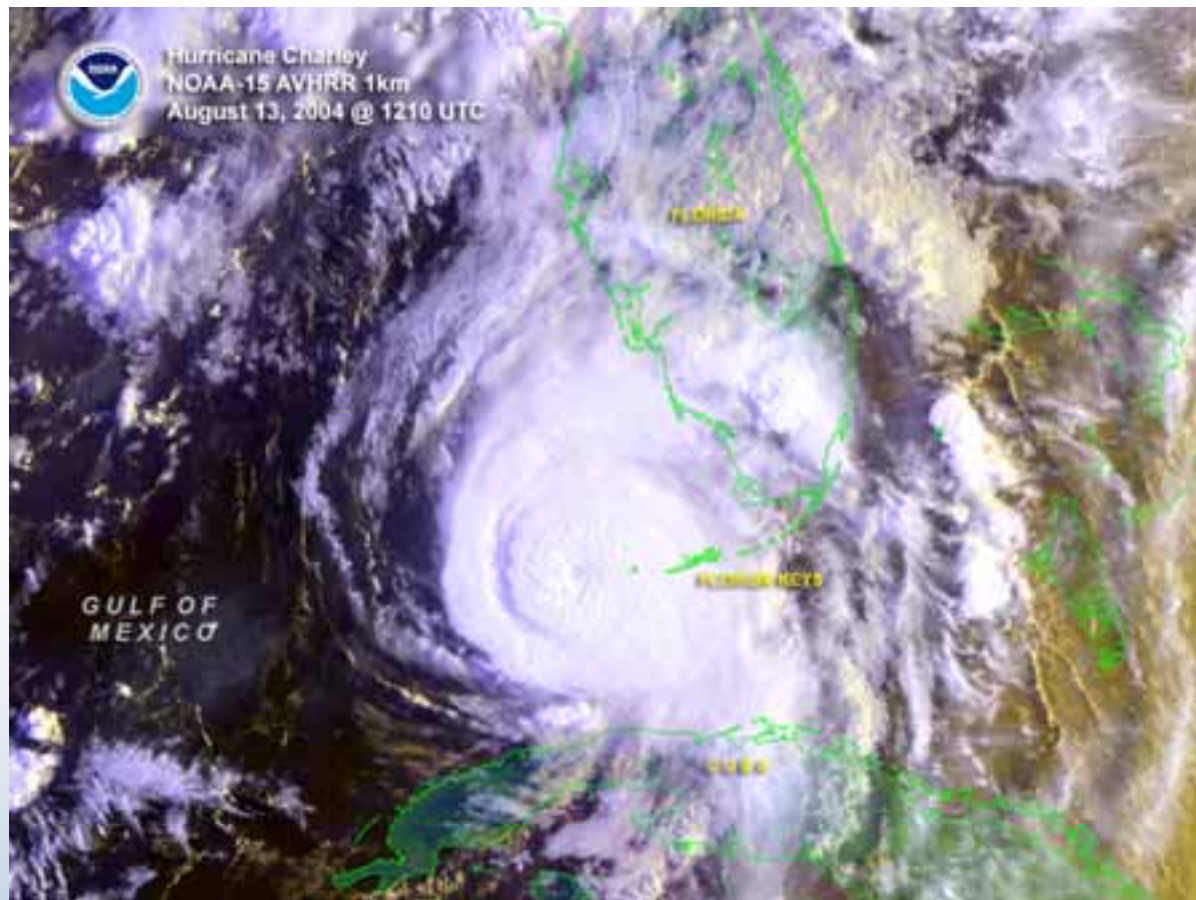
FEMA Hurricane Readiness – Coastal Communities



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Hurricane Charley



FEMA Hurricane Readiness – Coastal Communities



CHARLEY #11 - Assuming AVERAGE FORECAST ERROR - the EYE should track as white cone next 3 days / gray 4-5 days

OLD Advisory
CHARLEY # 11A
 Thu 08/12/04 02E
 (06Z) Initial Posit.
 18.00 N 79.20 W
 74kt (85mph)
 Sat 5th Category 1
 Movg 13kt (15mph)

Change
 ADVY
 ADVY
 ADVY

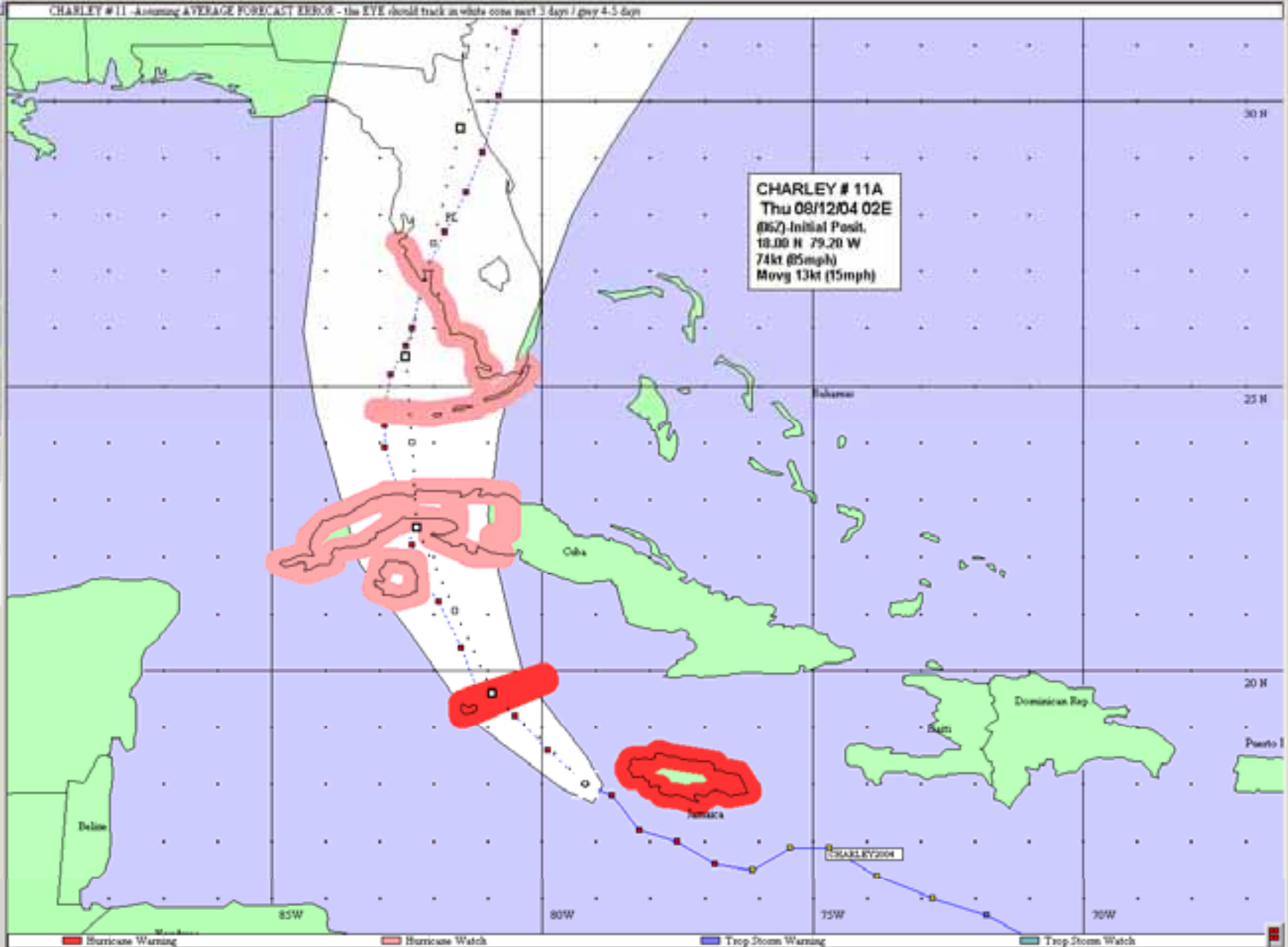
Map
 ST
 ST
 ST

Mode - Easy Swath
 ADVY
 ADVY
 ADVY

Other
 ADVY
 ADVY
 ADVY

Overlay List... OFF
 Storm
 Advy

- Charley 2004
- Kyle 2002
- Gordon 2000
- Josephine 1996
- Wind januar 2005
- Tyler 2005
- Irene 1999
- Otto 2004



CHARLEY # 12 - 4-Runway AVERAGE FORECAST ERROR - the EYE should track as white cone next 3 days / gray 4-5 days

OLD Advisory
CHARLEY # 12
 Thu 08/12/04 05E
 (09Z)-Initial Posit.
 18.60 N 79.90 W
 75kt (85mph)
 Sat 5th Category 1
 Movg 14kt (16mph)

Change
 ADVY
 ADVY
 ADVY

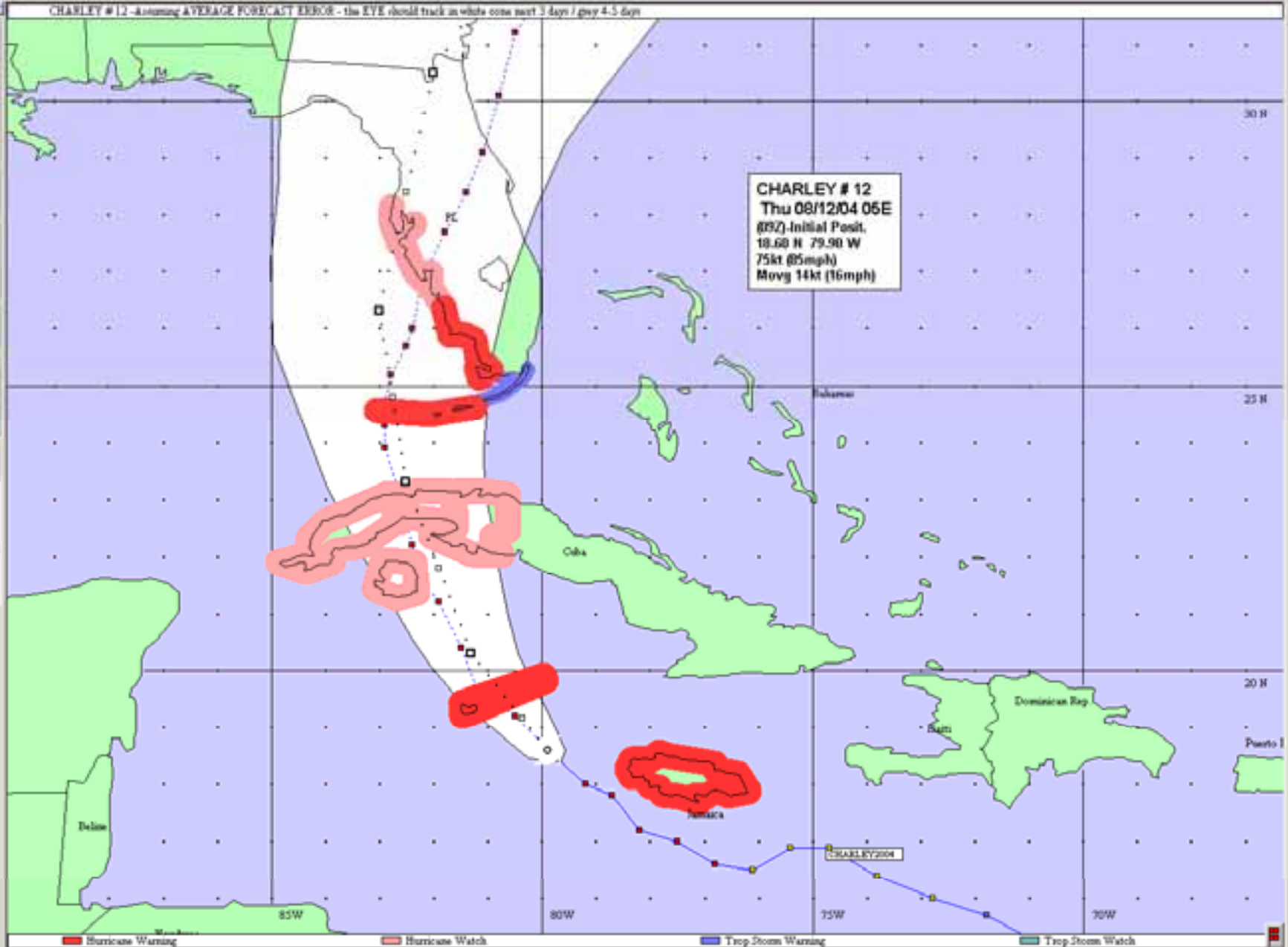
Map
 ST
 ST
 ST

Mode - Easy Swath
 ST
 ST
 ST

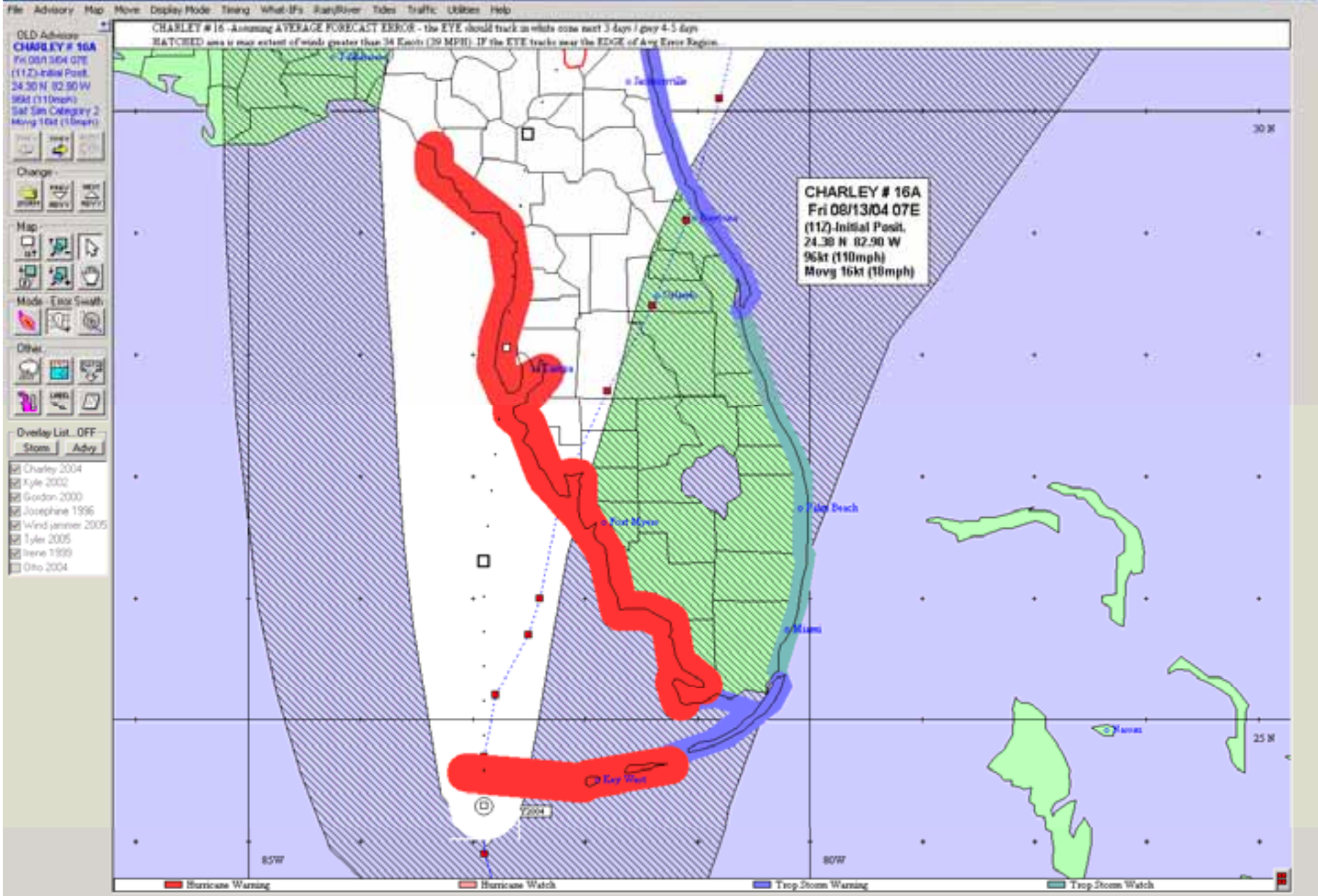
Other
 ST
 ST
 ST

Overlay List... OFF
 Storm
 Advy

- Charley 2004
- Kyle 2002
- Gordon 2000
- Josephine 1996
- Wind jammer 2005
- Tyler 2005
- Irene 1999
- Otto 2004



CHARLEY # 12
 Thu 08/12/04 05E
 (09Z)-Initial Posit.
 18.60 N 79.90 W
 75kt (85mph)
 Movg 14kt (16mph)



CHARLEY # 18 - Assuming AVERAGE FORECAST ERROR - the EYE should track as white cone over 3 days / grey 4-5 days

OLD Advisory
CHARLEY # 18
 Fri 08/13/04 14E
 (16Z) Initial Posit.
 26.00 N 82.40 W
 125kt (145mph)
 Sat Sun Category II
 Movg 17kt (20mph)

Change
 [Icons for map settings]

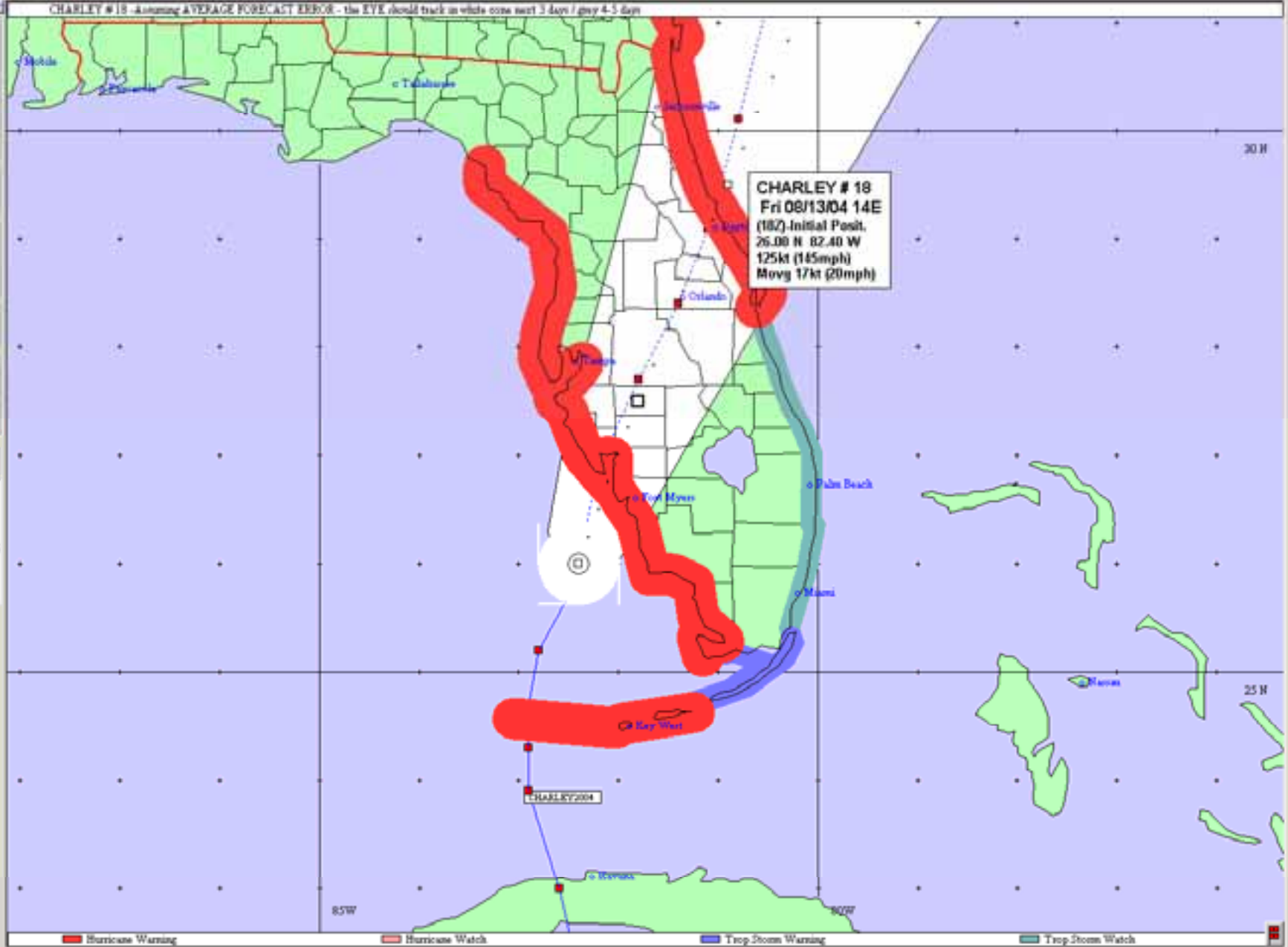
Map
 [Icons for map navigation]

Mode: Easy Swath
 [Icons for map modes]

Other
 [Icons for other features]

Overlay List... OFF
 Storm | Advy

- Charley 2004
- Kyle 2002
- Gordon 2000
- Josephine 1996
- Wind jammer 2005
- Tyler 2005
- Irene 1999
- Otto 2004

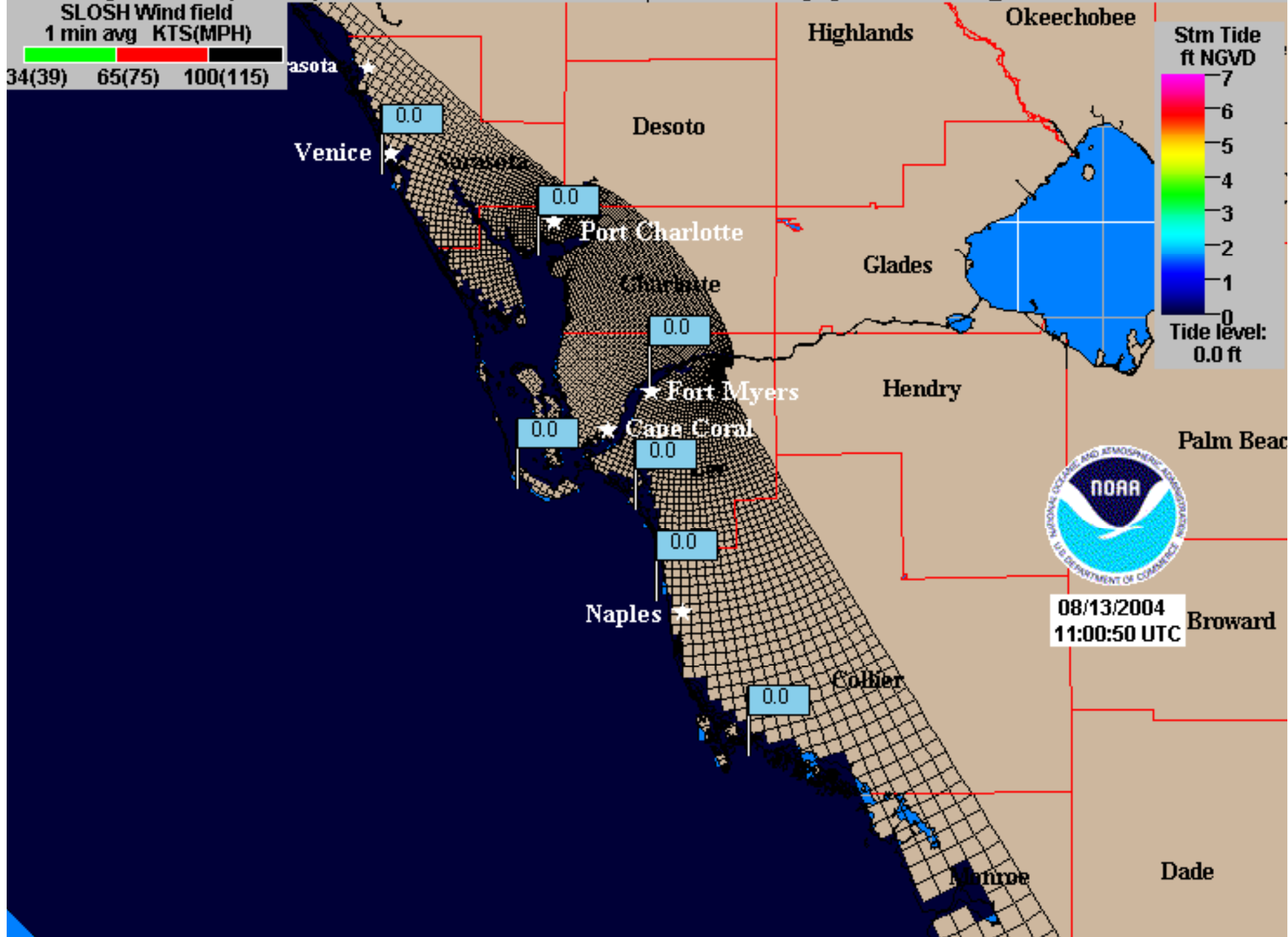


CHARLEY # 18
 Fri 08/13/04 14E
 (16Z) Initial Posit.
 26.00 N 82.40 W
 125kt (145mph)
 Movg 17kt (20mph)

Basin: Elliptical Fort Myers <fmy>

Storm: c:/slosh/pkg/data/rexfiles/C_RMW06.BRJ.BT.rex

SLOSH Wind field
1 min avg KTS(MPH)
34(39) 65(75) 100(115)



