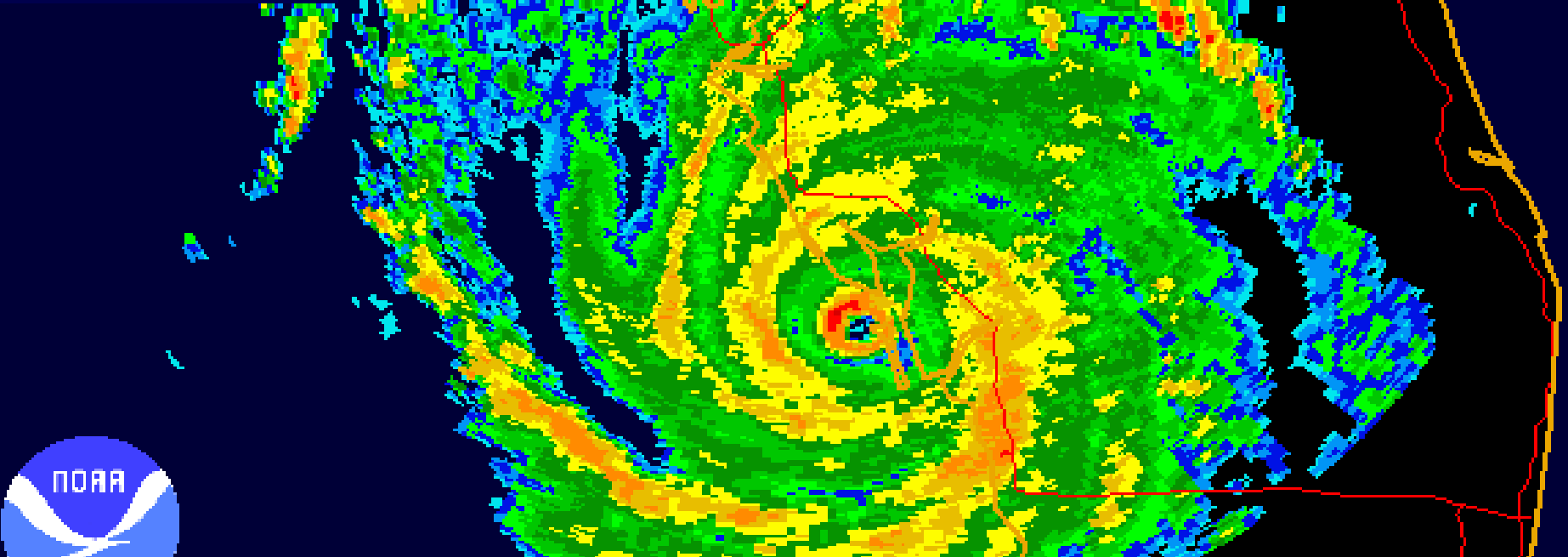


10 years after Hurricane Charley

A Retrospective

Scott M. Spratt
Warning Coordination Meteorologist
NWS Melbourne, FL

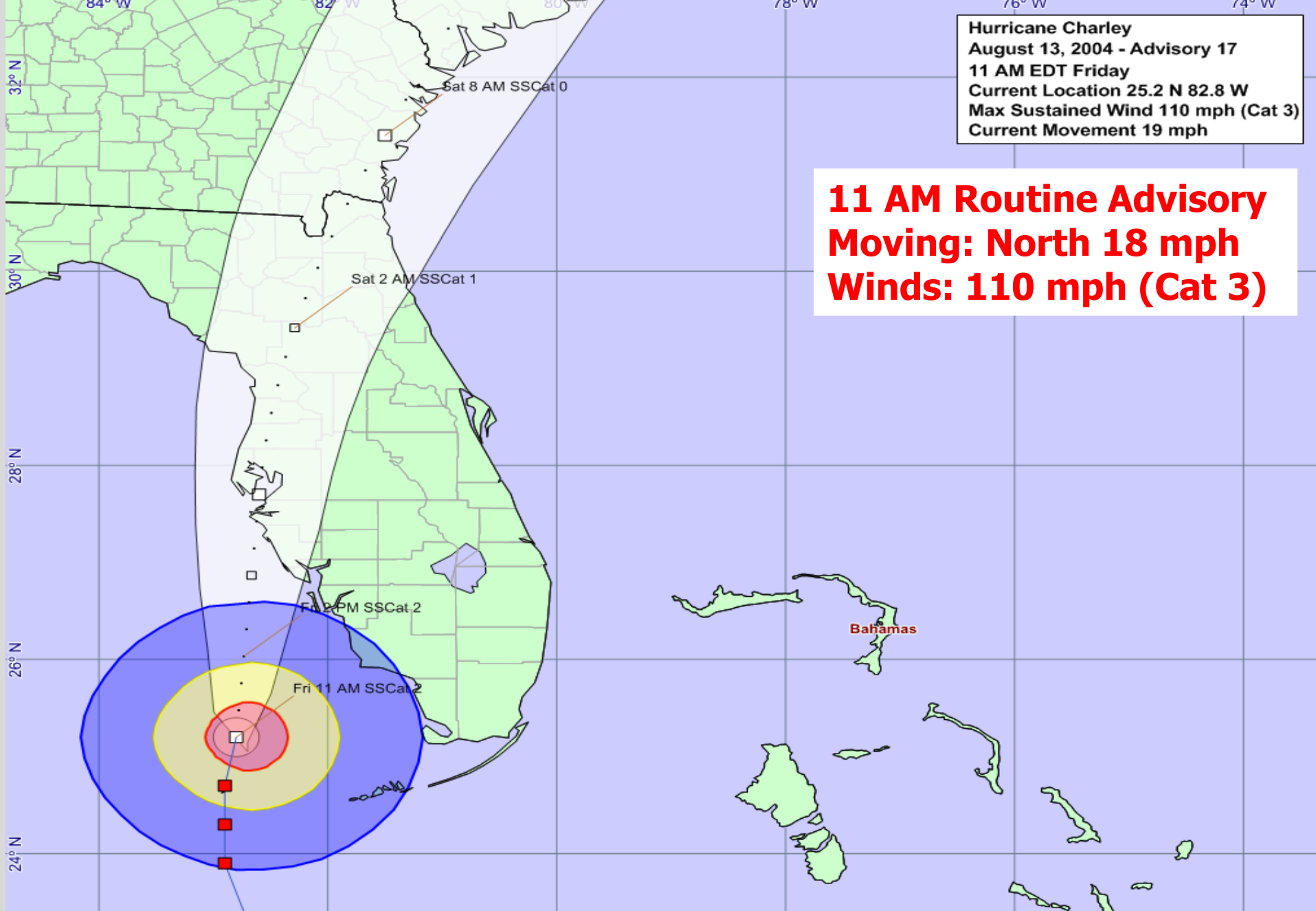
Hurricane Charley
(2004)



Florida Governors Hurricane Conference – May 15, 2014

Hurricane Charley
August 13, 2004 - Advisory 17
11 AM EDT Friday
Current Location 25.2 N 82.8 W
Max Sustained Wind 110 mph (Cat 3)
Current Movement 19 mph

11 AM Routine Advisory
Moving: North 18 mph
Winds: 110 mph (Cat 3)



□ forecast positions Potential Track Area: day 1-3 day 4-5 Wind Extents: at current location

Watches: hurricane tropical storm Warnings: hurricane tropical storm

Sustained Wind Speeds: tropical storm ≥ 34kt/39mph strong tropical storm ≥ 50kt/58mph hurricane ≥ 64kt/74mph