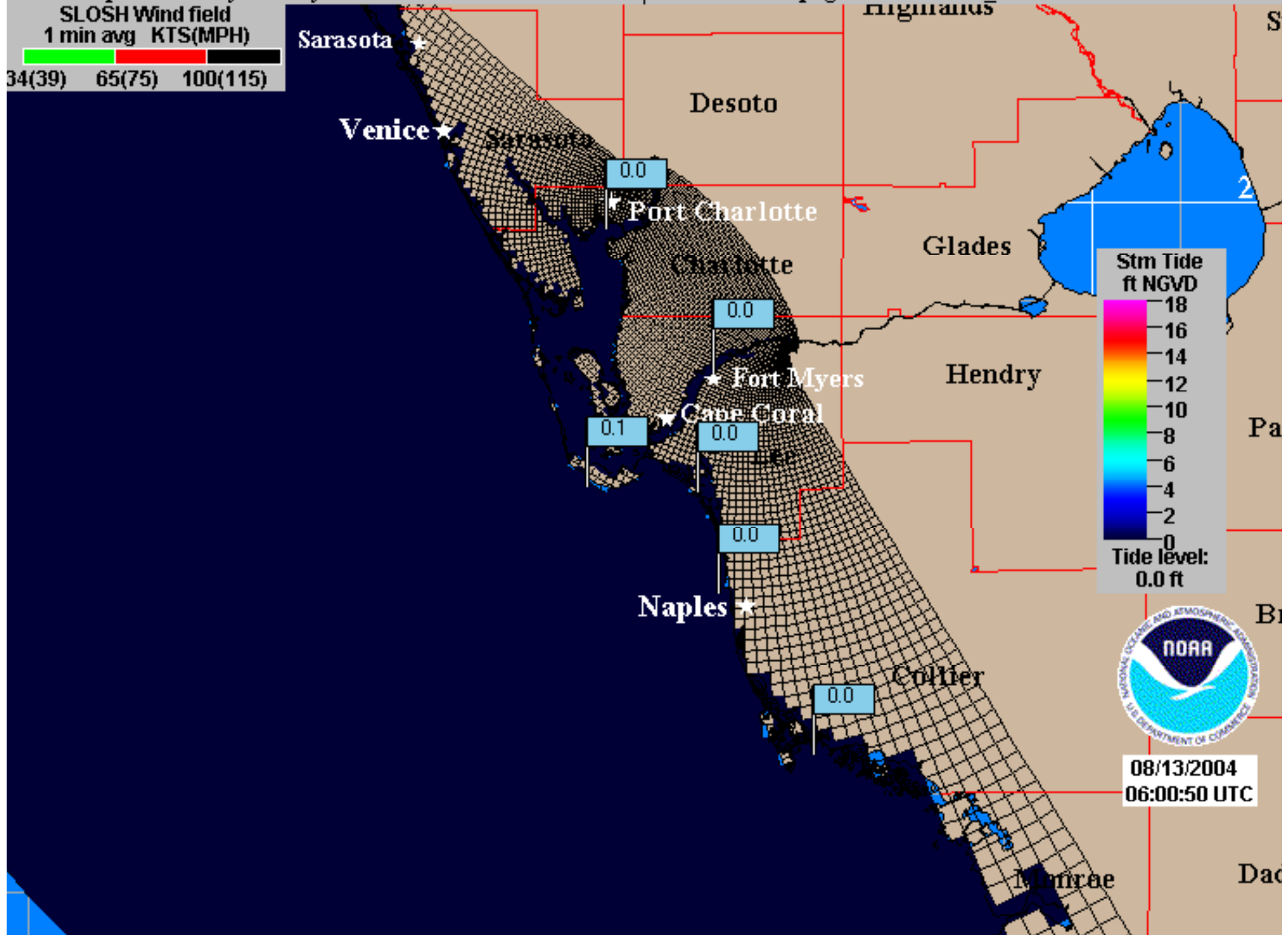
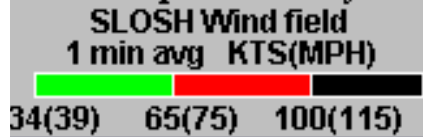
Storm Tide
ft NGVD
7
6
5
4
3
2
1
0
Tide level:
0.0 ft



08/13/2004
11:00:50 UTC

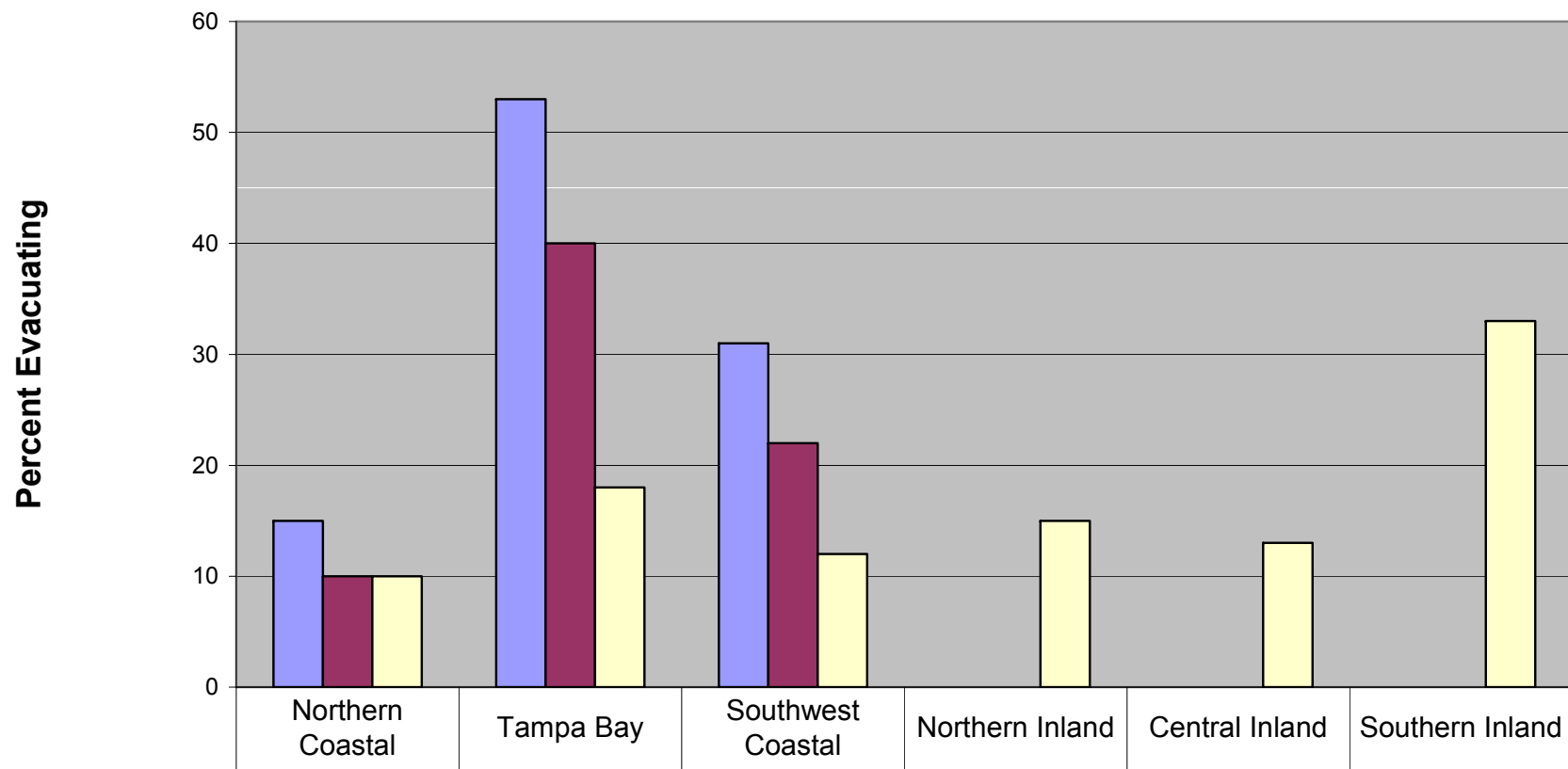
Basin: Elliptical Fort Myers <fmy>

Storm: c:/slosh.pkg/data/rexfiles/C_RMW24.BRJ.BT.rex





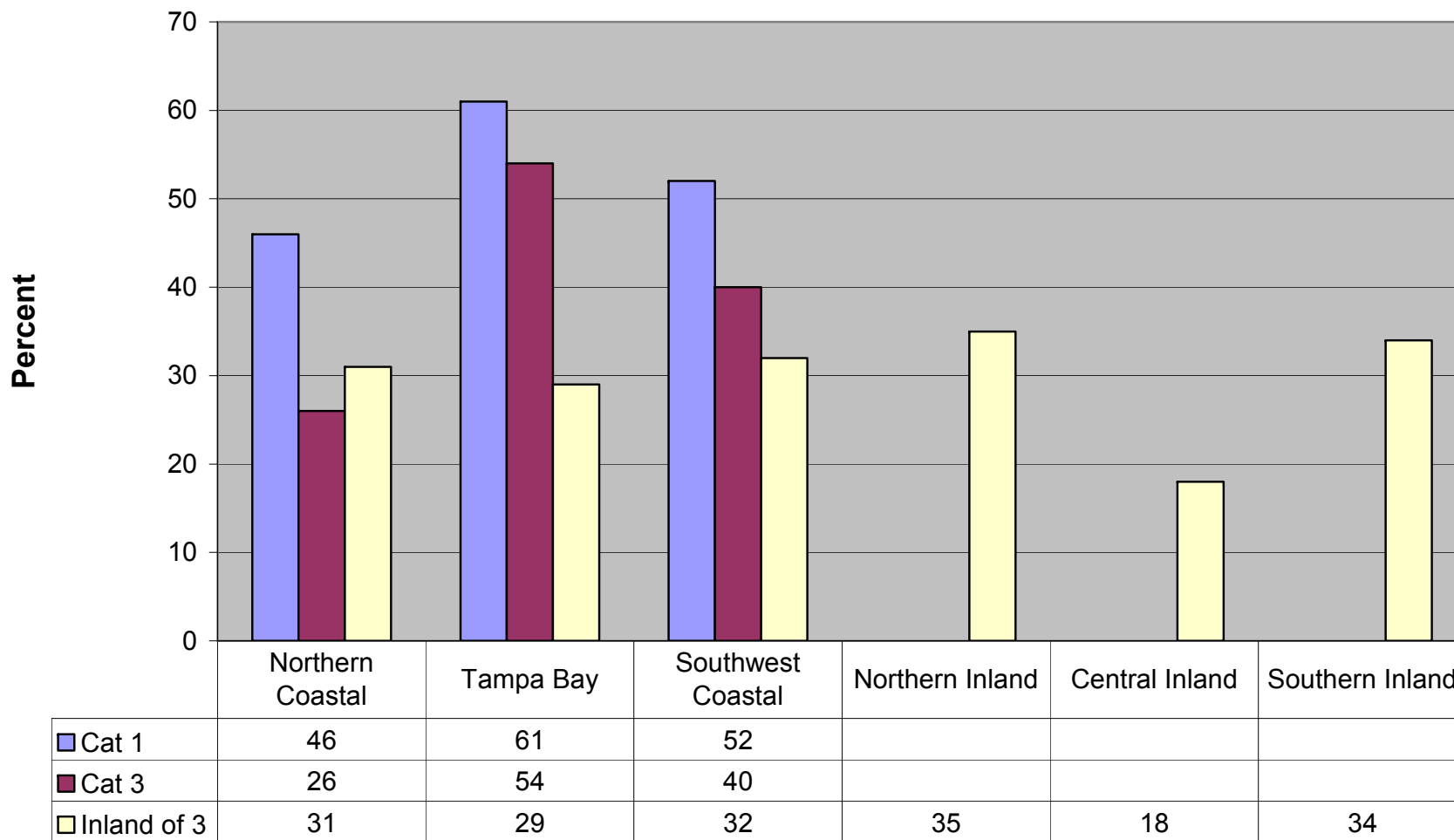
Evacuation Participaiton Rates in Charley by Location and Risk Zone



■ Cat 1	15	53	31			
■ Cat 3	10	40	22			
■ Inland of 3	10	18	12	15	13	33



Believe Home Would Flood Dangerously in 155 MPH Hurricane





2004 Charley Evacuation

Post Storm Behavioral Findings:

- Evacuees selected evacuation routes because it was the route they routinely use.
- 49% to 70% of evacuees went to friends and relatives.
- Very few respondents stated that they took routes because of recommendations from officials.
- 1.3 cars per family were used.
- Less than 5% towed trailers/boats/motorhomes.
- 37% to 52% said they spent less than \$50 per day during the evacuation.
- 82% of those who stayed said they would stay again if Charley hit today – Storm Surge Education!





2004 Charley Evacuation

- Principle reason for not leaving a Cat 1 area = well built house followed by track of storm.
- 48% of SW FL respondents think house residing in Cat 1 surge area is safe in 155mph Cat 4- Citizens are evacuating b/c of wind not surge in Cat 1-3 storm surge vulnerable areas!
- 63% of the SW FL residents in a Cat 1 zone did not hear and Evacuation Notice.
- 43% of residents do not know who issues a warning.
- 12% of SW FL stated that work kept them from leaving.
- 6% to 20% of evacuees sought public shelters!





Post Storm Assessment

- ◆ Counties not issuing phased evacuation orders according to Evacuation Zones.
- ◆ Typically found that many citizens never hear a specific evacuation warning order.
- ◆ EM's may focus too much on the forecast track and not consider the error cone sufficiently.





Who Issues Evacuations?

- ◆ When asked if an official told them to evacuate for Ivan, affirmative answers varied considerably by region: **Monroe County 75%, Louisiana 63%, Mississippi 50%, Alabama 34% and the Florida Panhandle 28%.**

How Does The Public Interpret Forecast and Evacuation Order?

- ◆ What is the difference between Mandatory, Voluntary, Recommended, Partial, Full, etc. etc?
- ◆ The watches and warnings issued by the National Hurricane Center (NHC) were somewhat important or very important factor in the evacuation decisions for 95% of these households. However...their knowledge of the meaning of watches and warnings is limited.





Post Storm Assessment

- ◆ Well Designed Zones to promote phased evacuations
- ◆ Social Capital Issues – How does the public receive the message?
- ◆ How do we determine Real Time Evacuation Participation Rates?
- ◆ Who should evacuate & Where do we evacuate?
- ◆ Increase public awareness and self assessment capabilities
- ◆ What about reentry?
- ◆ Travel 10's of miles not 100's!
- ◆ Reduce the number of people evacuating through public awareness efforts.





Activity 5:1—HES Products

Divide the class into three groups—

Group A:

*What HES products might be useful during a hurricane evacuation **RESPONSE** (both pre-landfall and post-landfall phases)?*

Group B:

*What HES products might be useful for community **MITIGATION** activities?*

Group C:

*What HES products might be useful for **PREPAREDNESS** activities?*



Take 15 minutes



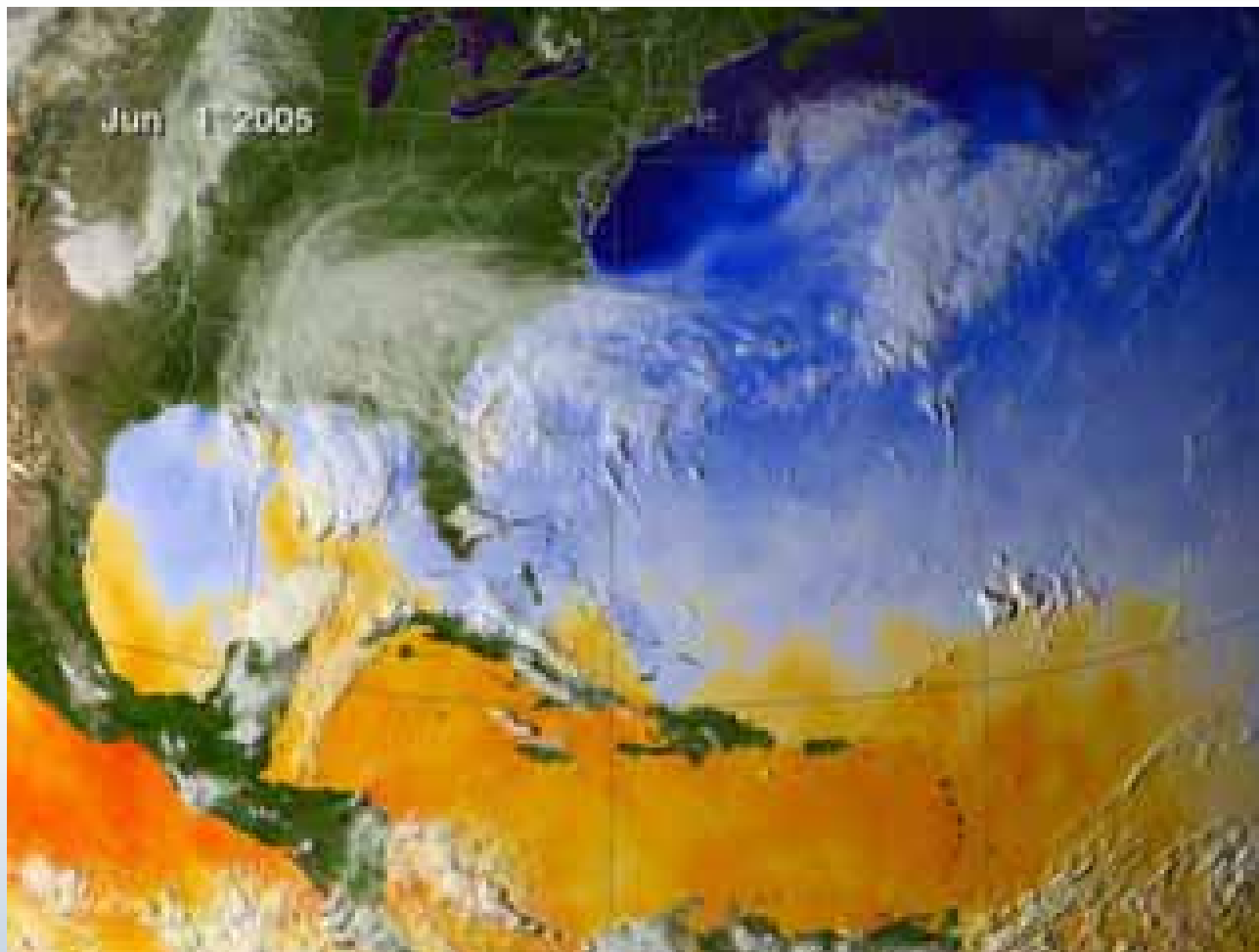
Lessons Learned

- ◆ How can the hurricane studies and products help in preparing for a tropical cyclone?
- ◆ How do you use the products in your pre-season planning procedures and processes?
- ◆ Who can update your HES?





Unit 6: Monitoring the Hurricane



FEMA Hurricane Readiness – Coastal Communities



6-1



Unit 6: Monitoring the Hurricane

- ◆ Tracking Tropical Depressions, Tropical Storms, and Hurricanes
- ◆ Roles of Hurricane Forecasting Organizations
- ◆ Advisory Products for Monitoring Hurricanes
- ◆ Hurricane Forecasting
- ◆ Lessons Learned





National Weather Service

- ◆ Tropical Prediction Center/National Hurricane Center (TPC/NHC)- Hurricane forecast (broad view)
- ◆ Hydrometeorological Prediction Center (HPC)- national rainfall forecast and outlooks (NHC backup)
- ◆ River Forecast Centers (RFC)-Rain/River observations, outlooks and forecasts
- ◆ Storm Prediction Center (SPC)- Severe weather outlooks and watches
- ◆ Local Weather Forecast Office (WFO)- Community specific information, watches and warnings





Monitoring the Hurricane



- ◆ Local leaders must have current and accurate information regarding tropical cyclones (i.e., tropical depressions, tropical storms, and hurricanes)
- ◆ Improved forecasts have contributed to a significant reduction in the number of deaths attributed to tropical cyclones





Tracking Hurricanes



Satellites



**Dropsondes
and RAOBs**

Aircraft



Ships and Buoys



Radar

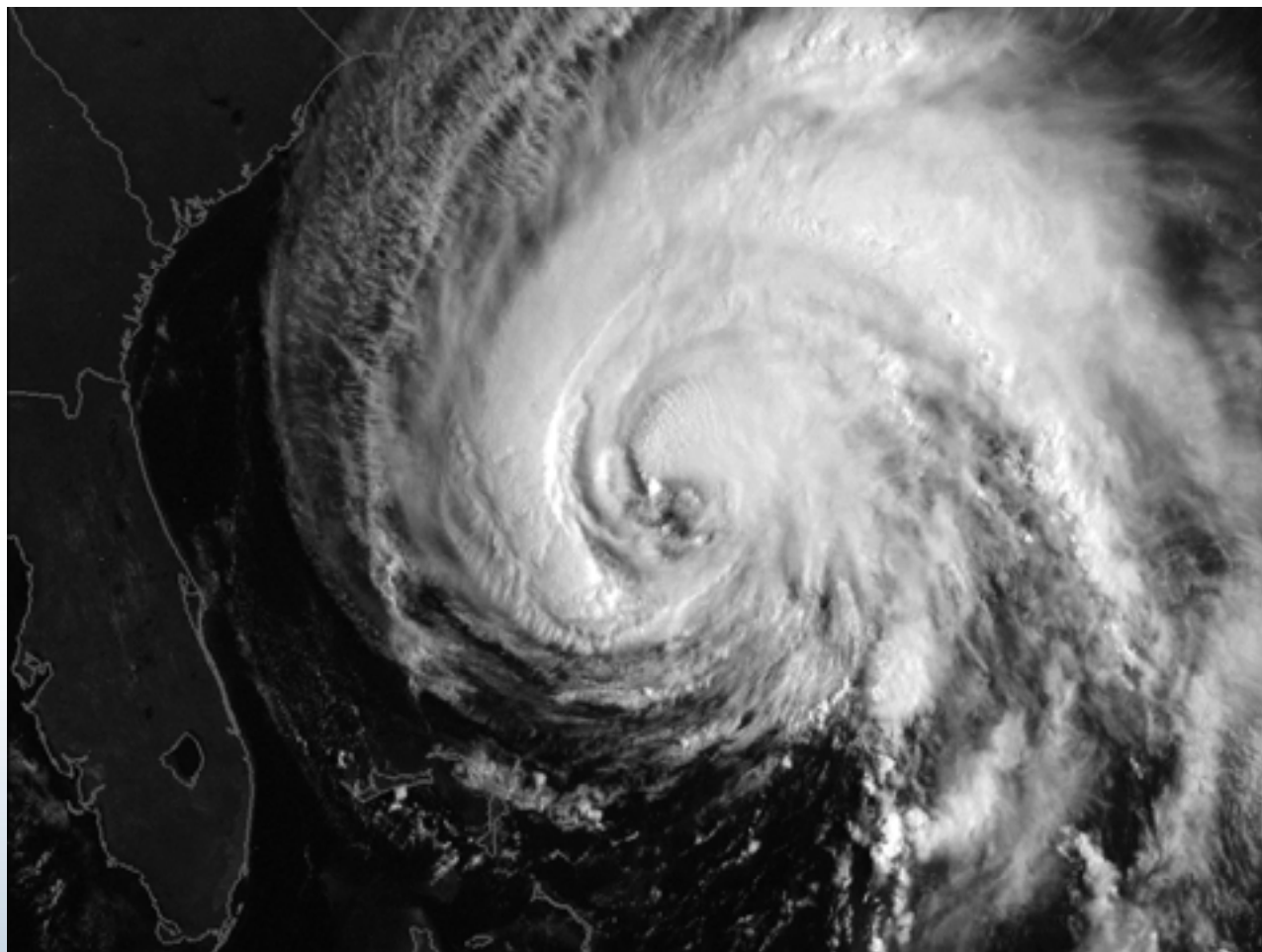


**Land
Stations**

The COMET Program



Satellite Location



FEMA Hurricane Readiness – Coastal Communities





Satellite-based Wind Data

- ◆ Meteorological satellites return information on areas where no other data is available
- ◆ Satellite cloud-motion winds – created by tracking cloud elements from one satellite image to the next
- ◆ Passive microwave winds – an instrument (such as a Stepped Frequency Microwave Radiometer) on a satellite detects the microwave radiation emitted by the ocean surface.
- ◆ Scatterometer winds – an active instrument that fires microwave pulses at the ocean surface and detects the returned signal from small waves. This signal is related to the wind speed and direction (Example: QuikScat)



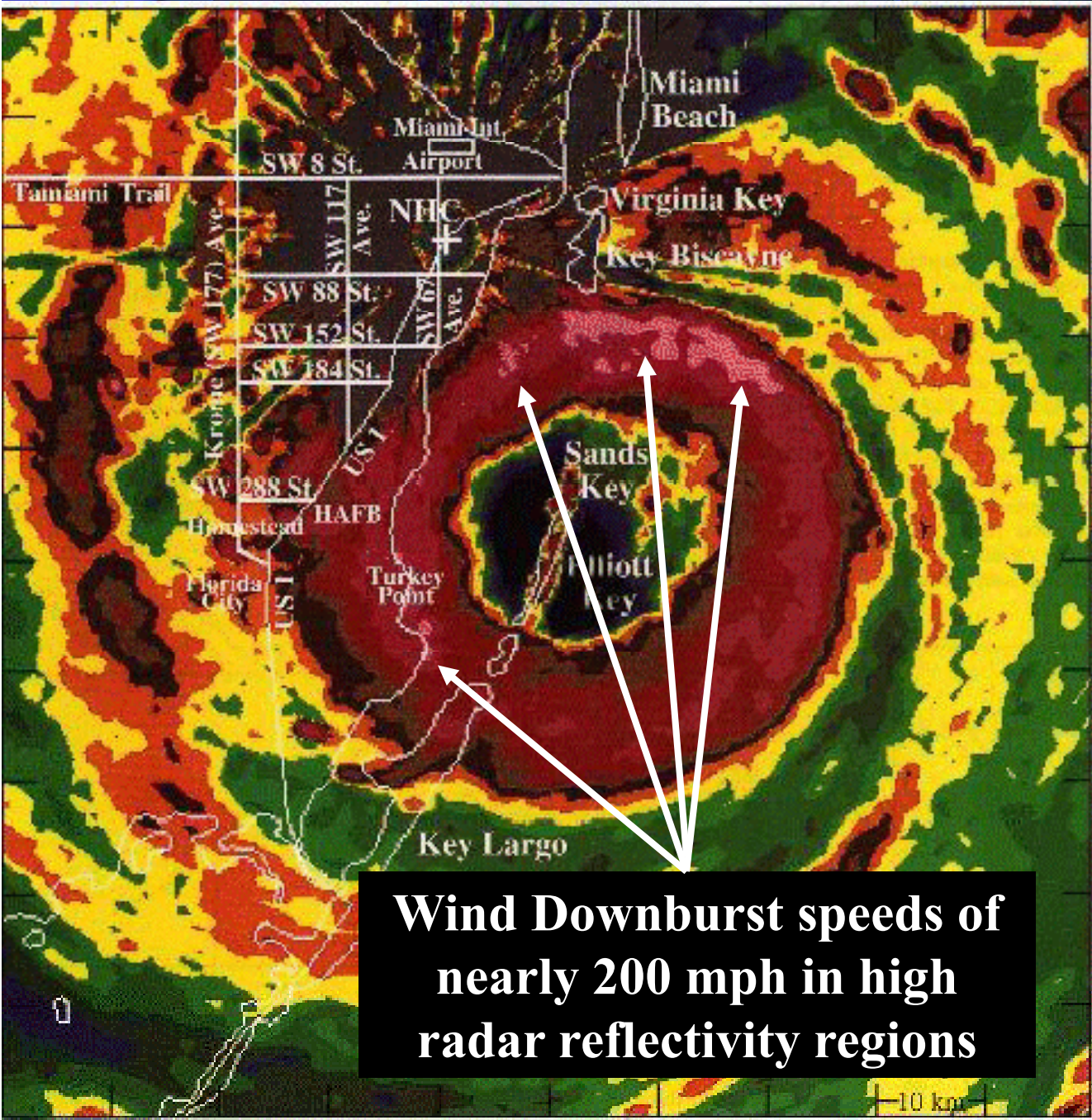


Radar Location

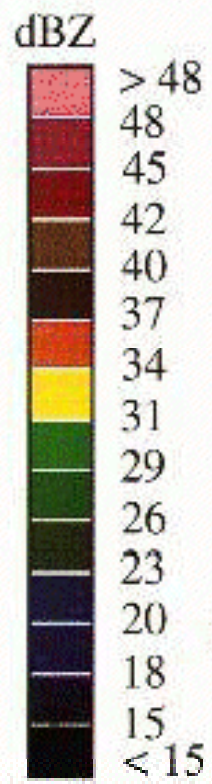


HURRICANE ANDREW

NWS MIAMI RADAR
August 24, 1992
08:35 UTC 04:35 EDT



Wind Downburst speeds of nearly 200 mph in high radar reflectivity regions



Hurricane Research Division



NOAA/AOML
Miami, FL

Domain: 100 x 100 km



Limitations of Land-based Radar Wind Data

- ◆ WSR-88D winds have relatively short-range (~ 125 n mi), which means they are normally only useful after warnings are up and preparation decisions have been made.
- ◆ The WSR-88D only detects winds blowing toward or away from the radar, which makes it difficult to evaluate the full wind field from a single fixed radar.
- ◆ The WSR-88D has internal sampling issues which can reduce the spatial coverage (“purple haze”).
- ◆ The WSR-88D winds are typically measured several hundred to several thousand feet above the surface.





Hurricane Reconnaissance Aircraft



Air Force WC-130



NOAA WP-3





Hurricane Reconnaissance Aircraft



NOAA G-IV
(High Altitude Reconnaissance)



FEMA Hurricane Readiness – Coastal Communities



6-12



Hurricane Reconnaissance Aircraft



T-6

(The First "Hurricane Reconnaissance" Aircraft)

July, 1943



FEMA Hurricane Readiness – Coastal Communities



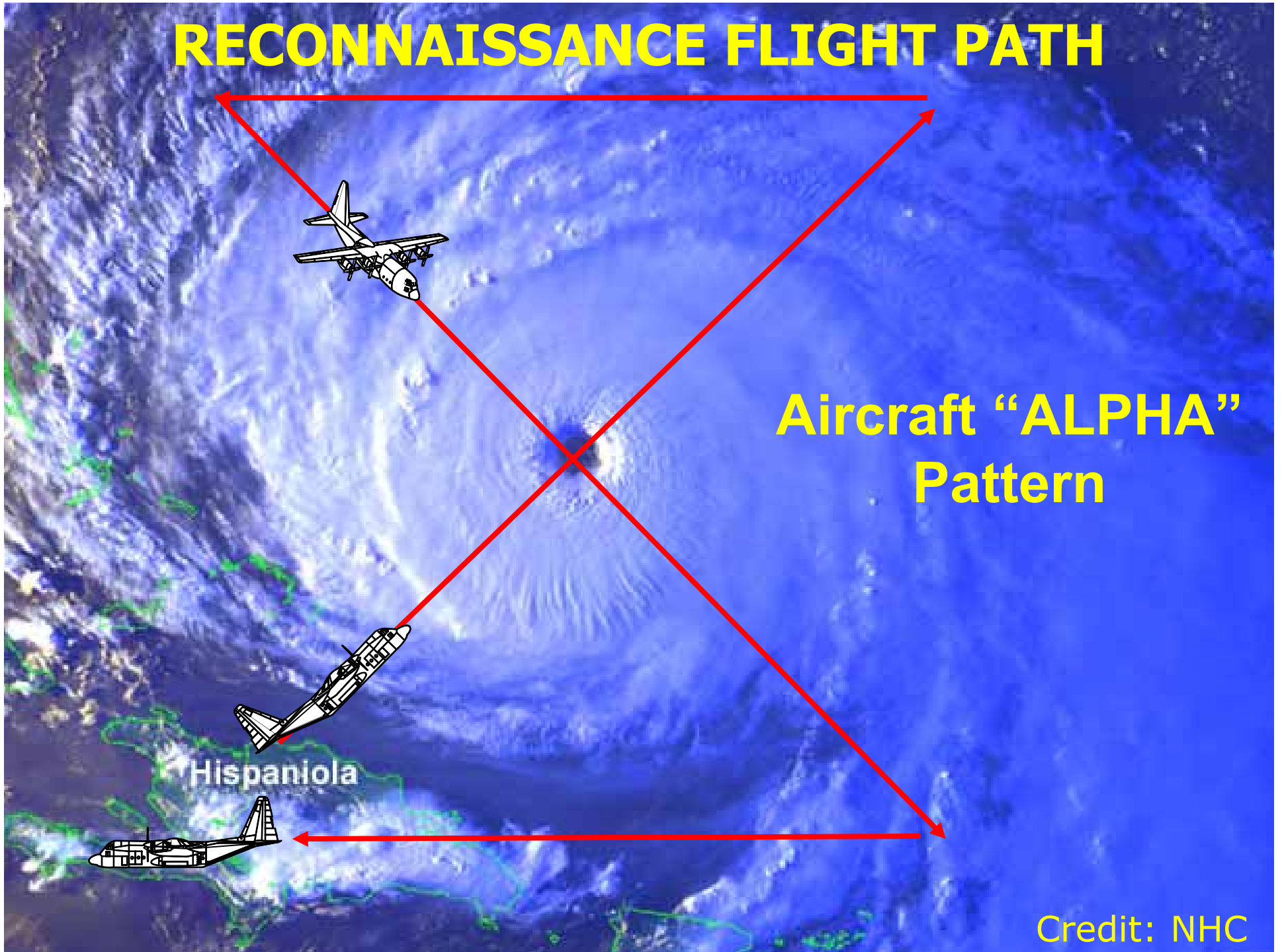
6-13

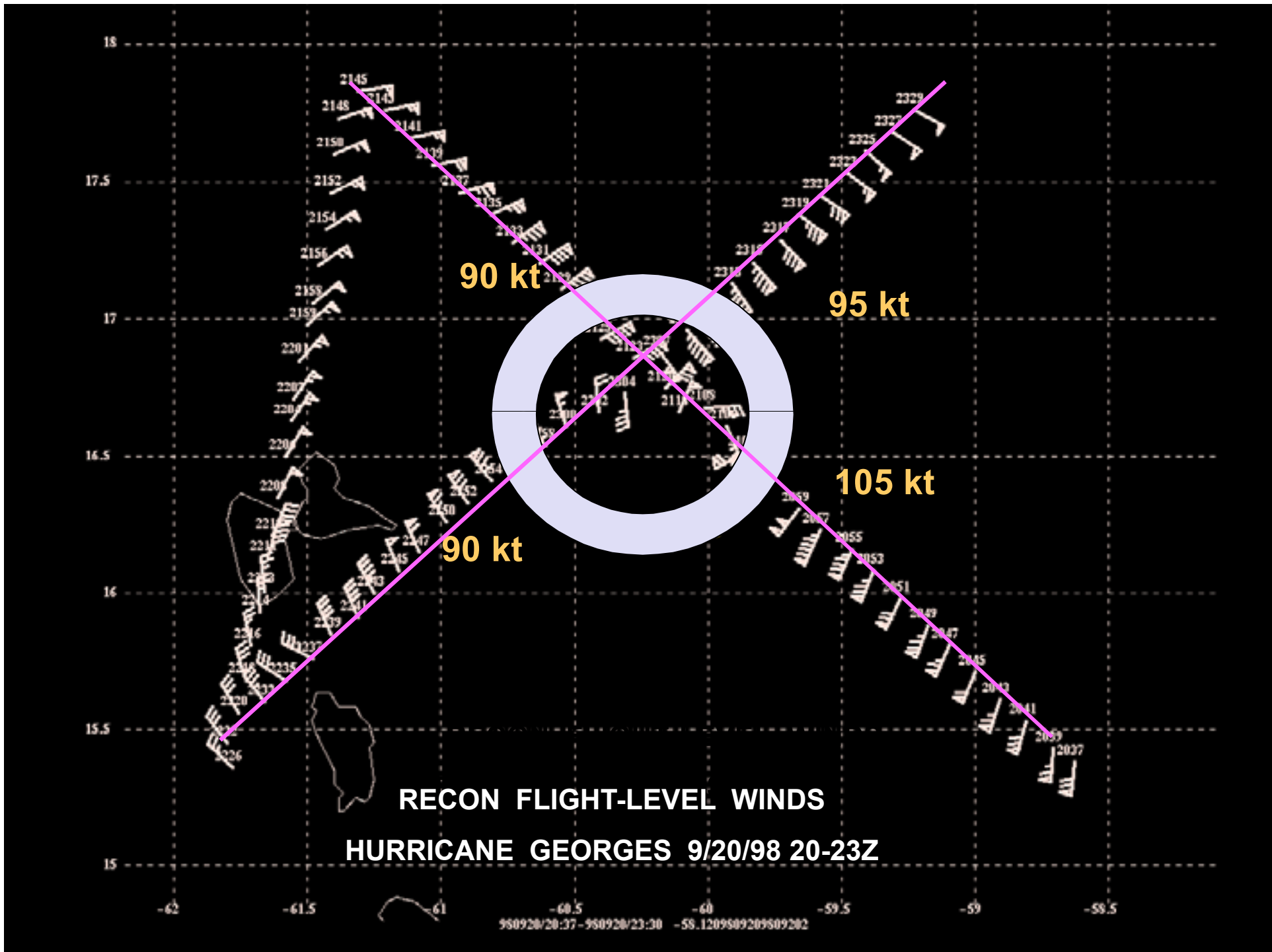
RECONNAISSANCE FLIGHT PATH

Aircraft "ALPHA"
Pattern

Hispaniola

Credit: NHC







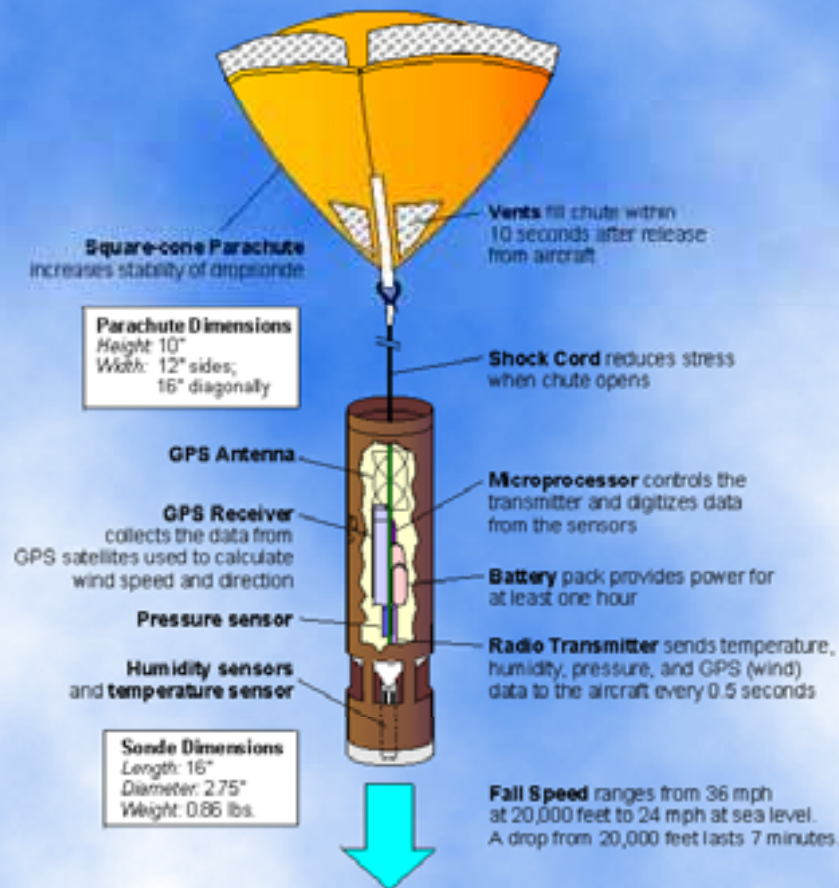
Dropsondes are released from Hurricane Hunter aircraft at an altitude of about 10,000 feet.



FEMA Hurricane Readiness – Coastal Communities

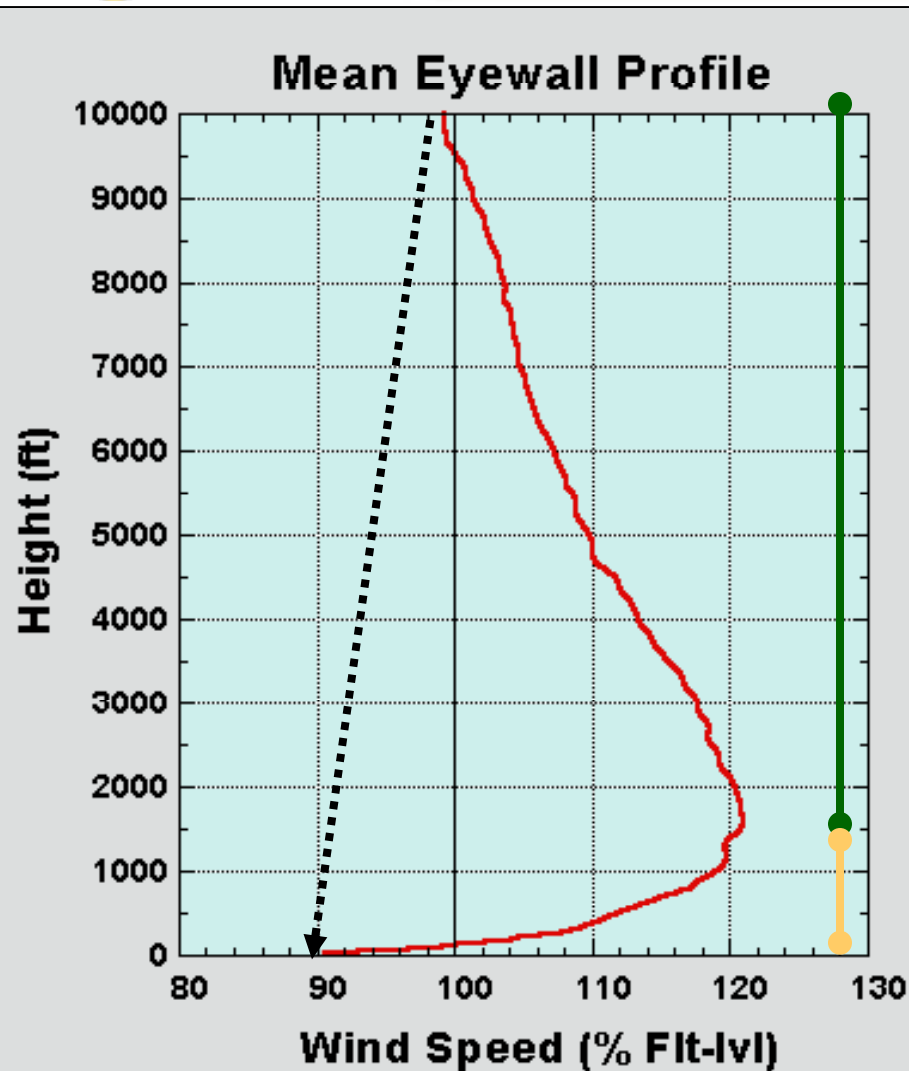
NCAR GPS Dropsonde

the definitive atmospheric profiling tool





Considerable Differences Between Flight Level Winds and Surface Winds



Since a hurricane is a “warm-core” low, winds increase downward from flight-level (10,000 ft)

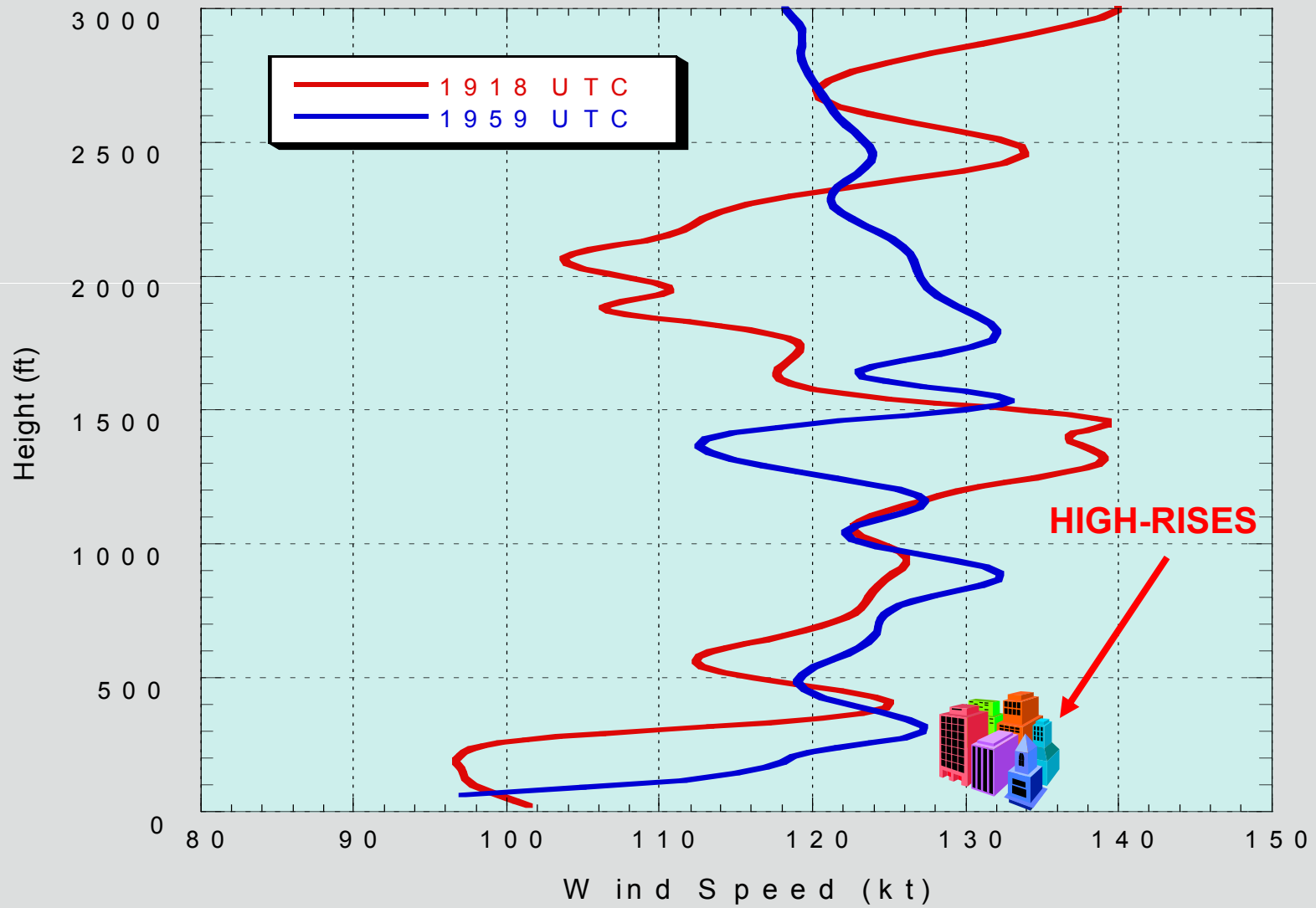
However, friction causes the wind to decrease in the lowest 1,500 ft of the eyewall



6-17

Credit: NHC

Hurricane Georges - Eyewall
GPS Dropsonde Wind Profiles
19 September 1998





Limitations of Surface Data

- ◆ Data often lost during landfalls due to power failures, communications failures, or station destruction.
- ◆ Instruments almost never sample the maximum wind, which occurs in a small area.
- ◆ Instrument placing and exposure can seriously affect the measured wind speed – resulting in both lower and higher wind measurements.
- ◆ Friction reduces the surface wind speeds over land, which can result in significant wind speed differences between just offshore and just onshore.

(major source of HURREVAC problems!)





Why understand the limitations of observations?

- Analysis (and forecast) of the size of a Tropical Storm or Hurricane plays an important role in the location and timing of watches and warnings
- Timing of onset of various wind speeds plays a critical role in evacuation and emergency services decisions





Hurricane Forecast Coordination

Forecasts and Warnings are Coordinated With:

- ❶ The Hydrometeorological Prediction Center (HPC) and Ocean Prediction Center (OPC) in Washington, D.C.
- ❷ Local National Weather Service offices in the potentially affected area
- ❸ Department of Defense (DOD) offices
- ❹ Caribbean meteorological offices





National Weather Service

- ◆ Tropical Prediction Center/National Hurricane Center (TPC/NHC)
- ◆ Hydrometeorological Prediction Center (HPC)
- ◆ River Forecast Centers (RFC)
- ◆ Storm Prediction Center (SPC)
- ◆ Local Weather Forecast Office (WFO)





Which NWS Office Does What?

- National Hurricane Center
 - Issues **Coastal** Tropical Storm/Hurricane Watches & Warnings
- Local Weather Forecast Office
 - Issues **Inland** Tropical Storm/Hurricane Watches & Warnings
 - Issues Extreme Wind Warnings for CAT 3+ Eye Wall Winds





Which NWS Office Does What?

- Storm Prediction Center
 - Issues Tornado Watches
- Local Weather Forecast Office
 - Issues Tornado Warnings





Which NWS Office Does What?

- River Forecast Center
 - Run computer models and create guidance
- Weather Forecast Office
 - Issues Aerial & River Flood Watches & Warnings
 - Issues Coastal Flood Watches & Warnings





Which NWS Office Does What?

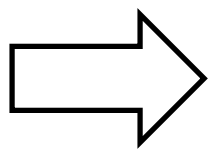
- National Hurricane Center
 - Creates the BIG picture
 - All WFO products are based on their guidance
- Weather Forecast Office
 - Creates the local picture of hurricane affects
 - The Hurricane Local Statement is the main summary of expected local impacts!



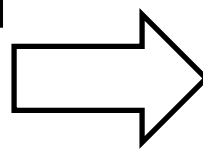


Role of Local Weather Forecast Office

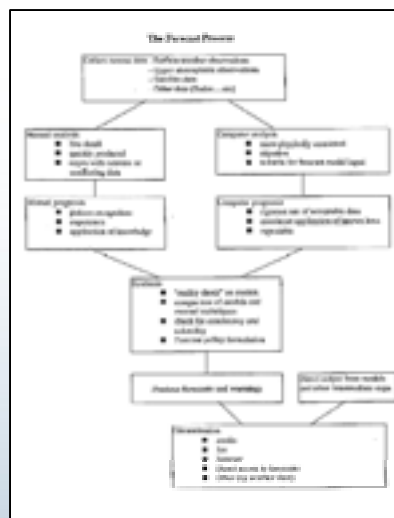
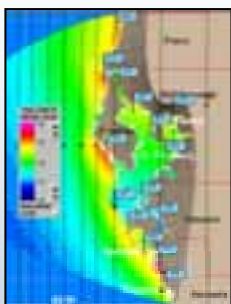
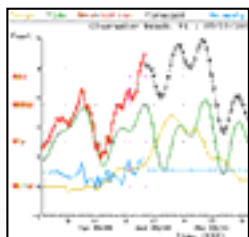
Analyze all the various products and forecasts



Develop localized picture of timing and affect



Communicate uncertainty and impacts so our customers can make informed decisions





WFO Webinars to Emergency Management



- ◆ Contact your local WFO for details
- ◆ Every 6 hours around NHC Advisory issuance

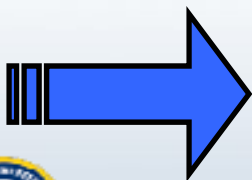




Advisory Products for Monitoring Hurricanes

TPC/NHC produces four types of advisory products:

- 1.** Tropical cyclone public advisory
- 2.** Tropical cyclone forecasts/advisory
- 3.** Tropical cyclone discussion
- 4.** Tropical cyclone wind speed probabilities



All four advisory products are issued every six hours for all tropical cyclones.