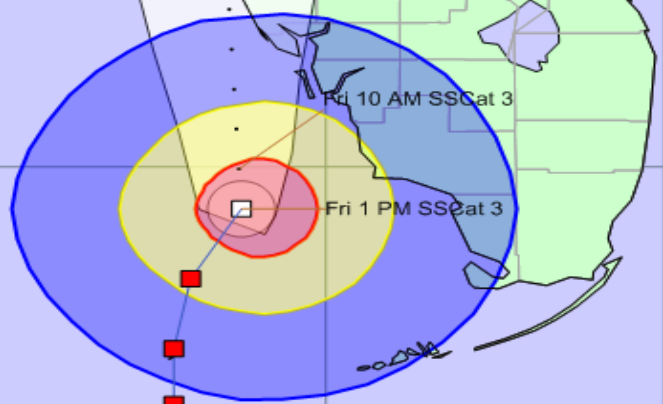
Hurricane Charley
August 13, 2004 - Advisory 17A
1 PM EDT Friday
Current Location 25.7 N 82.5 W
Max Sustained Wind 125 mph (Cat 3)
Current Movement 20 mph

INLAND VOLUSIA-ORANGE-SEMINOLE-
INCLUDING THE CITIES OF...DELAND...ORLANDO...SANFORD
110 PM EDT FRI AUG 13 2004

...INLAND HURRICANE WIND WARNING...
...FLOOD WATCH TODAY AND TONIGHT...

.THIS AFTERNOON...BECOMING WINDY. RAIN AND SCATTERED THUNDERSTORMS.
RAIN WILL BE HEAVY AT TIMES. HIGHS IN THE MID 80S. SOUTHEAST WINDS
INCREASING TO 20 TO 25 MPH AND GUSTY LATE. CHANCE OF RAIN 100
PERCENT.

.TONIGHT...VERY WINDY. RAIN AND SCATTERED THUNDERSTORMS. LOWS IN THE
MID 70S. SOUTHEAST WINDS 50 TO 60 MPH WITH GUSTS TO HURRICANE FORCE.
CHANCE OF RAIN 100 PERCENT.