TPC/NHC Six-hour forecast cycle

Time (UTC)	Task / Event
00:00	Synoptic time, cycle begins
00:45	Receive satellite fix data
01:00	Initialize models
01:20	Receive model guidance, begin preparing forecast
02:00	NWS/DOD hotline coordination call
03:00	Advisory package deadline
03:15	FEMA conference call
06:00	Next cycle begins



Public Advisory (Partial Example)

ZCZC MIATCPAT3 ALL
KNHC DDHHMM

TTAA00
BULLETIN

HURRICANE CHARLEY ADVISORY NUMBER 16
NWS TPC/NATIONAL HURRICANE CENTER MIAMI FL
5 AM EDT FRI AUG 13 2004

...HURRICANE CHARLEY IN THE FLORIDA STRAITS...

AT 5 AM EDT...0900Z...THE HURRICANE WARNING IS EXTENDED NORTHWARD ALONG THE FLORIDA WEST COAST TO THE STEINHATCHEE RIVER. A HURRICANE WARNING IS NOW IN EFFECT FOR THE FLORIDA KEYS FROM THE DRY TORTUGAS TO THE SEVEN MILE BRIDGE...AND FOR THE FLORIDA WEST COAST FROM EAST CAPE SABLE NORTHWARD TO THE STEINHATCHEE RIVER. A HURRICANE WARNING MEANS THAT HURRICANE CONDITIONS ARE EXPECTED WITHIN THE WARNING AREA DURING THE NEXT 24 HOURS. PREPARATIONS SHOULD BE RUSHED TO COMPLETION.



FEMA Hurricane Readiness – Coastal Communities



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Tropical Cyclone Public Advisory Format

Primarily intended for the **general public**, this advisory follows a standard format to provide the following information :

- ◆ Lead statement that highlights significant aspects of the storm
- ◆ Watches and Warnings issued
- ◆ Center location and motion forecast
- ◆ Wind speed and intensity
- ◆ Expected storm surge
- ◆ Actions to be taken
- ◆ Associated meteorological events





Special Tropical Cyclone Public Advisory

A **Special Public Tropical Cyclone Advisory** is issued when:

- ◆ Storm conditions require issuance between regularly scheduled public advisories
- ◆ A significant change has occurred, requiring the issuance of a revised forecast package
- ◆ Conditions require change or cancellation of an existing warning
- ◆ A tornado threat develops or the hurricane forecaster believes other significant changes have occurred

Content is similar to that of a scheduled advisory, but its format may be less formal and less complete.





Intermediate Tropical Cyclone Public Advisory

An **Intermediate Tropical Cyclone Public Advisory** is issued when:

- ◆ There are tropical cyclone watches or warnings in effect
- ◆ Coastal watches or warnings can be discontinued; however, they can NOT be issued in this product.

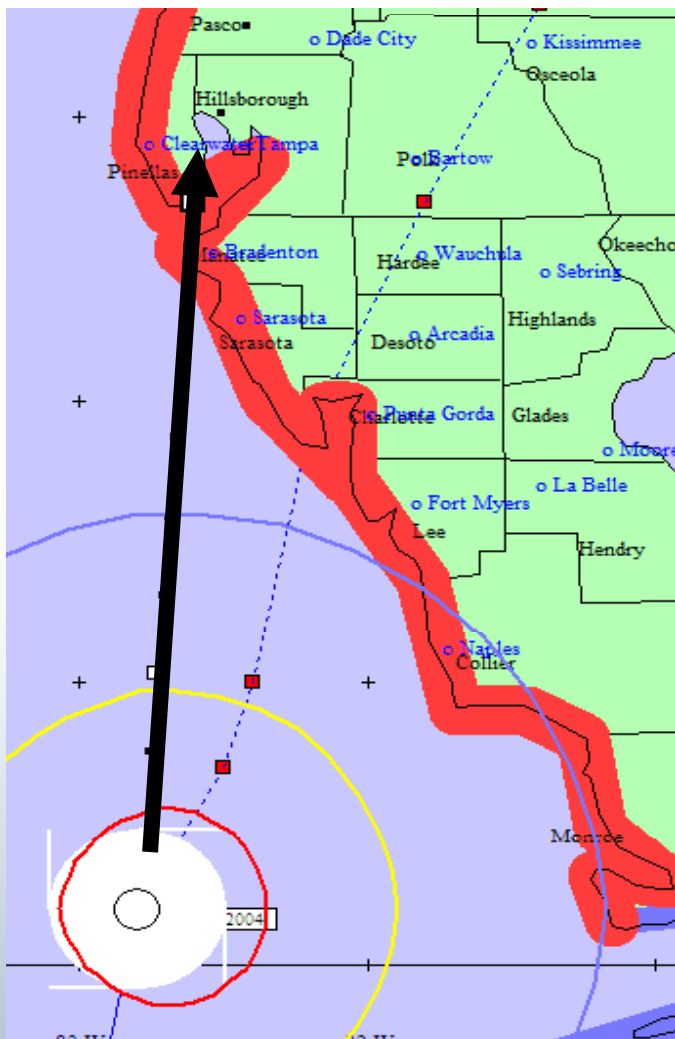
Content is similar to that of the regularly scheduled public advisory.



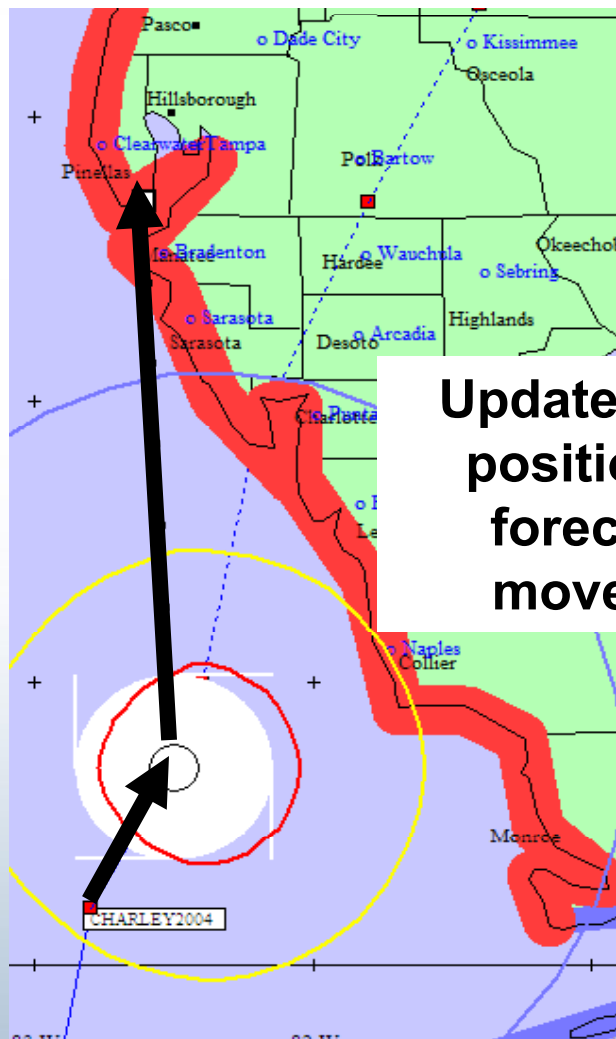


Regular vs Intermediate Advisories

11 AM, Regular Advisory



1 PM, Intermediate Advisory

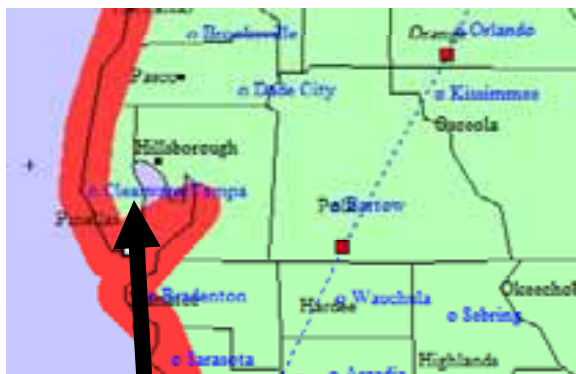


Updates storm position, not forecasted movement



Intermediate vs Special Advisories

1 PM, Intermediate Advisory



Updates storm position, not forecasted movement



2 PM, Special Advisory



Updates storm position AND forecasted movement





Summary of Public Advisories

- ◆ **TC Public Advisory**: Issued every six hours once a tropical cyclone has developed
- ◆ **Intermediate TC Public Advisory**: Issued every three hours once watches/warnings have been issued and every two hours once a reliable center is indicated on radar. The only updates are storm position and discontinuation of any watches/warnings.
- ◆ **Special TC Public Advisory**: Issued whenever a significant change in a tropical cyclone has occurred (example: wind speed increase or change in storm movement) and/or a watch/warning needs to be issued before the regularly scheduled TC Public Advisory.





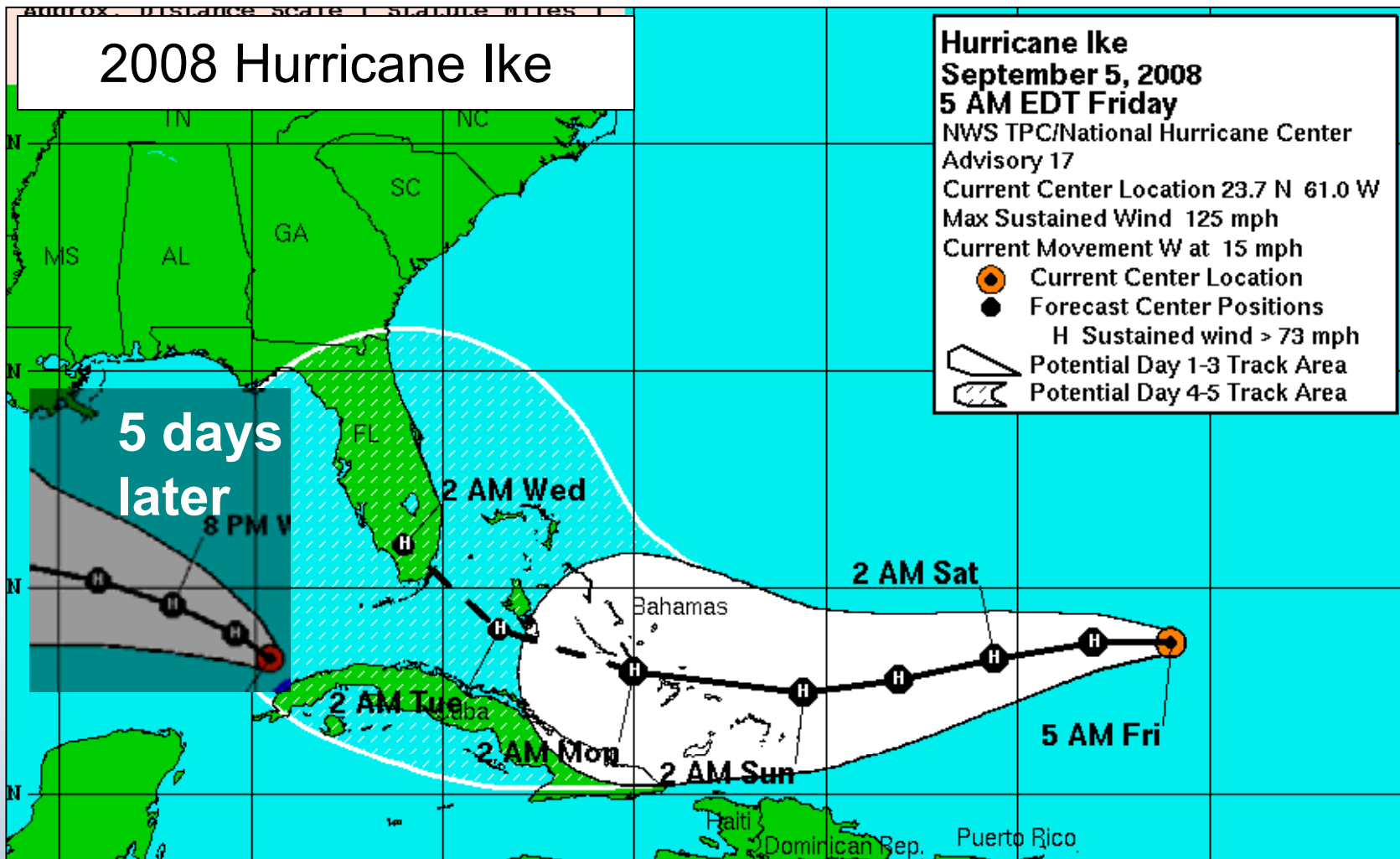
Tropical Cyclone Forecast/Advisory

- ◆ Contains wind field information
- ◆ Data from this advisory is used to create HURREVAC and Internet graphics
- ◆ Follows a standard format to provide 12-, 24-, 36-, 48-, 72-, 96-, and 120-hour forecast positions
- ◆ Where appropriate, the tropical storm forecast/advisory will also include information, such as:
 - Watches/warnings
 - Present location, accuracy, and movement
 - Other





The Familiar Watch/Warning Graphic





Tropical Cyclone Discussions

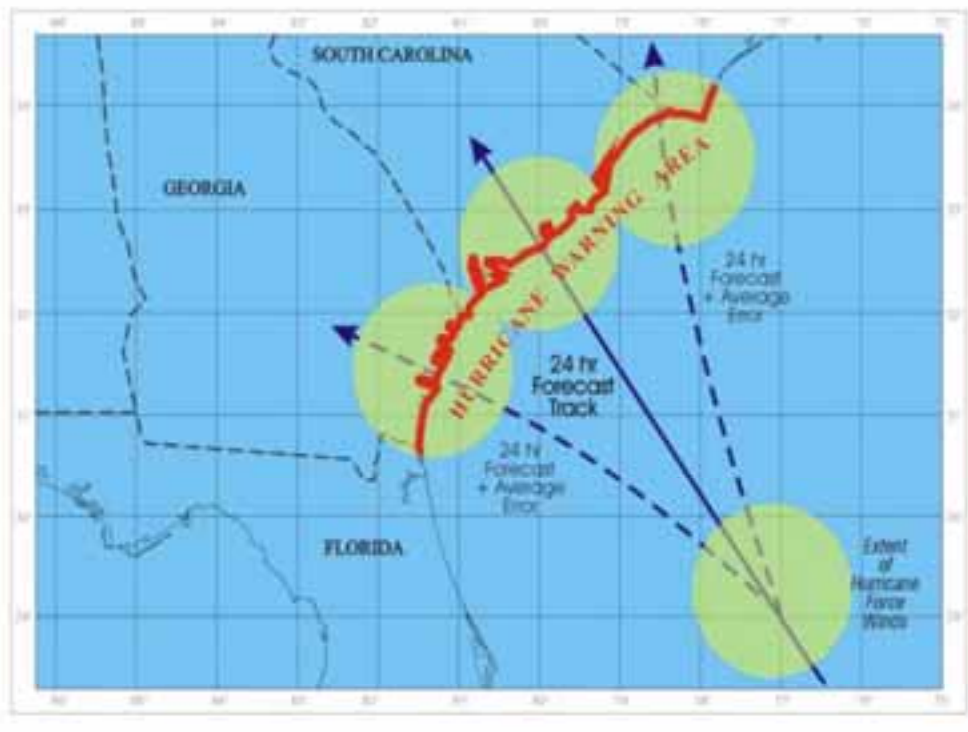
Intended for other forecasters, these discussions explain the rationale for the current forecast level of confidence. They generally include:

- ◆ Prognostic reasoning
- ◆ The objective techniques employed
- ◆ NOAA NWS model guidance used
- ◆ Coordinated 12-, 24-, 36-, 48-, 72-, 96-, and 120-hour tropical cyclone forecast points
- ◆ Maximum wind speed forecasts for each forecast point
- ◆ Other meteorological decisions
- ◆ Plans for watches and/or warnings





Hurricane Statistics 2000-2006



Average watch length was 489 miles

Average warning length was 417 miles

Average coastal length that actually received hurricane force winds: 100 miles

Your chance of hurricane force winds:

- If in a hurricane watch – 20% or a 1 in 5 chance
- If in a hurricane warning – 25% or a 1 in 4 chance



Deal or No Deal?

.01

.10

1.00

5.00

Banker is offering \$200,000 to quit.

If you say “**No Deal**”, there is only a 20% chance of knocking the \$1 million case out of play in the next round.

1,000,000

Deal or No Deal?

.01

.10

1.00

5.00

The \$1 million case is knocked out, this is an **extreme event!**

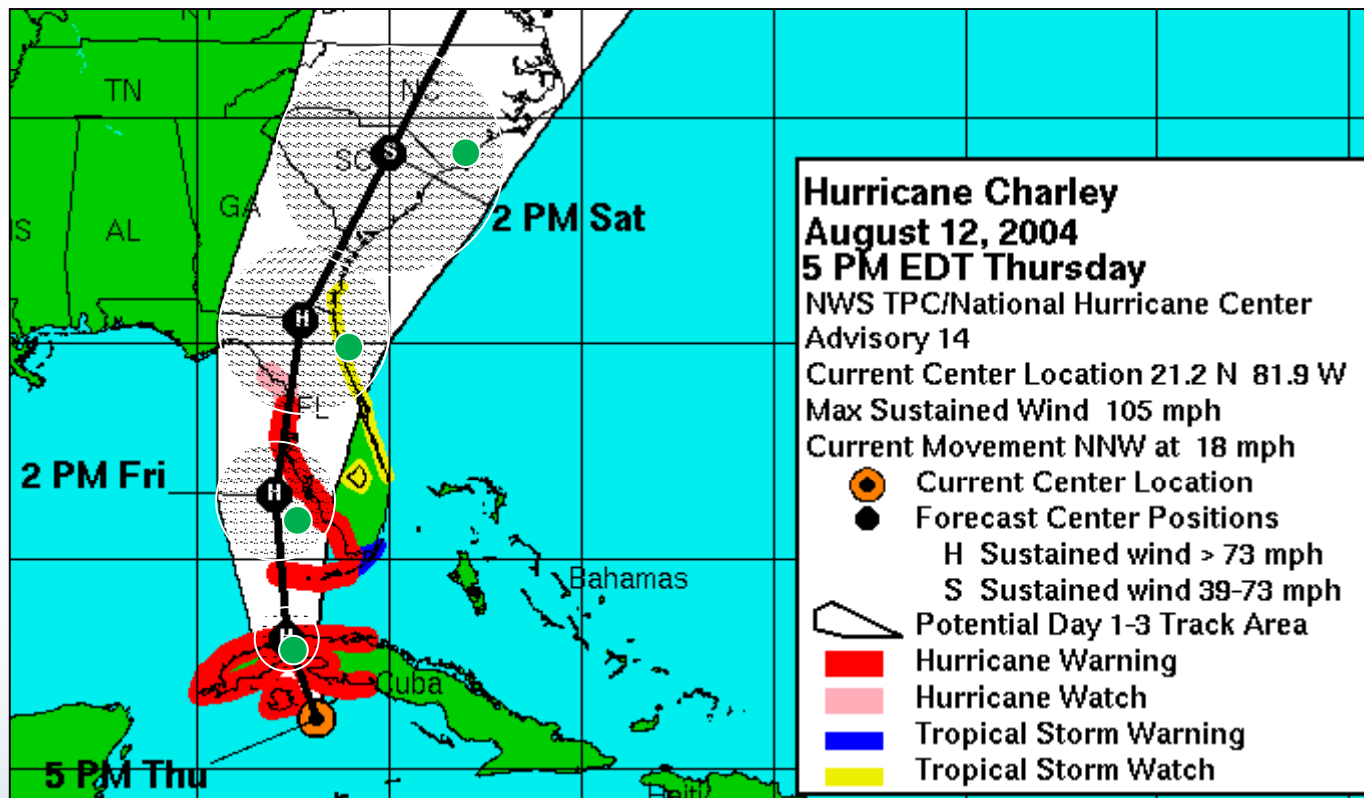
A hurricane is an extreme event!
It can take away your home, can hurt your family, and cost billions of dollars.



Forecasting With Uncertainty

5-Year Average Forecast Errors 2003-2007

- 12 hour – 34 miles
- 24 hour – 58 miles
- 36 hour – 82 miles
- 48 hour – 106 miles
- 3 day – 154 miles
- 4 day – 208 miles
- 5 day – 272 miles

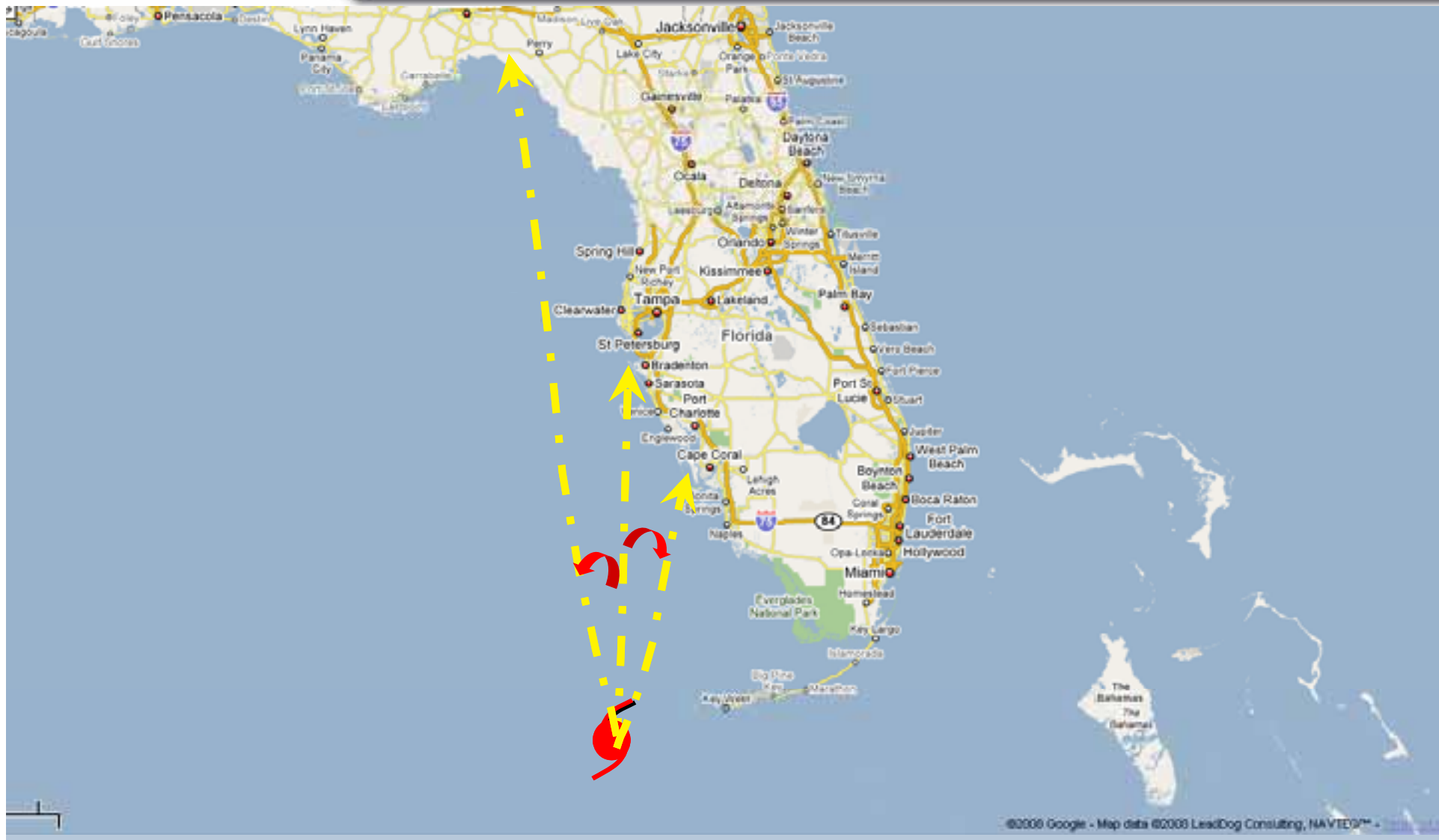


The cone is formed by enclosing the area swept out by a set of circles along the forecast track (at 12, 24, 36 hours, etc)

The size of each circle is related to the average error



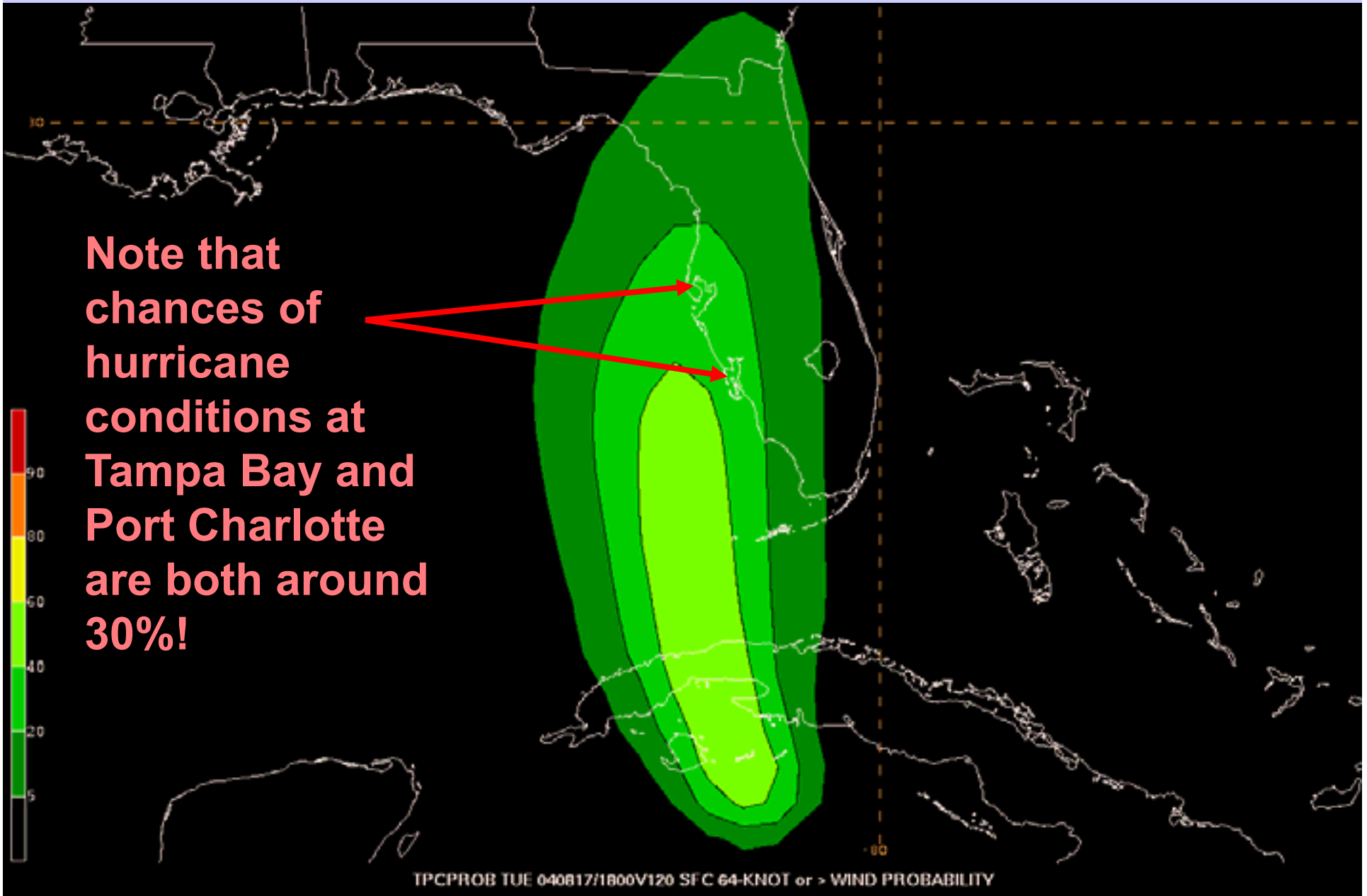
What if Charley veered a bit to the left?



64 kt Cumulative

0-120 h

18 UTC Thu 12 Aug



Hurricane Charley (2004)



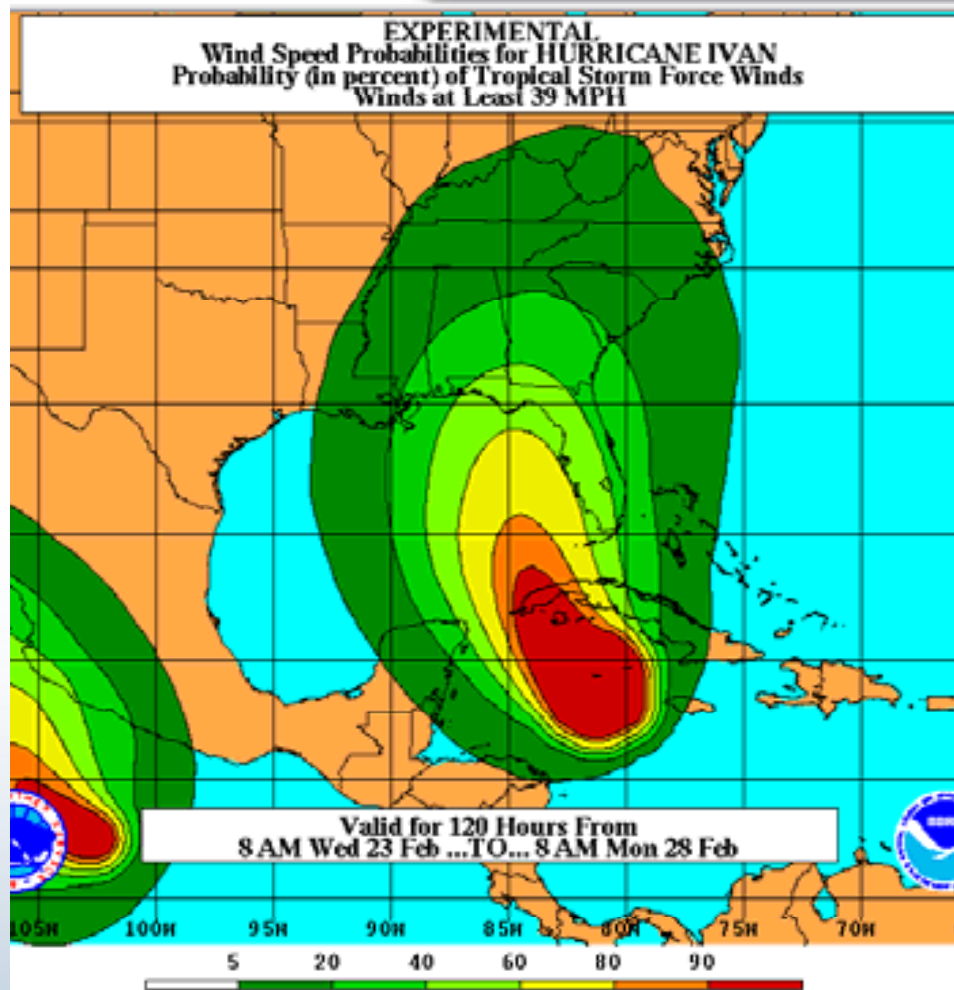
Wind Forecasts from the NHC

- ◆ These products provide probabilities of surface wind speeds of at locations along the coastlines and inland sites of the United States and other countries in the Atlantic and eastern North Pacific basins are available.
- ◆ The probabilities are based on errors during recent years in the official track and intensity forecasts issued by the NHC.
- ◆ Variability in tropical cyclone size (wind radii) is also incorporated.





Wind Speed Probabilities Map



Conveys the combined uncertainty in track, intensity, and storm size at each point on the map





The Need for this Product

Need for improved means of conveying tropical cyclone forecast uncertainty to various types of users

- New product is about a *weather event* at any specific location
- Conveys chances of wind speeds of at least particular thresholds
 - 34 kt / 39 mph (tropical storm force)
 - 50 kt / 58 mph
 - 64 kt / 74 mph (hurricane force)
- Accounts for combined uncertainty in track, intensity, and size
- Extends to 5 days
- Includes inland locations





What do the products tell you?

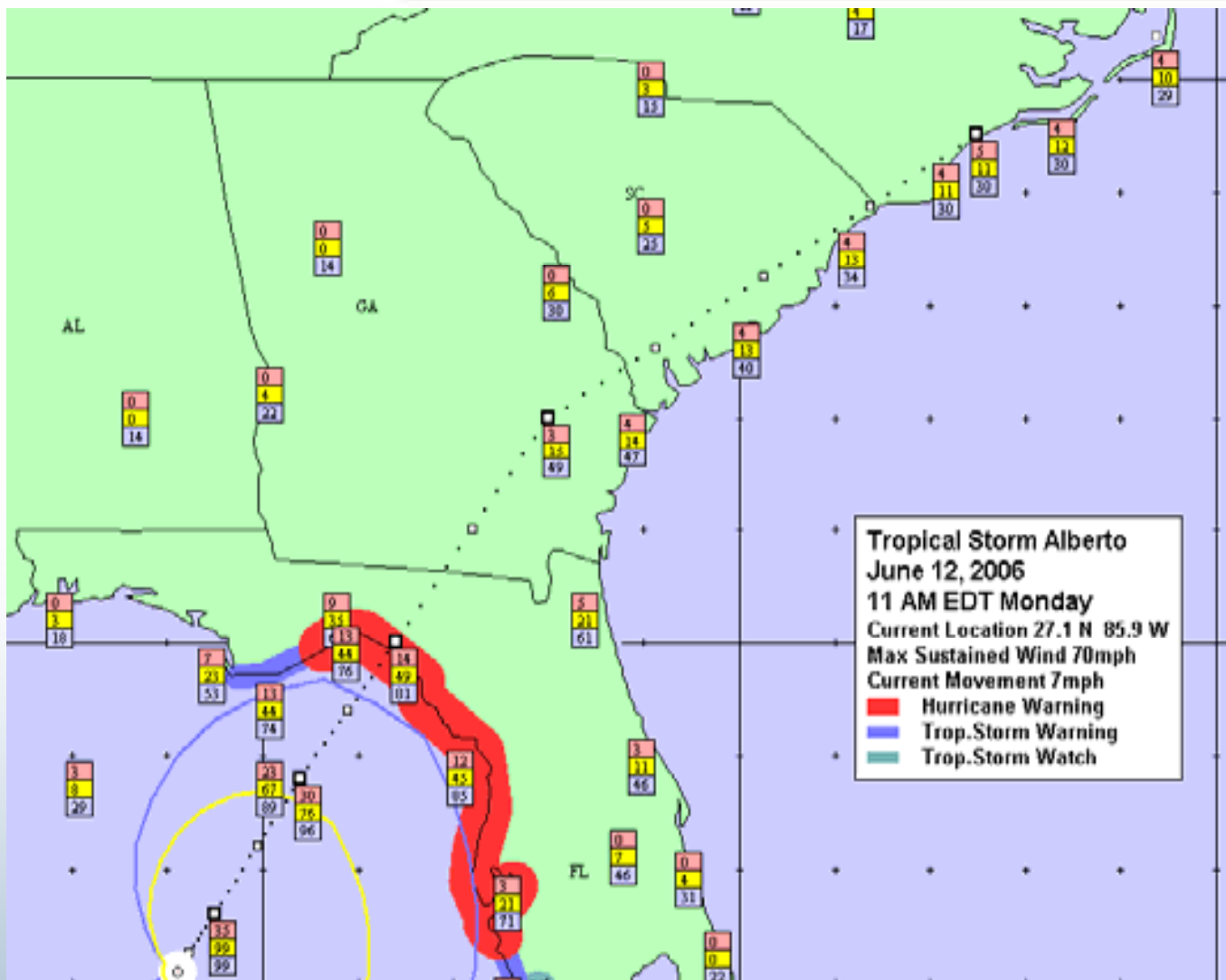
- What are the chances this event is going to happen to me?
 - *Do I need to prepare?*
 - Cumulative period probabilities
 - New graphics and text products from NHC and CPHC

- When is the event most likely to start at my location?
 - *How much time do I have left to prepare?*
 - Individual period probabilities
 - New text products from NHC and CPHC





Wind Speed Probs in HURREVAC



- Plotting the Wind Probability text product

- Showing Chances of:

- Hurricane Force winds (red),

- 50 Kt winds (yellow), and

- TS winds (blue)

6-51



WFO Hurricane Local Statements

Local WFOs analyze NHC products and issue Hurricane Local Statements (HLS), which contain:

- ◆ Lead statement
- ◆ Counties, or municipalities included in the HLS
- ◆ Watches and/or warnings in effect
- ◆ Recommended precautionary actions
- ◆ Storm surge and storm tide information
- ◆ Present winds and the expected time of onset of tropical storm or hurricane-force winds
- ◆ Tornado, flood, flash flood, rip current, beach erosion, and inland high wind potential
- ◆ The time of the next statement





Inland Tropical Storm/Hurricane Watches and Warnings

- ◆ Issued when a tropical storm is expected to remain at tropical storm/hurricane strength well inland
- ◆ Calls greater attention to the threat
- ◆ Issued when tropical storm/hurricane-force winds are anticipated beyond coastal areas—even though the actual occurrence, time, and location may be uncertain
- ◆ Wind fields from the tropical storm forecast/advisory will be used as guidance when preparing the watch





Extreme Wind Warning

- ◆ Issued by a local forecast office when sustained winds of 115 mph or higher are expected to occur over the warned area within one hour
- ◆ Used *ONLY* for Category 3 or stronger hurricanes

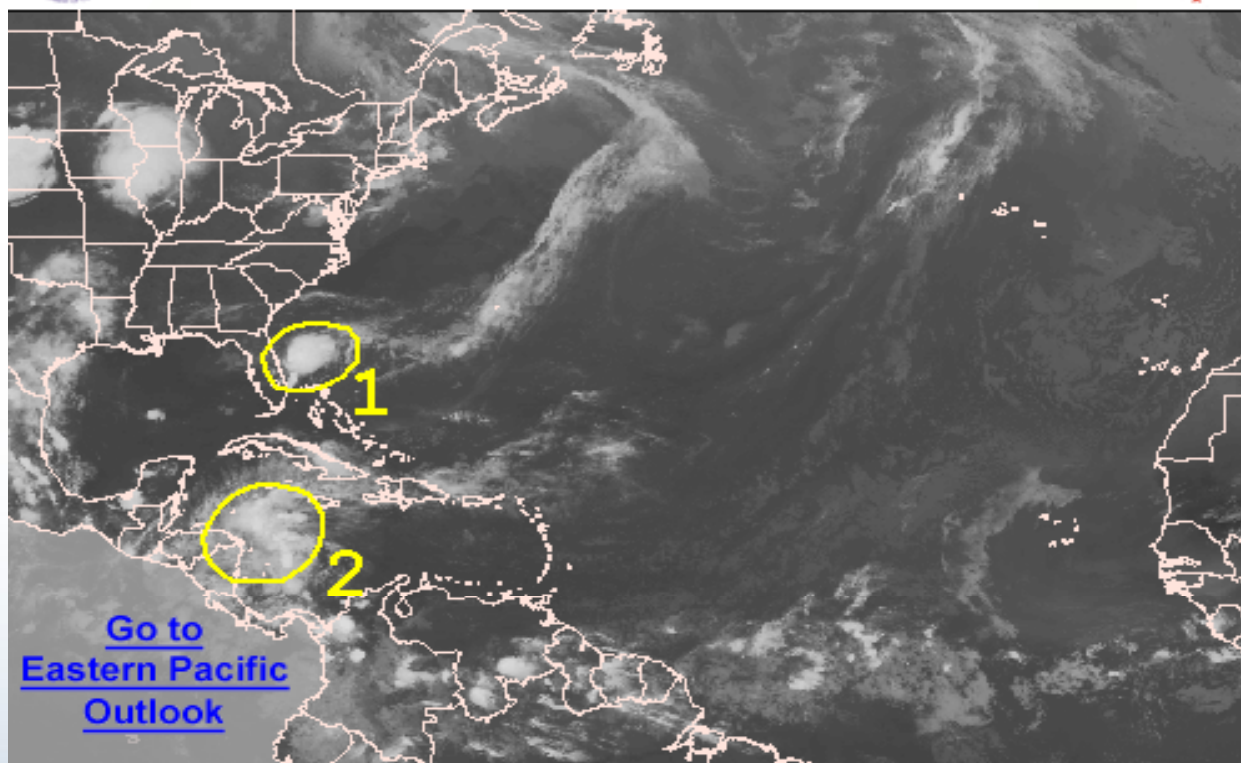




Graphical Tropical Weather Outlook



Experimental Graphical Tropical Weather Outlook



Discussion: 20070621 1030 PM EDT

Sat Image: 20070622/0145 UTC

The highlighted and numbered areas, if any, indicate current locations of weather systems discussed in the Tropical Weather Outlook below.





<http://weather.gov>

The screenshot shows the National Weather Service website interface. The 'Rivers' tab is highlighted with a red circle. Below the navigation tabs, there is a map of the United States with various colored markers indicating flood stages at different gauge locations. A legend at the bottom right of the map provides the following information:

- 6 Gauges: Major Flooding
- 14 Gauges: Moderate Flooding
- 38 Gauges: Minor Flooding
- 79 Gauges: Near Flood Stage
- 3032 Gauges: In Flood
- 232 Gauges: Observations older than 24 hours
- 12 Gauges: Out of Service

Additional statistics shown on the page include: 3537 Total Gauges and 58 Locations in Flood.



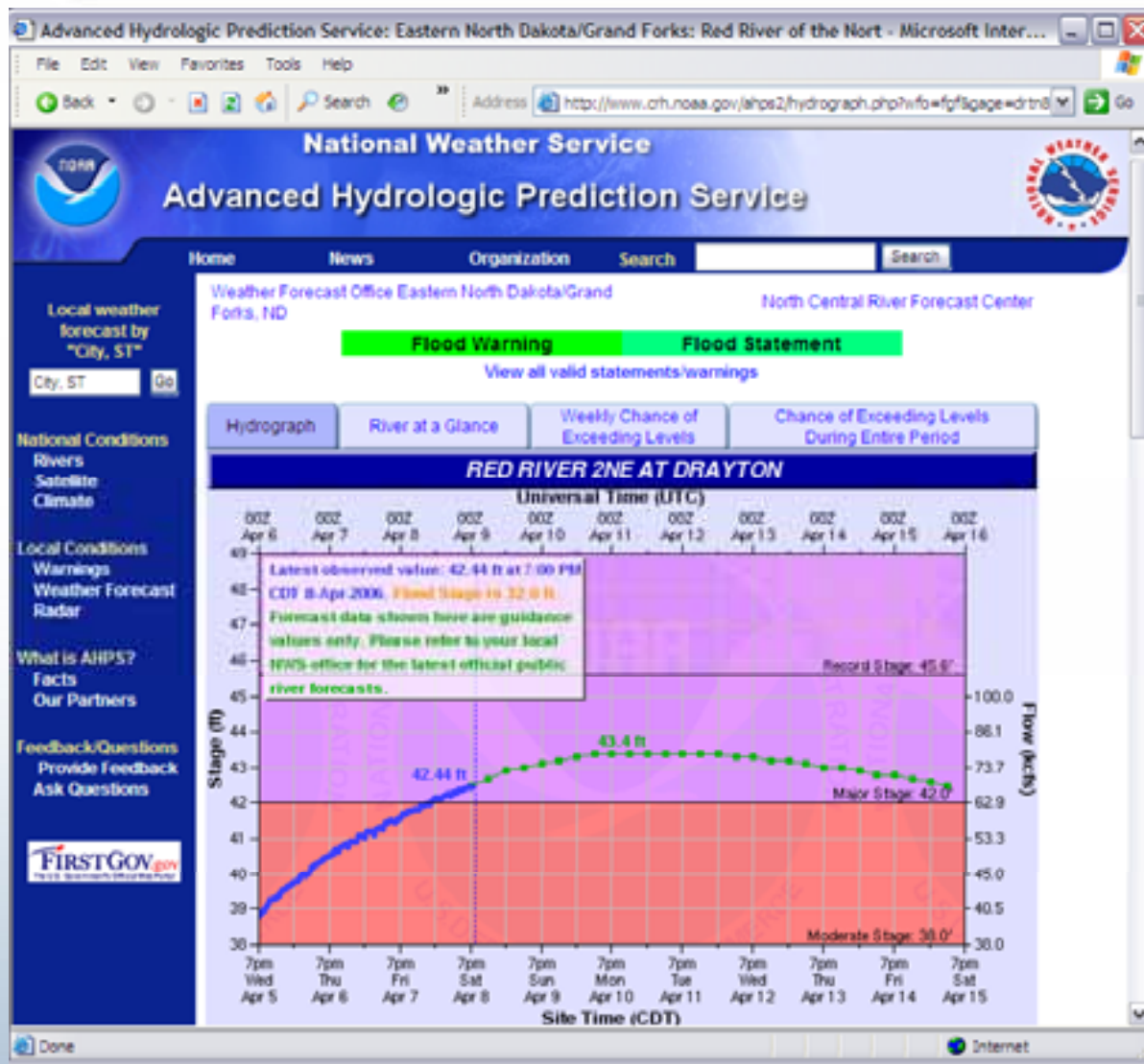


Advanced Hydrologic Prediction Service





Advanced Hydrologic Prediction Service





Changes for 2009

- The Tropical Cyclone Storm Surge Probability products, previously experimental, will become operational.
- The Atlantic and Eastern Pacific Tropical Cyclone Wind Field Graphics will become operational.
- The Atlantic and Eastern Pacific Graphical Tropical Weather Outlooks will become operational.
- The “Special Tropical Disturbance Statement” will be discontinued and replaced with a "Special Tropical Weather Outlook". The Special Tropical Weather Outlook will be issued when significant changes have occurred to disturbances between the regular Outlook issuance times.
- Storm surge information and forecasts in the Public Advisory will be expressed in terms of “height above ground level” or “inundation”.

Go to http://www.nhc.noaa.gov/nhc_new_2009.shtml for a complete list of changes.





Hurricane Forecasting



- ◆ The TPC/NHC relies on hurricane computer modeling and observational instrumentation for hurricane forecasting
- ◆ Over the past 20 years, forecast accuracy has increased
- ◆ Despite advances in data collection systems, the accuracy of forecasts is still limited





Constructing the NHC Forecast

- Based on the knowledge and experience of the forecaster combined with model guidance and all available data
- Important to maintain consistency with the previous forecast
- Also important to remember that the guidance could be wrong!





TRACK FORECASTING



- ◆ USE OF INITIAL MOTION, CLIMATOLOGY, AND PERSISTENCE
- ◆ CONTINUITY FROM PREVIOUS FORECAST
- ◆ USE OF COMPUTER GUIDANCE MODELS
- ◆ NON-METEOROLOGICAL FACTORS





SOME TRACK PREDICTION MODELS USED BY THE NHC

(RELATIVELY SIMPLE)

- ◆ CLIPER
- ◆ NHC90
- ◆ BAMS
- ◆ BAMB
- ◆ BAMD
- ◆ LBAR

(MORE COMPLEX)

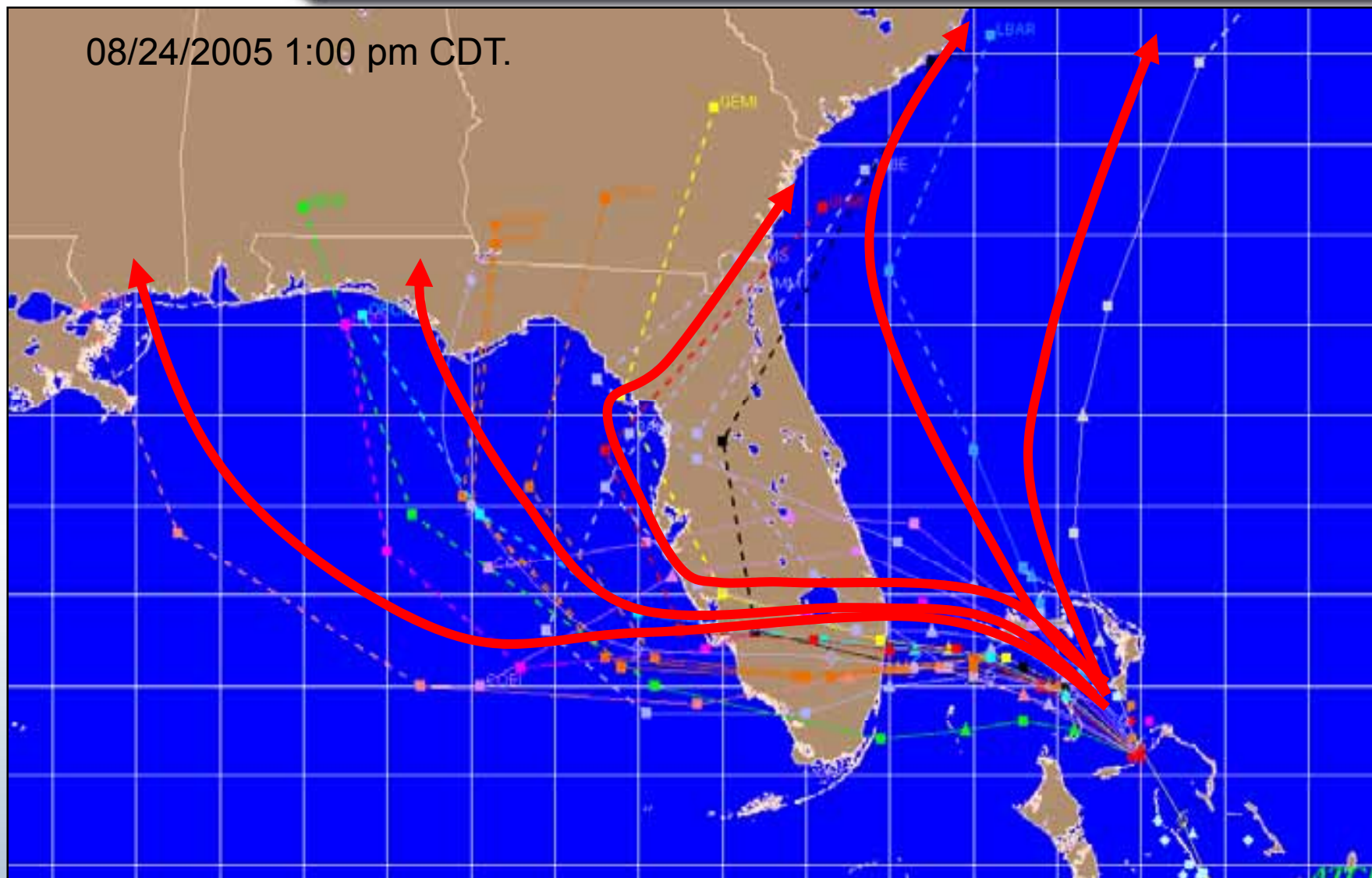
- ◆ GFDL
- ◆ GFS
- ◆ NOGAPS
- ◆ UKMET
- ◆ ECMWF





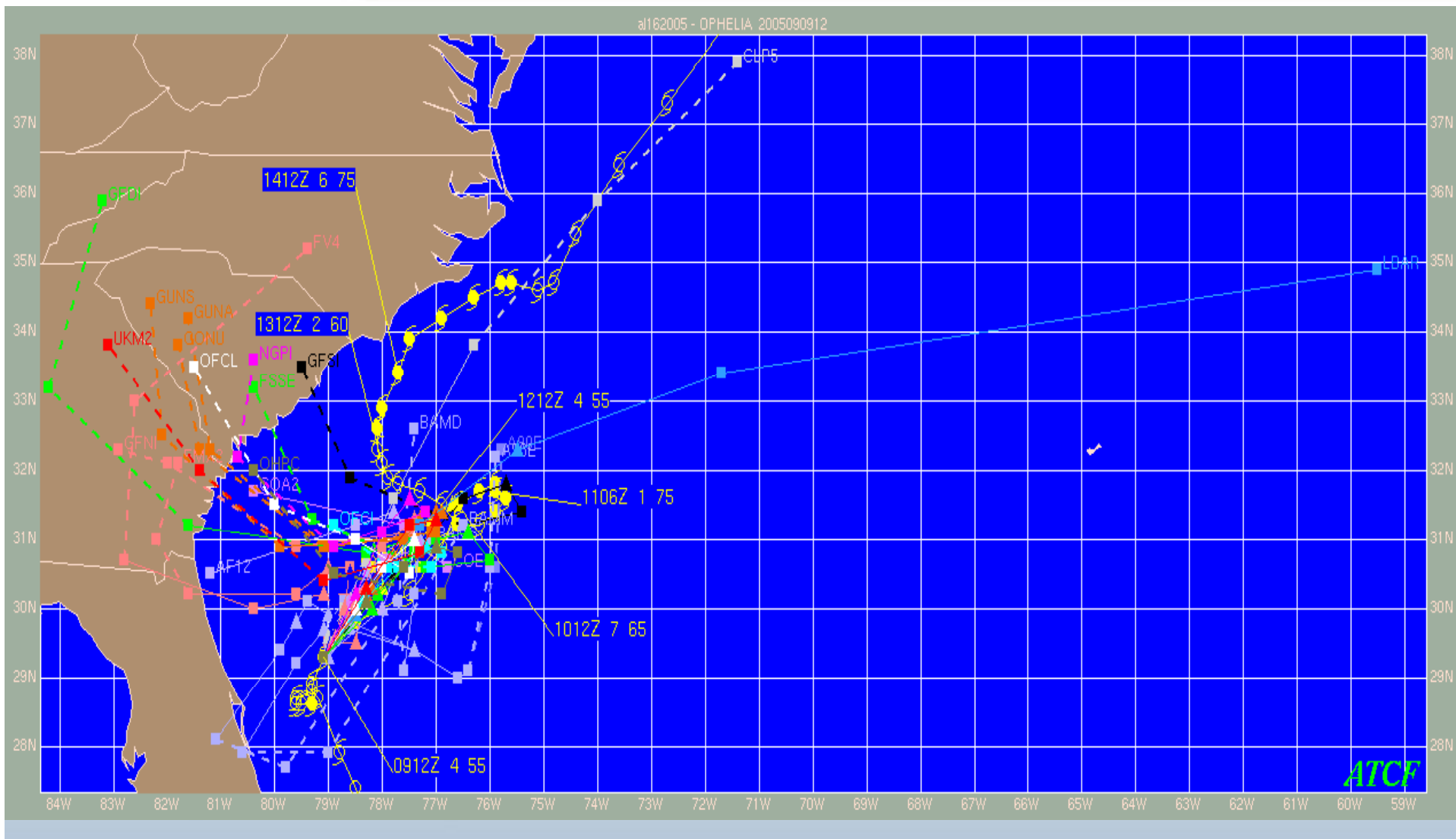
Katrina 5 Day Forecast Model Plots

08/24/2005 1:00 pm CDT.



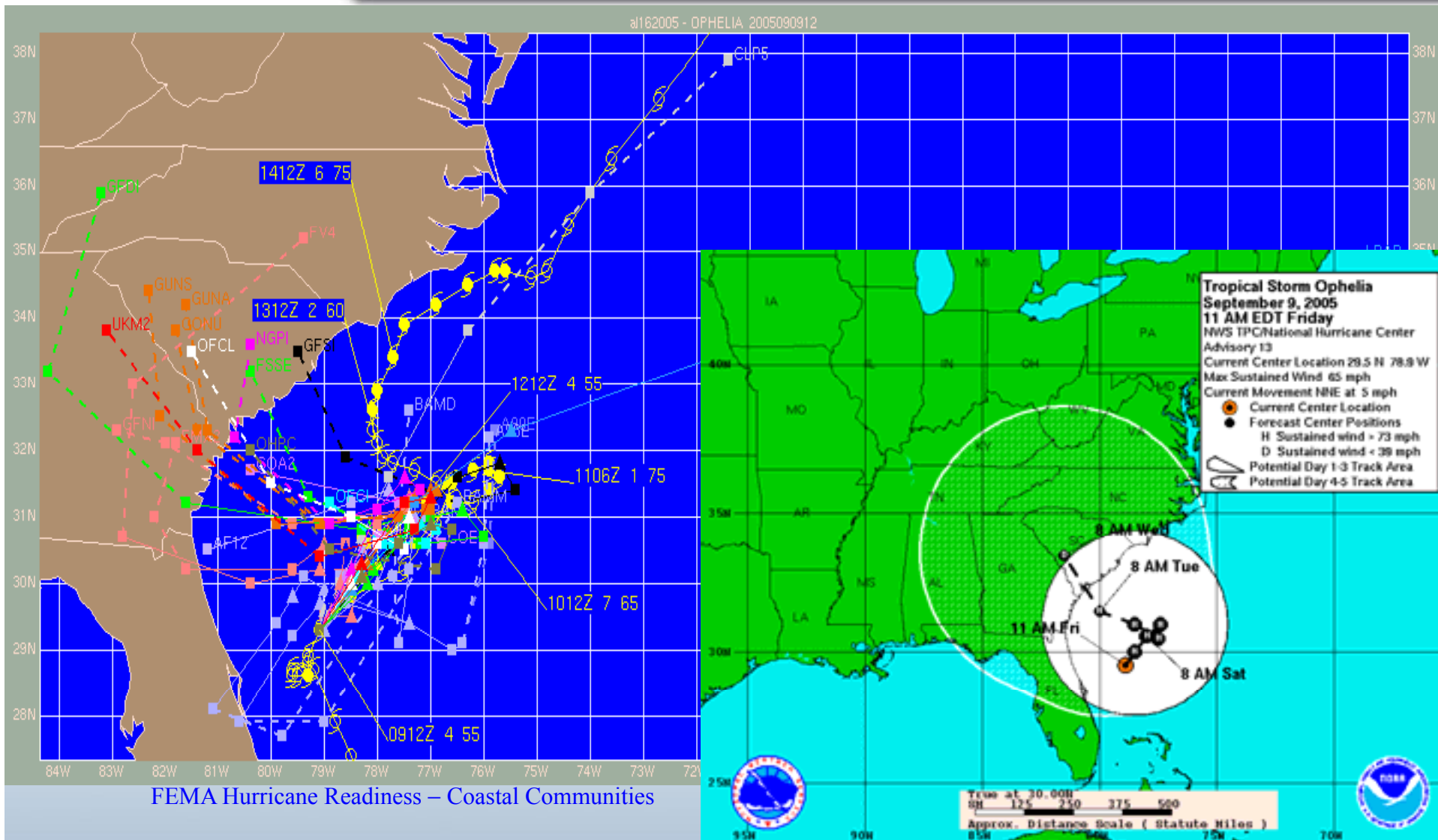


Forecasting can be a Challenge!





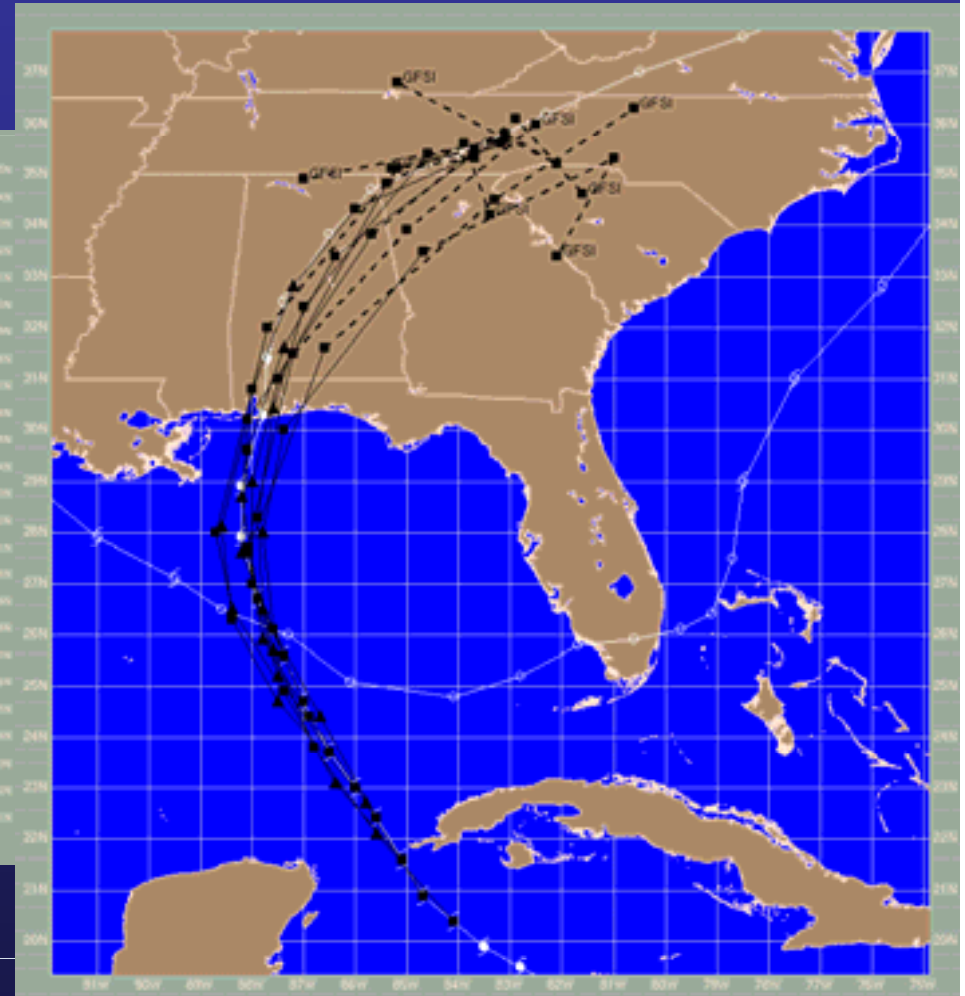
Forecasting can be a Challenge!



GFS Track Forecasts for Ivan



9/7/04 12Z – 9/11/04 12Z: SIGNIFICANT RIGHT BIAS



9/13/04 12Z – 9/15/04 12Z: EXCELLENT IN SPECIFYING IVAN'S LANDFALL LOCATION ON GULF COAST.



Inaccuracies in Observations

- ◆ Having enough observations to supply data for the computer models is a problem, especially over the ocean
- ◆ Observational tools take measurements in different ways, and all of them have different accuracies
- ◆ The forecaster must determine, out of all these measurements and computer runs, which ones best represent the storm
- ◆ Forecasters must also be concerned about rapid changes that take place between model runs





Errors in Forecasting

◆ The NHC average forecast track error at 72 hours is roughly **150** nautical miles.



◆ A 'perfect' forecast is knowing the location and intensity with 100 percent accuracy.

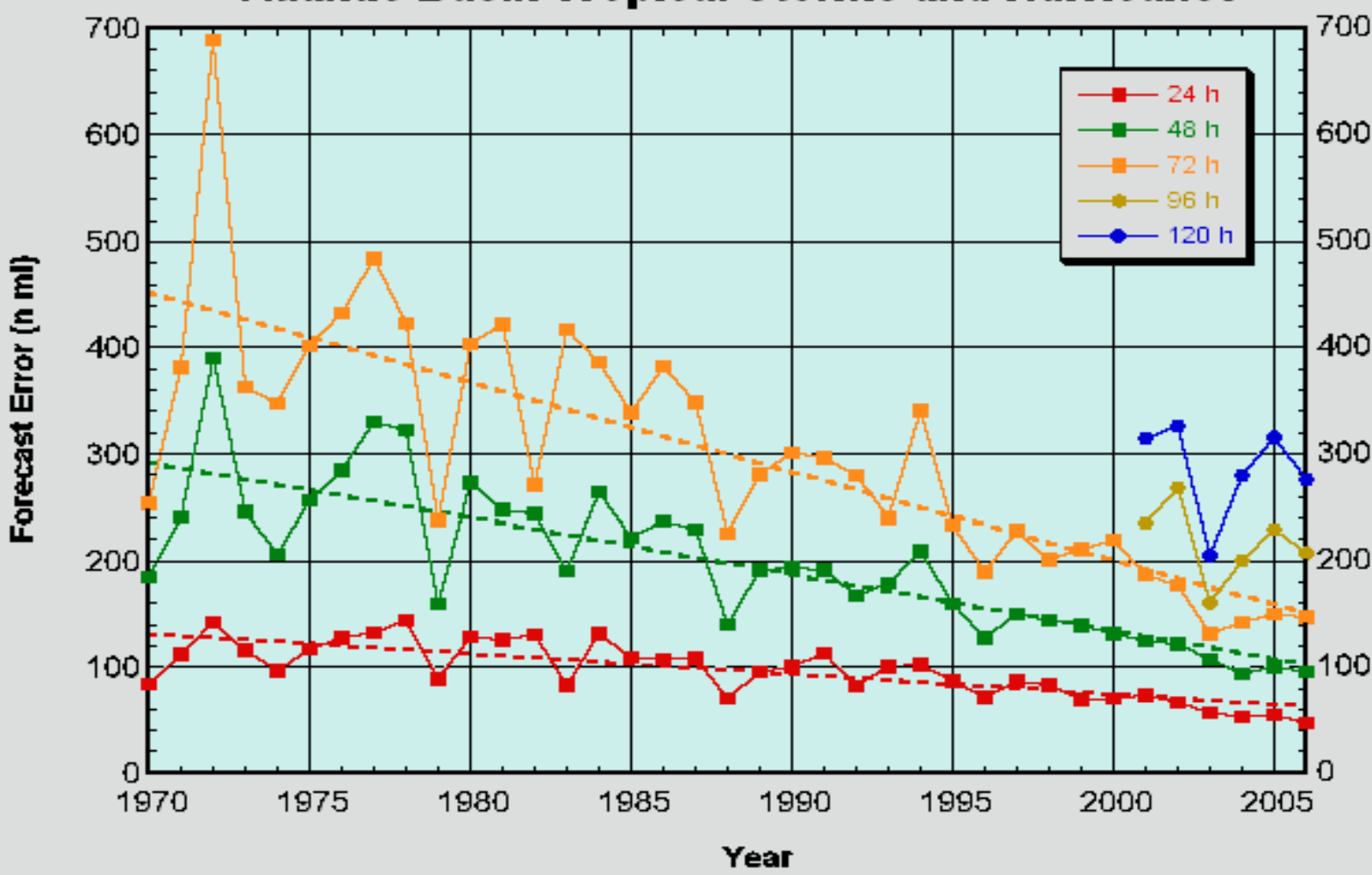
This gap is the reality that underlies decision-making.





Successes and Challenges

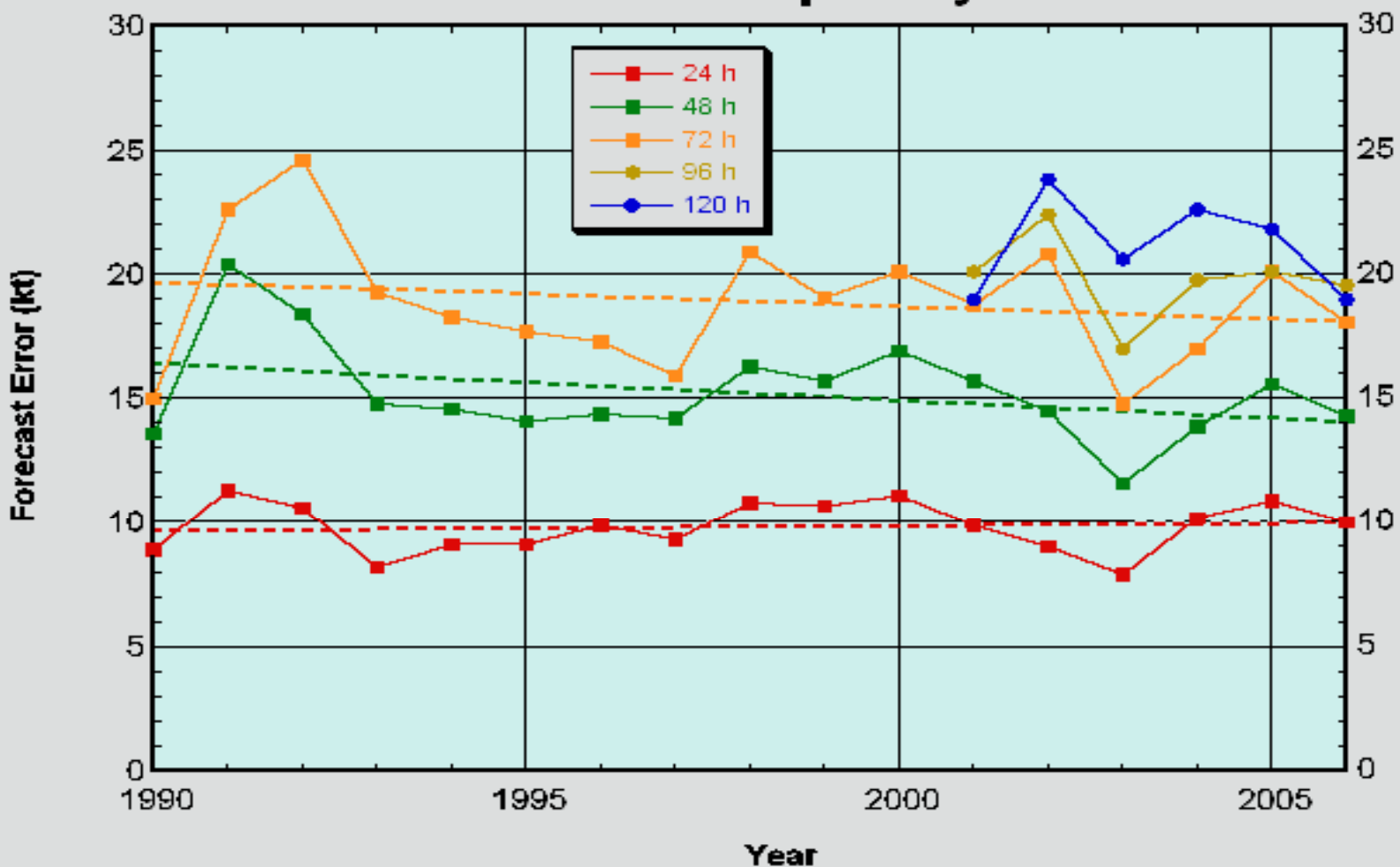
**NHC Official Annual Average Track Errors
Atlantic Basin Tropical Storms and Hurricanes**





Successes and Challenges

NHC Official Annual Average Intensity Errors Atlantic Basin Tropical Cyclones



Remarks about Intensity Forecasting

- Intensity forecasting is not as advanced as track forecasting. Compared to climatology and persistence, there is only very limited skill.
- Current guidance is provided mainly by statistical models. Improvements in these models, using oceanic heat content and rapid intensification criteria, are likely.
- Dynamical models show little skill in intensity forecasting; however, in time, improvements to these models and enhanced observations offer hope for the future.



Three Main Sources of Errors

- ◆ Methods of observation:
 - Satellite
 - Reconnaissance
 - Radar
- ◆ Inaccuracies in the observations or insufficient numbers of observations
- ◆ Incomplete understanding of the physics of the hurricane and the atmosphere in which it is embedded





Probabilities and Margins of Error

- ◆ Plan for a storm one category higher than is currently forecast
- ◆ Prepare in advance to take action in case the track shifts suddenly or the storm's speed increases
 - Speed up storm by 6 hours





Track Errors and Evacuation Decisions



- ◆ You must make the decision to evacuate while keeping track errors in mind – about 60 n mi at 24 hours (2-yr running average 2004-2005)
- ◆ Hurricane conditions typically affect a swath of about 100 statute miles of coastline. Watches and warnings are usually issued for 400-500 miles of coastline
- ◆ Costs of evacuations and loss of life are weighed against errors in forecasting to decide on a course of action





HURREVAC as a Forecasting Tool

HURREVAC uses the TPC/NHC advisory package to graphically show the:

- ◆ Hurricane's track
- ◆ Forecast track errors
- ◆ Strike probabilities
- ◆ Wind fields



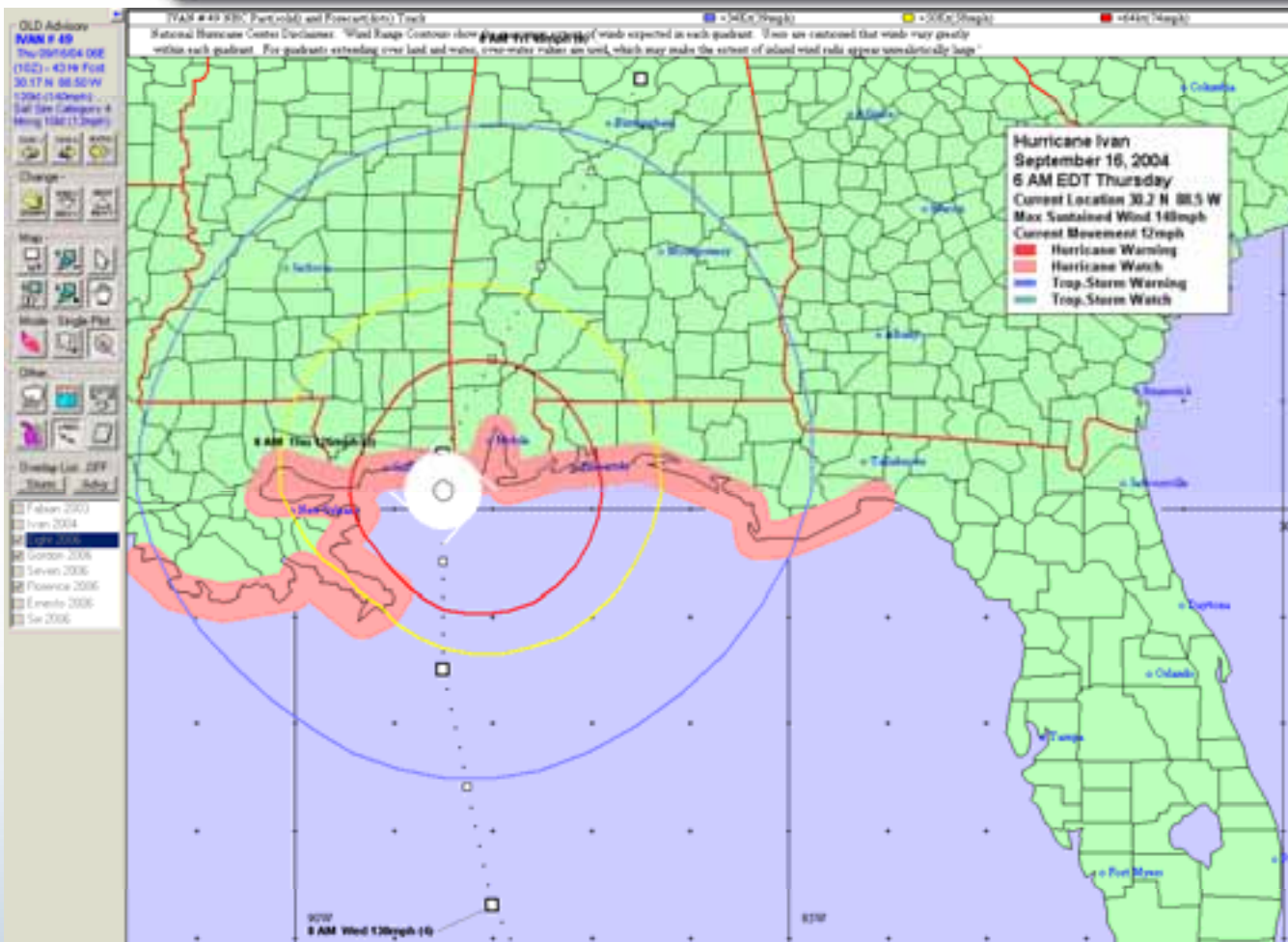
When combined with HES information, HURREVAC provides data for making an evacuation decision.

HURREVAC IS NOT A WEATHER FORECAST MODEL!!!



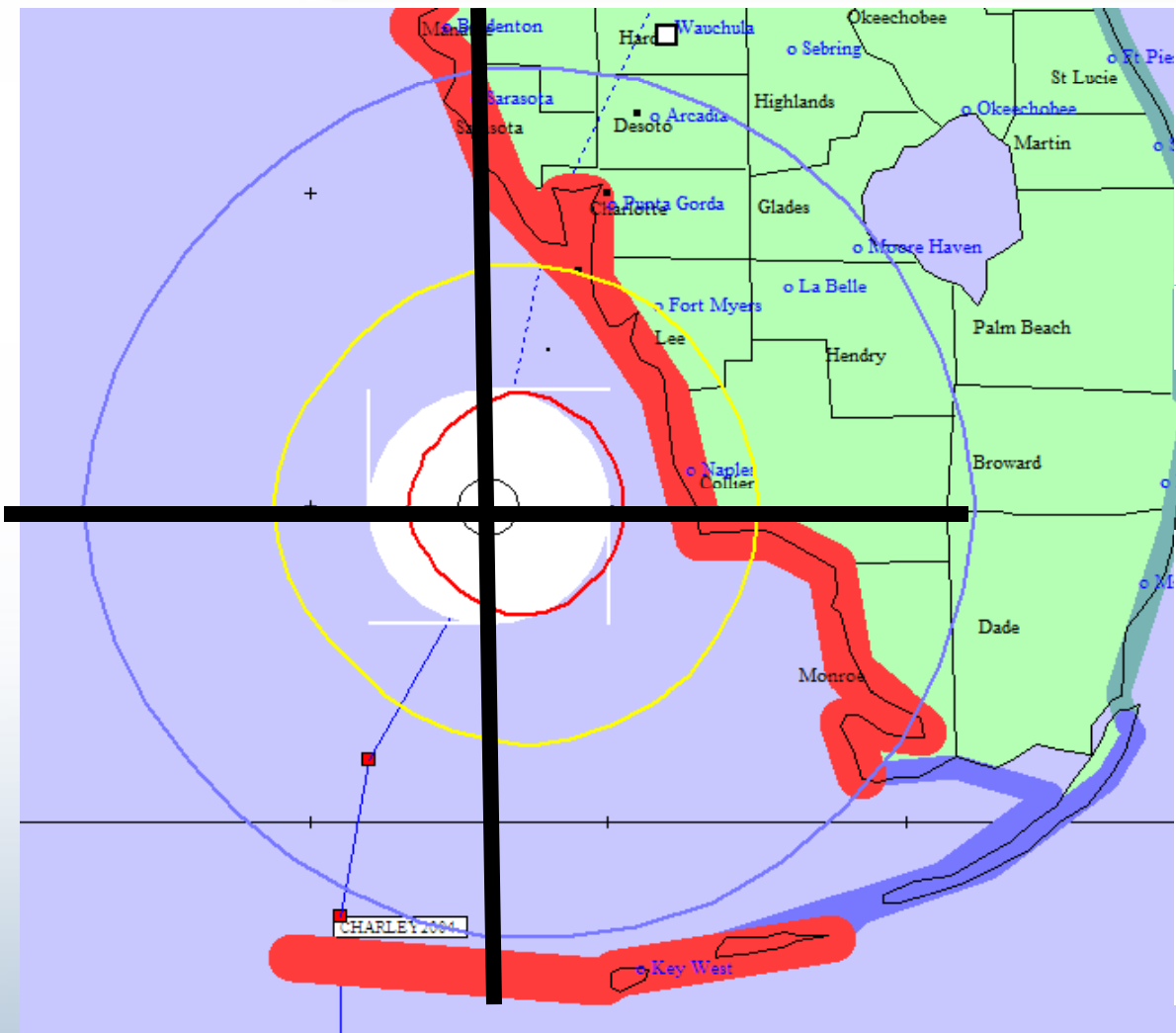


Wind Radii mode of HURREVAC





NHC Wind Forecasts



Wind is not reduced over land

Over land, use speed as potential for gusts



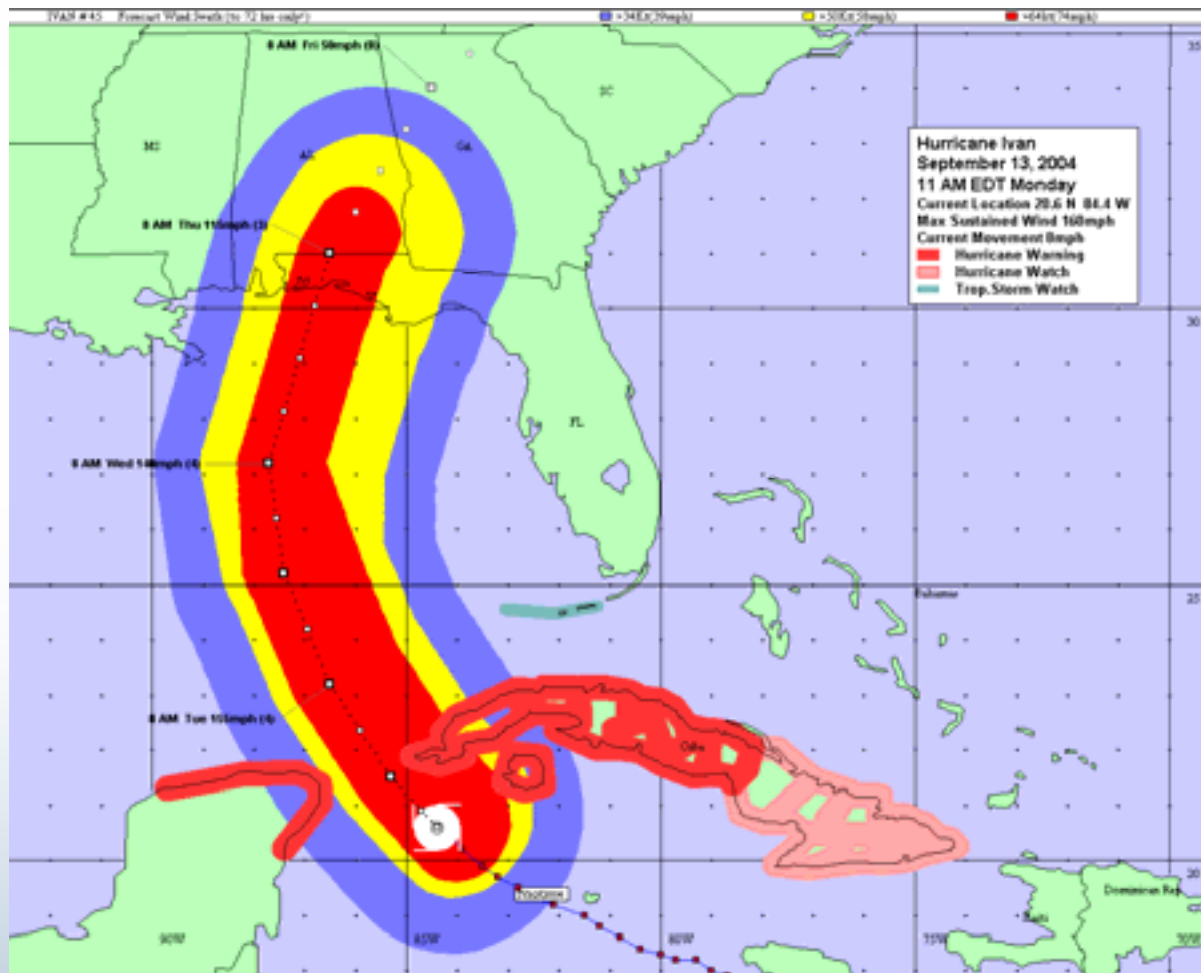
Wind Radii Issues

- ◆ Radii are not the real-time winds. They are based on forecast extent of winds in respective quadrants.
- ◆ Winds are not symmetric or “doughnut shaped”
- ◆ Wind radii are not valid over land
- ◆ Best if used as a rough guide to estimate arrival and departure of tropical storm or hurricane force winds.





Wind Swath Mode

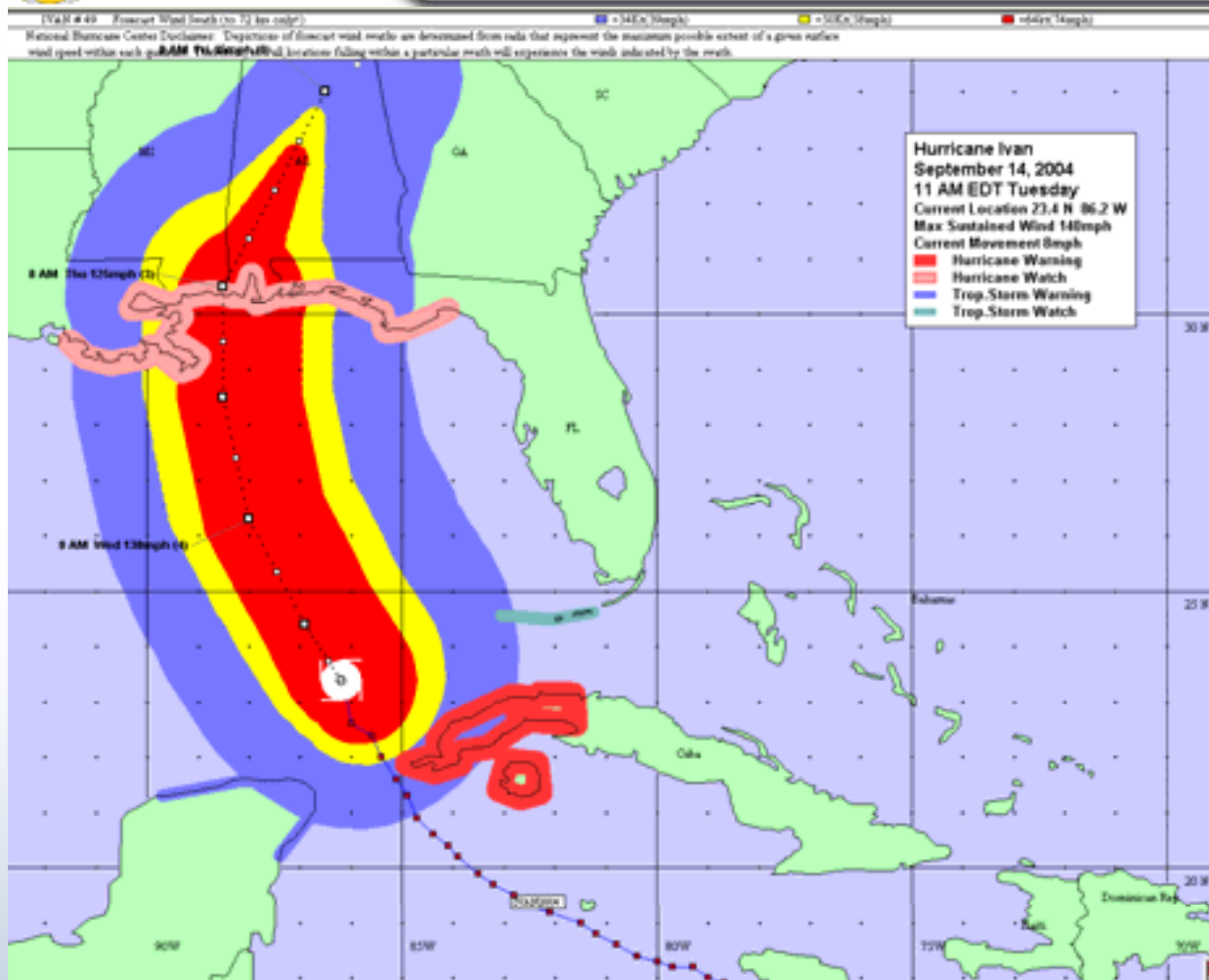


- ◆ Hurricane force winds are not expected for SW Alabama
- ◆ Just TS winds in SE MS.
- ◆ A good planning tool?





Wind swath-24 hrs later?

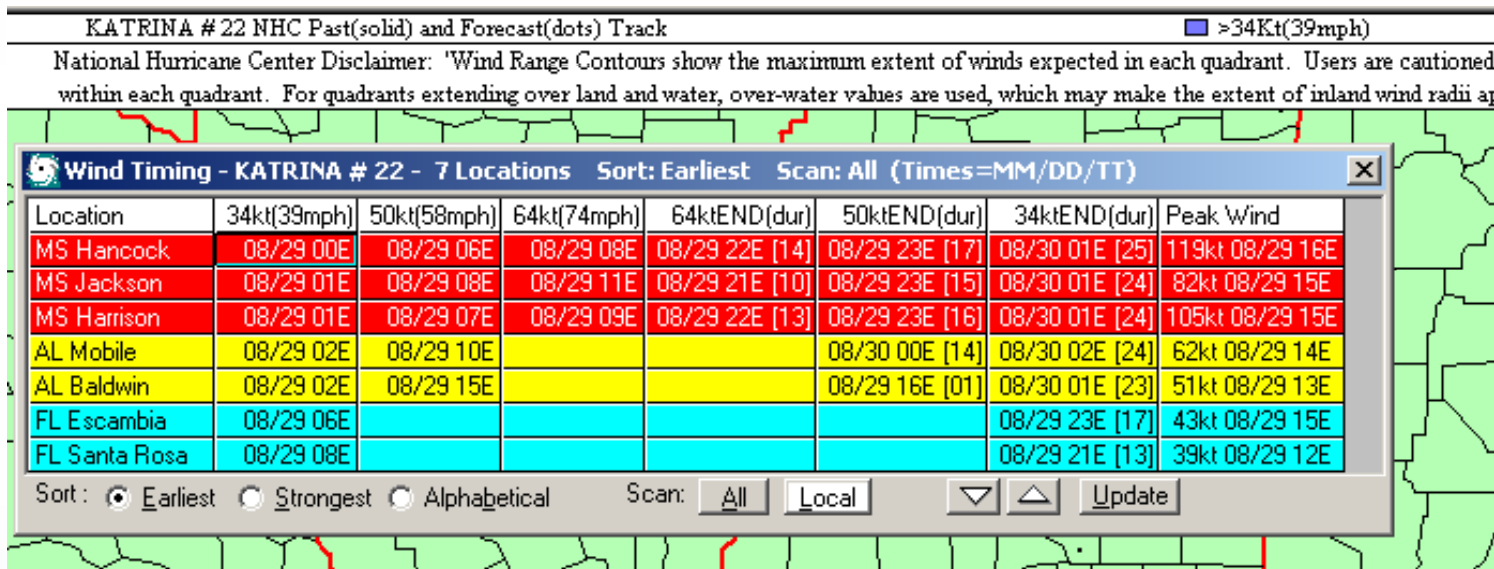


- ◆ Hurricane force winds are now expected in SW AL and SE MS
- ◆ Best if used within 24 hrs of landfall, coupled with the Decay model





Wind Timing Table



- ◆ Shows wind arrival and end times based on the current forecast track, radii, and forward speed.





Wind Timing, Single Location

Wind Forecast Details KATRINA Advy.# 23 - Single County/Parish (MS Hancock)

Date/Time (hr)	Wind Speed	From Direction	34kt distance	50kt distance	64kt distance	Eye distance	Hour
08/28/05 14EDT	less than 34kt	ENE (060)	67 miles	116 miles	143 miles	225 miles	0
08/28/05 15EDT	less than 34kt	ENE (060)	60 miles	109 miles	136 miles	218 miles	1
08/28/05 16EDT	less than 34kt	ENE (060)	53 miles	101 miles	128 miles	210 miles	2
08/28/05 17EDT	less than 34kt	ENE (060)	45 miles	94 miles	121 miles	203 miles	3
08/28/05 18EDT	less than 34kt	ENE (060)	38 miles	87 miles	114 miles	196 miles	4
08/28/05 19EDT	less than 34kt	ENE (060)	31 miles	79 miles	106 miles	188 miles	5
08/28/05 20EDT	less than 34kt	ENE (060)	23 miles	72 miles	99 miles	181 miles	6
08/28/05 21EDT	less than 34kt	ENE (060)	13 miles	62 miles	89 miles	171 miles	7
08/28/05 22EDT	less than 34kt	ENE (060)	4 miles	52 miles	79 miles	161 miles	8
08/28/05 23EDT	35kt (40mph)	ENE (060)	0 miles	43 miles	70 miles	151 miles	9
08/29/05 00EDT	39kt (44mph)	ENE (060)	0 miles	33 miles	60 miles	142 miles	10
08/29/05 01EDT	43kt (49mph)	ENE (070)	0 miles	20 miles	48 miles	132 miles	11
08/29/05 02EDT	45kt (51mph)	ENE (060)	0 miles	11 miles	38 miles	122 miles	12
08/29/05 03EDT	48kt (55mph)	ENE (060)	0 miles	1 miles	29 miles	112 miles	13
08/29/05 04EDT	53kt (60mph)	ENE (060)	0 miles	0 miles	19 miles	103 miles	14
08/29/05 05EDT	59kt (67mph)	ENE (070)	0 miles	0 miles	9 miles	93 miles	15
08/29/05 06EDT	64kt (73mph)	ENE (070)	0 miles	0 miles	0 miles	83 miles	16
08/29/05 07EDT	72kt (82mph)	ENE (070)	0 miles	0 miles	0 miles	74 miles	17
08/29/05 08EDT	81kt (93mph)	ENE (070)	0 miles	0 miles	0 miles	64 miles	18
08/29/05 09EDT	91kt (104mph)	ENE (070)	0 miles	0 miles	0 miles	53 miles	19
08/29/05 10EDT	102kt (117mph)	ENE (070)	0 miles	0 miles	0 miles	41 miles	20
08/29/05 11EDT	108kt (124mph)	E (080)	0 miles	0 miles	0 miles	30 miles	21

Timeline Off [Update]

- ◆ Breaks down wind timing hour by hour, based on forecast.





Unit Summary

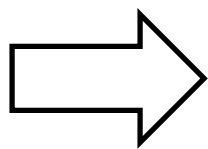
- ◆ Hurricane forecasting is a shared responsibility between the NHC and the local WFO
- ◆ The NHC provides information about the hurricane's
 - present position
 - track
 - wind speed
 - threat of severe weather
 - intensity
 - threat of flood / flash flood



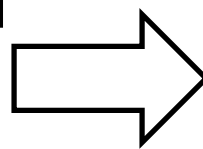


Repeat: Role of Local Weather Forecast Office

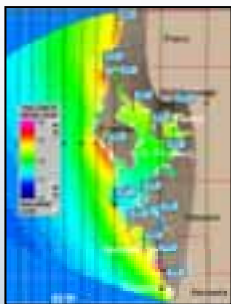
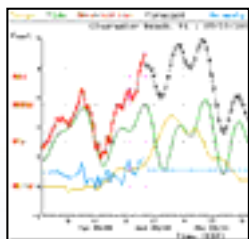
Analyze all the various products and forecasts



Develop localized picture of timing and affect



Communicate uncertainty and impacts so our customers can make informed decisions





Lessons Learned

- ◆ When monitoring the storm what are the most critical factors?
- ◆ How can we correct/improve the inaccuracies in tropical storm observations?
- ◆ What tools/products have been most useful and accurate in forecasting tropical storms?





Unit 7—Evacuation Decision Considerations

- ◆ Decision-Making Authority Issues
- ◆ Hurricane Action Template
- ◆ Risk Profiling
- ◆ Regional Decision Making
- ◆ Activity 7:1—Guided Discussion—Current Issues





Decision-Making Process

- ◆ Define ultimate authority
- ◆ Consensus from other elected officials
- ◆ Verification by local ordinance or state code





Protective Action Decision-Making

- ◆ What are some examples of Protective Action Decision-Making in your jurisdiction?





Forecast Factors

- ◆ Plan for one hurricane category higher than forecast
- ◆ Current forecast
- ◆ Error cone
- ◆ Projected storm track
- ◆ Storm intensity
- ◆ Storm direction





Rule of Thumb

- ◆ Run from the water (storm surge/flooding)
- ◆ Hide from the wind
- ◆ Evacuation should focus on the flood-prone areas





Vulnerable Facilities

- ◆ Mobile Homes
- ◆ Substandard Construction
- ◆ Manufactured Housing
- ◆ Special Needs Populations
- ◆ Isolated Areas
- ◆ Tourist Areas
- ◆ Special Events





Who Is Most Vulnerable?

- ◆ What are some examples in your community of vulnerable populations?





Who Needs to Leave or Stay?

- ◆ Basic Questions
 - Do they live in a storm surge area?
 - What structures will withstand the winds?
 - What areas are most susceptible to inland flooding?
 - Shadow evacuations
 - Community isolation
 - Who should leave first?





In-County vs. Out-of-County Evacuations

- ◆ How vulnerable is the area?
- ◆ What resources are available immediately, short term, and long term?
- ◆ What are the host out-of-county considerations?

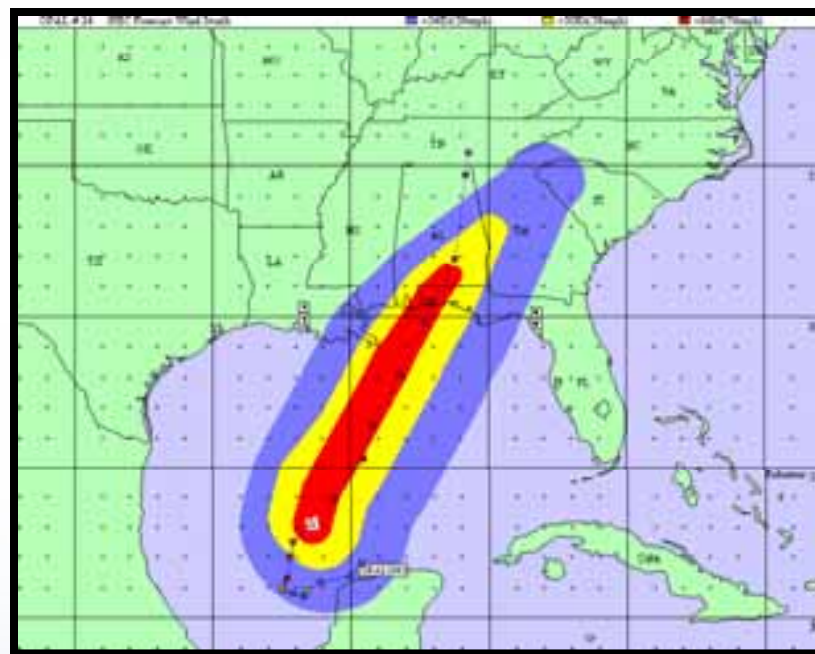




Effective Evacuation Decisions

The Hurricane Risk Profile concept addresses:

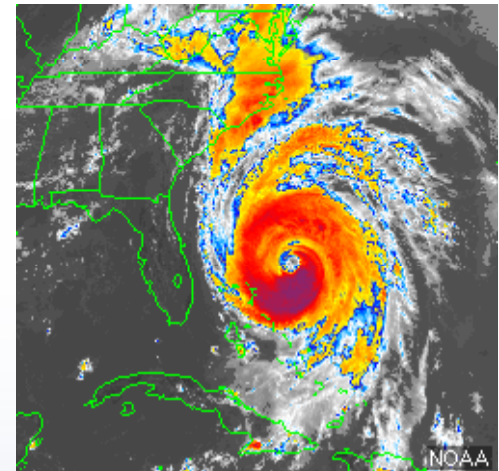
- ◆ What questions must be addressed by state/local officials before issuing an evacuation?
- ◆ Decision makers must guard against shadow evacuations and make informed decisions based upon the forecast threat.





Effective Evacuation Decisions

- ◆ Politics vs. planned evacuation processes
- ◆ Economic impacts
- ◆ Decision making authority
- ◆ Accountability: can you support your decision?



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***Evacuation Decision's are made
to save lives!***



7-11



Risk Profiling

- ◆ The HES has determined who is vulnerable to tropical cyclone hazards

- ◆ Risk Profiling concept will help determine the specific risk based upon the forecast
 - Risk can be tracked and will assist with accountability for your decision

 - Risk Profiling be used in conjunction with a Readiness Checklist





Risk Profiling

Where/When/How should you focus your evacuation efforts?

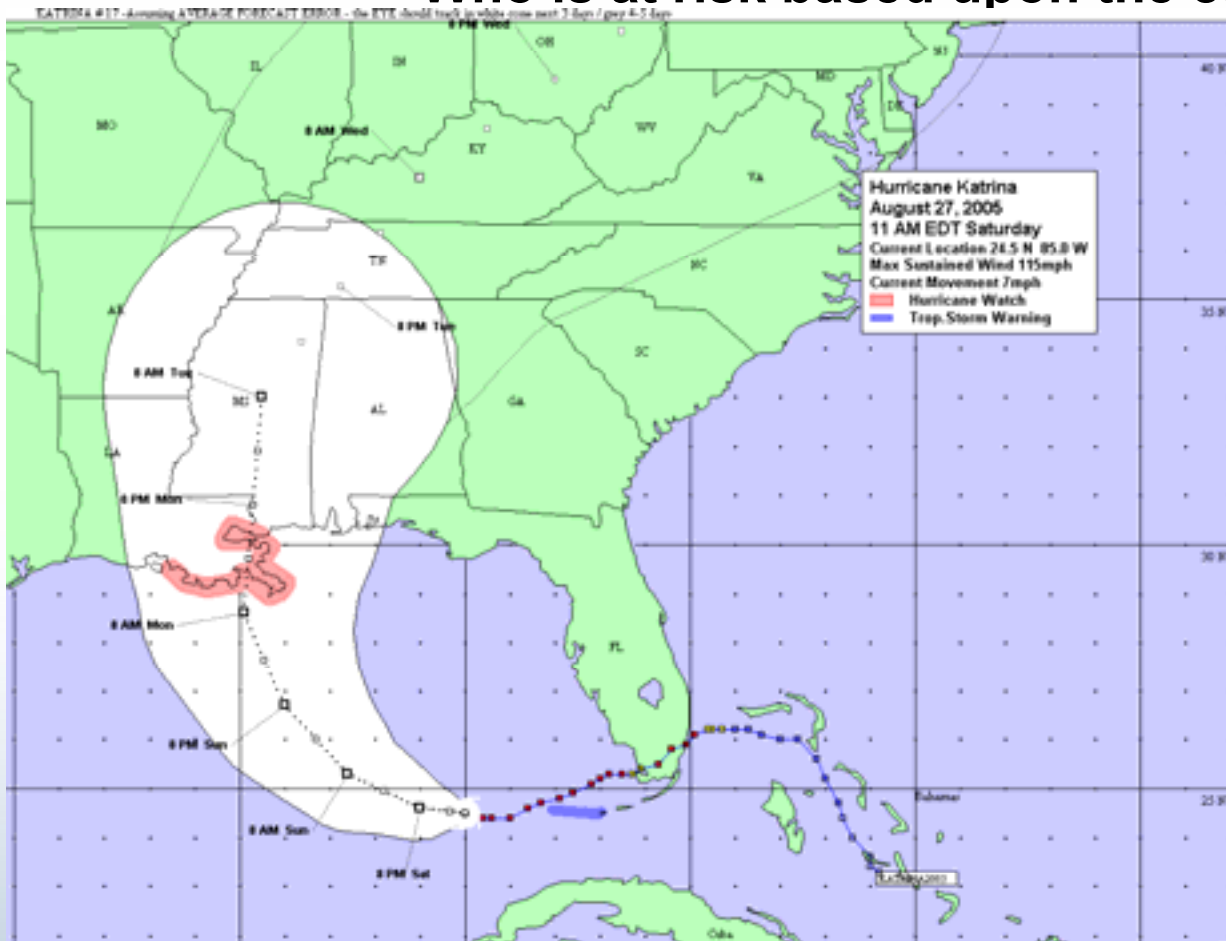
- ◆ Defining the Risk Area
- ◆ Determining Intensity at which to plan evacuations
- ◆ Consider Evacuation Scenarios and timing
- ◆ Other Considerations that may impact your decision





Defining the Risk Areas

Who is at risk based upon the current forecast?



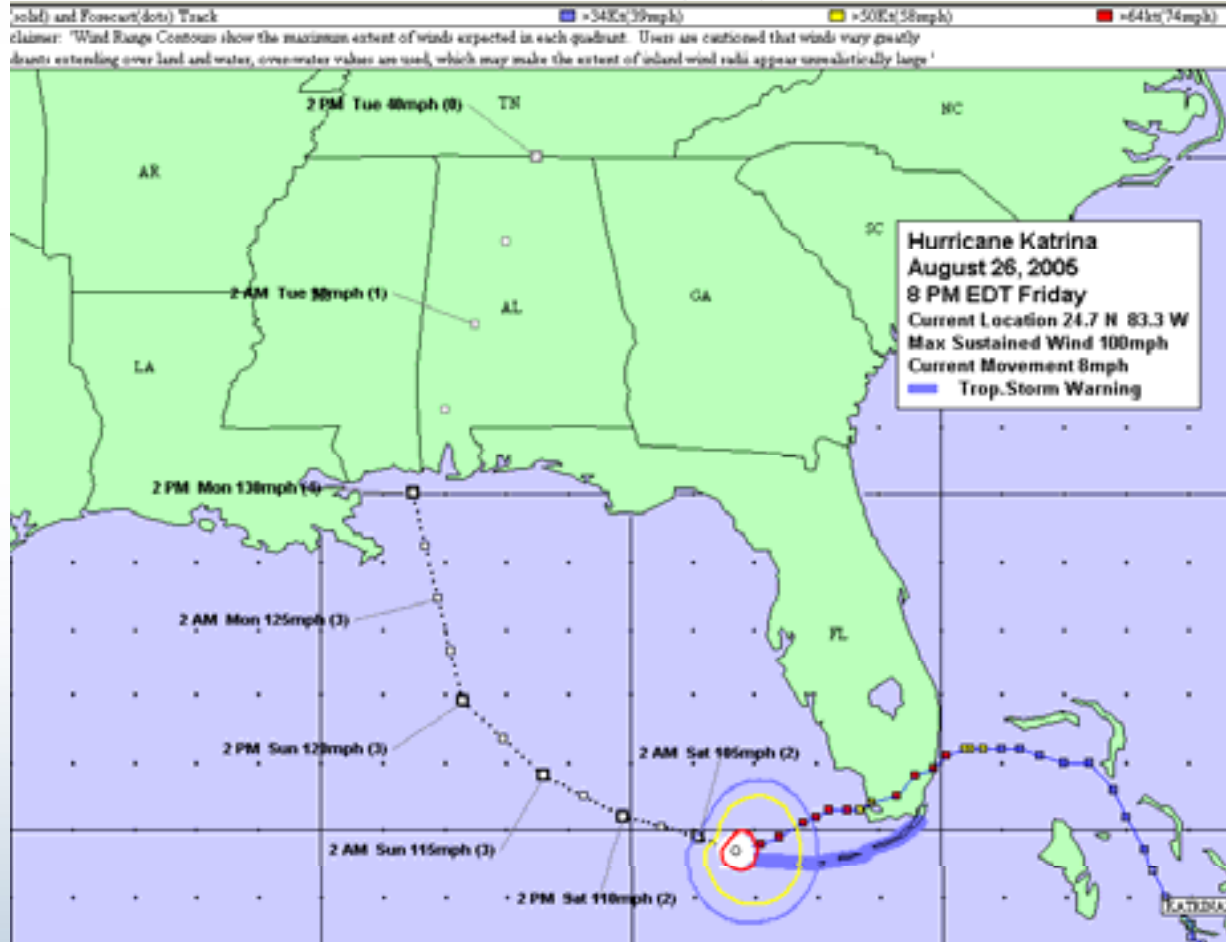
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- ◆ Are you within the error cone?
- ◆ Are watches or warnings issued?
- ◆ What are your wind speed probabilities? Are they increasing?
- ◆ What is the forecasted peak wind speed at impact?
- ◆ Is the track trending towards or away from your coast?
- ◆ Based on these factors you should have a well defined at risk area.



Intensity Planning

The category of storm will drive your evacuations.



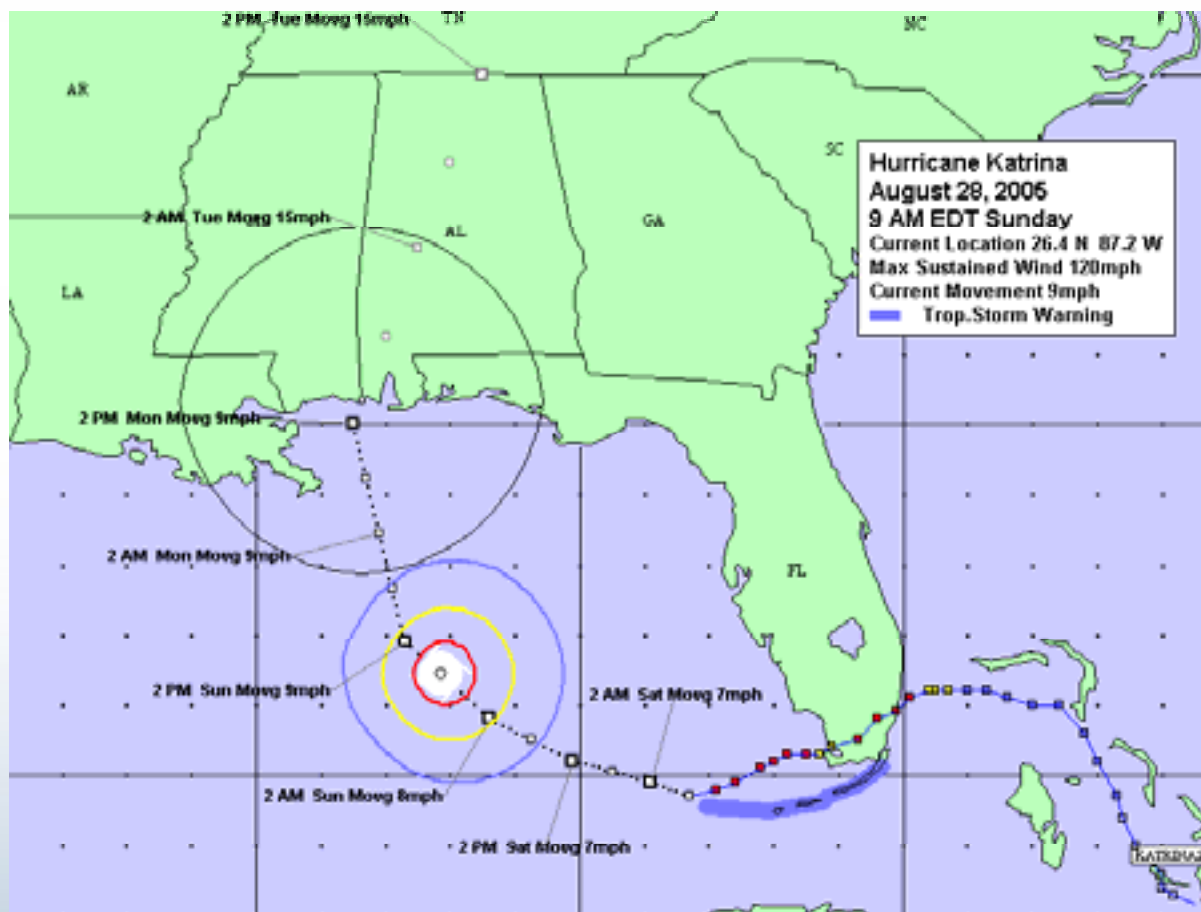
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- ◆ What is the current intensity?
- ◆ What is the highest forecast intensity?
- ◆ How close is the intensity to the next category?
- ◆ How many hours before the landfall of the eye?
- ◆ Based on these factors you should have a well defined expectation of the intensity to plan for.



Evacuation Scenarios

Timing TS winds and clearance times



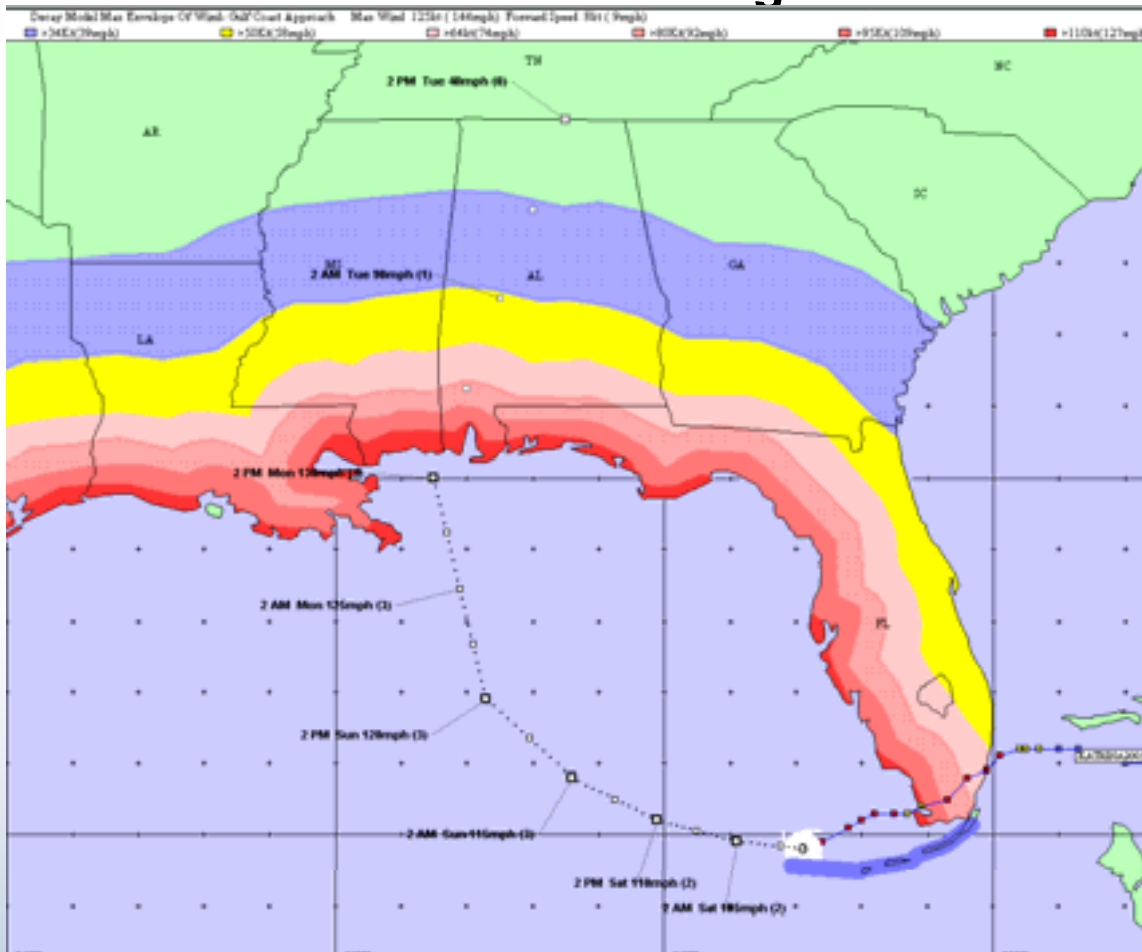
- ◆ Is the forward speed changing?
- ◆ What is the clearance time based on the Intensity Planning?
- ◆ What are the differences between Direct to Point and forecast track timing calculations?
- ◆ What time of day is the decision time?
- ◆ Based on these factors you should have a well defined time of your decision time.



Other Considerations

Planning for events out of your control

- ◆ Is it a holiday, special event, or weekend?
- ◆ Are other regions evacuating?
- ◆ What is the extent of impacts for others in your region?
- ◆ Based on these factors you should have an understanding of other factors that may impact your clearance time and ultimately your decision time.



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Florida Risk Profile

Automating Risk Profiling in HURREVAC

Hurricane Risk Profile (State) for Florida
 Tropical Cyclone: KATRINA Advisory # 14 Date/Time: FRI 08/26/05 17 EDT

B - Storm Intensity and Evacuation Scenario Critical Indicators 1 of Concern

Criteria	Conditions	R	Y	G
1 What is the current intensity of the storm? Cat 2	Red: Major Hurricane (Cat 3/4/5) Yellow: Hurricane (Cat 1 or 2) Green: Tropical Storm or lesser			Y
2 How is the storm intensity forecast to change before landfall? Increase to 4	Red: Increase in Category Yellow: No Increase in Cat Green: Decrease in Cat	R		
3 Is the storm max forecast intensity within 5 mph of the next highest Saffir/Simpson category? 21 mph	Red: If within 5mph of next category Yellow: ±within 10mph of next cat Green: Not within 5mph of next category			G
4 How many hours until forecast landfall of eye? >72 hrs or not in FL	Red: 49 or more hours Yellow: 25 to 48 hours Green: 24 hours or less	R		
5 Planning Assumption for determination of evacuation zones: are there any red or yellow boxes in E3 or E4 zones? Yes...No Zones Up 1 to Cat 5	Red: Average Evac Zones one Category higher Yellow: Not used Green: Evac Zones remain same	R		
6 What is the tourist population in the region at risk (counties in the error cone)? Medium	Red: High Occupancy Yellow: Medium Occupancy Green: Low Occupancy			Y

Buttons: Summary, Advy+, Advy-, Evac Options..., Recalculate, Print, Help, Exit

- ◆ A quick way to get a feel for the latest risk
- ◆ Available for statewide risk and individual counties
- ◆ Not the solution nor the final word on evacuation decision making
- ◆ An objective way of assessing risk
- ◆ Please contact your State Program Manager for details



Regional Considerations

- ◆ Evacuation decisions by one jurisdiction can and do affect others
- ◆ Inter-county and inter-state coordination is necessary
- ◆ Inland officials must be given adequate notice to absorb the impact of other jurisdictions' decisions
- ◆ State agencies should provide leadership





Regional Communications

- ◆ How effectively can you communicate with other EOCs?
- ◆ How do public safety officials communicate?
- ◆ How effective are your communications with the in-county and out-of-county shelters?





Shelter Considerations

- ◆ Facility vulnerability
- ◆ Family and friends
- ◆ Motels and hotels
- ◆ Public shelters (American Red Cross and others)
- ◆ Facility capabilities and POCs
- ◆ Train staff
- ◆ Good Samaritan Shelters
- ◆ Refuge of Last Resort
- ◆ Liability





Activity 7:1—Guided Discussion—Current Issues

- ◆ Current issues facing your jurisdictions in hurricane readiness planning and preparation





Unit 8: Hurricane Readiness Checklist

- ◆ Hurricane Readiness Checklist Overview
- ◆ Pre-Season Action Considerations
- ◆ 120, 72, 48–36, and 24 hours before landfall
- ◆ Impact
- ◆ Post-Landfall
- ◆ Activity 8:1—Hurricane Readiness Checklist
- ◆ Lessons Learned





Hurricane Readiness Checklist

- ◆ Designed to facilitate coordination between local decision-making officials and prompt them to initiate hurricane protective actions.





Pre-Season Action Considerations

- ◆ Revise and update local plans and SOPs
- ◆ Train staff, conduct exercises/drills and table tops
- ◆ Conduct pre-season coordination meetings
 - ESF primary/secondary agencies
 - Shelter managers
 - Local and Regional Media
- ◆ Update decision-assistance tool capacity

Are there any other items to be considered?





120 Hours Before Landfall

- ◆ Alert Council/Commission Representatives
- ◆ Contact Local NWS WFO
- ◆ Contact Chamber of Commerce
- ◆ Alert Special Needs Entities





72 Hours Before Landfall

- ◆ Storm-monitoring actions
- ◆ Conference calls with NWS/NHC/STATE
- ◆ Update HURREVAC based on forecasts issued
- ◆ Notify response plan agencies and conduct preliminary briefings
- ◆ Partially activate EOC, activate phone lines, personnel, stage equipment, etc.
- ◆ Conduct preliminary evacuation meeting (clearance-time-based)
- ◆ Initial protective actions to be taken by Emergency Management





48–36 Hours Before Landfall

- ◆ State conference calls
- ◆ Activate EOC fully
- ◆ Public awareness considerations
- ◆ Issue situation reports/press releases
- ◆ Shelter meetings
- ◆ Additional evacuation/Traffic Control Coordination Meetings
- ◆ Voluntary/mandatory/recommended evacuations
- ◆ How does a hurricane watch impact decisions?
- ◆ Identify vulnerable populations





24 Hours Before Landfall

- ◆ Evacuation coordination/Decision meetings
- ◆ Monitor shelters
- ◆ Consider refuge of last resort
- ◆ Respond to various public awareness, information, and security issues





Impact

- ◆ During the impact phase of a storm, it is important to begin planning for an immediate/initial response based on the perceived and experienced impacts





Post-Landfall

- ◆ Impact assessment
- ◆ Search and rescue
- ◆ State/neighboring coordination
- ◆ Public awareness issues and re-entry issues





Activity 8:1—Hurricane Readiness Checklist

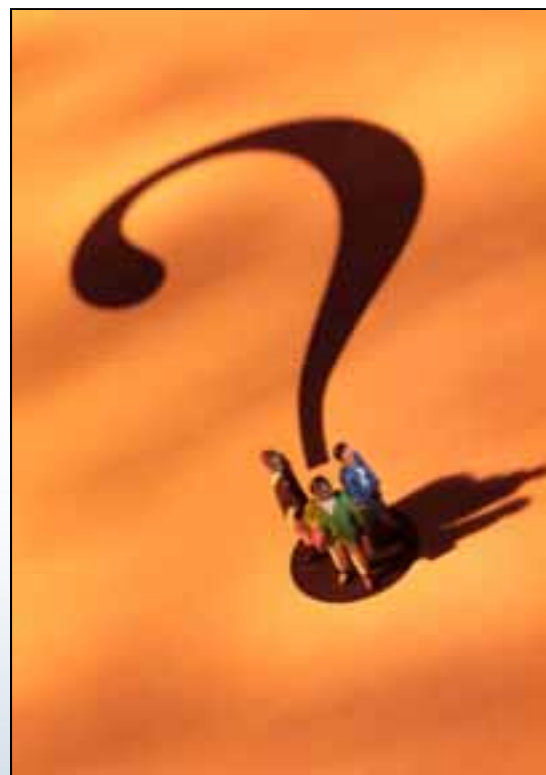
- ◆ Using the Hurricane Readiness Checklist, prioritize those items that have the most significant impact in your jurisdiction
- ◆ Add additional items that may be important to your planning and decision-making process





Lessons Learned

- ◆ What additional issues need to be addressed when planning for the impact of a tropical cyclone or hurricane?
- ◆ What other measures could be implemented when informing the public regarding the re-entry process?





Unit 9: Re-Entry

- ◆ Re-entry priority
- ◆ Safety issues
- ◆ Security issues
- ◆ Traffic
- ◆ Zones
- ◆ Public information
- ◆ Emergency Support Functions (ESFs)
- ◆ Activity 9:1—Best Practices
- ◆ Lessons Learned





Re-Entry Guidelines

- ◆ Now that citizens have evacuated, what is your re-entry plan/Annex?
- ◆ Determine that an area is safe and free from further harm or damage before people return to their homes and businesses
- ◆ It is important to coordinate with other communities and private sources





Evacuation vs. Re-Entry

- ◆ Decisions by elected officials
- ◆ Public information about routes
- ◆ Zones
- ◆ Phases
- ◆ Signage
- ◆ Traffic management/control
- ◆ Same ESFs
- ◆ Other?





Re-Entry Priority

Essential vs. Non-Essential:

- ◆ Re-entry priority: Who returns first?
- ◆ Law enforcement
- ◆ Search and Rescue
- ◆ Private sector
- ◆ Volunteers
- ◆ The “72-Hour Rule”



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Safety Considerations

- ◆ Search and rescue of casualties
- ◆ Hazardous Materials
- ◆ Water and waste
- ◆ Roads and bridges
- ◆ Utilities
- ◆ Use HAZUS?





Security Considerations

- ◆ Protection of lives
- ◆ Critical facilities
 - Public
 - Private
 - Other
- ◆ Private property
- ◆ ID badges and passes





Traffic

- ◆ Traffic signals
- ◆ Conditions of signage
- ◆ Variable messages boards
- ◆ Road blockades
- ◆ Personnel to direct traffic
- ◆ Alternate routes for detours
- ◆ Other jurisdictions





Zones

Red Zone: No utilities or public service, extreme devastation

Yellow Zone: Moderate to heavy damage, debris on roads

Green Zone: Normal traffic and activities





Public Information

- ◆ Coordinate information with other jurisdictions and agencies (joint press releases and press conferences)
- ◆ Provide updated information on extent of damage and road conditions
- ◆ Announce re-entry plans with routes
- ◆ Manage limited access for news media to promote the message





Public Information

- ◆ Emergency Alert Radio (EAS)
- ◆ Public Radio: Statewide
- ◆ Governor's Announcement





Activity 9:1—Best Practices

- ◆ Using information from a recent tropical cyclone or hurricane, discuss the Best Practices used throughout the re-entry process





Lessons Learned

- ◆ How did you involve personnel from other agencies in the disaster response?
- ◆ How well do you plan for coordination among Federal, state, and local agencies?
- ◆ Which private vendors might you contact for additional support and services?
- ◆ How well did your plans go for communicating with the public, for the purposes of re-entry?





Unit 10: Conclusion

- ◆ Jurisdictional Plans
- ◆ Takeaways
- ◆ Resources
- ◆ Training Opportunities
- ◆ Course Review and Evaluation





Jurisdictional Plans

- ◆ How current are your plans?
- ◆ When was the last time you conducted an exercise/drills and/or table-top exercise?





Takeaways

- ◆ What are the important takeaways you have learned from this training?
- ◆ How will you implement those in your jurisdiction?





Resources for Hurricane Planning

- ◆ The Internet
- ◆ Mitigation
 - Mitigation Technical Assistance Programs
 - Hazard Mitigation Grant Program
 - Wind and Water Technical Assistance Program





Training Opportunities

- ◆ State and Local Emergency Management Offices
- ◆ FEMA, Emergency Management Institute (EMI)
 - Independent study courses
 - Resident courses at EMI
- ◆ Emergency Education Network (EENET)
- ◆ Other
 - Conferences
 - Higher education institutions
 - Web-based courses





Course Review

Unit 1: *Introduction*

Unit 2: *Hurricane
Readiness*

Unit 3: *Hurricanes and
Hazards*

Unit 4: *Pre-Season
Readiness*

Unit 5: *Hurricane
Evacuation Studies*

Unit 6: *Monitoring the
Hurricane*

Unit 7: *Evacuation
Decision Considerations*

Unit 8: *Hurricane
Readiness Checklist*

Unit 9: *Re-entry*

Unit 10: *Conclusion*





Conclusion

Hurricane planning is an ongoing effort.

It requires continuous evaluation and planning to ensure that the community is always prepared, should a hurricane strike.





End of Course

*Thank you for your
active participation!*