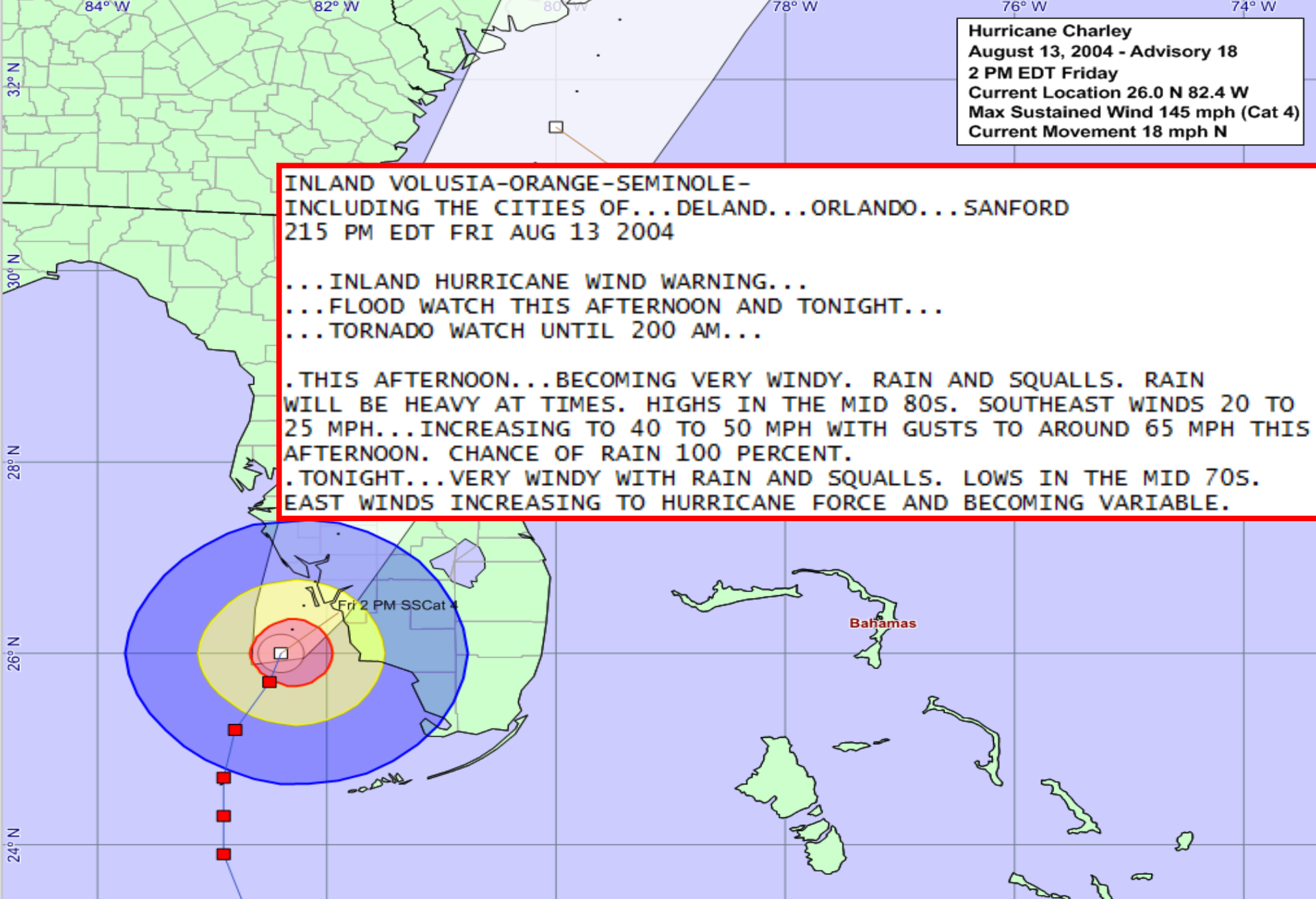
forecast positions Potential Track Area: day 1-3 day 4-5 Wind Extents: at current location
Watches: hurricane tropical storm Warnings: hurricane tropical storm
Sustained Wind Speeds: tropical storm >= 34kt/39mph strong tropical storm >= 50kt/58mph hurricane >= 64kt/74mph

Hurricane Charley
August 13, 2004 - Advisory 18
2 PM EDT Friday
Current Location 26.0 N 82.4 W
Max Sustained Wind 145 mph (Cat 4)
Current Movement 18 mph N

INLAND VOLUSIA-ORANGE-SEMINOLE-
INCLUDING THE CITIES OF...DELAND...ORLANDO...SANFORD
215 PM EDT FRI AUG 13 2004

...INLAND HURRICANE WIND WARNING...
...FLOOD WATCH THIS AFTERNOON AND TONIGHT...
...TORNADO WATCH UNTIL 200 AM...

.THIS AFTERNOON...BECOMING VERY WINDY. RAIN AND SQUALLS. RAIN
WILL BE HEAVY AT TIMES. HIGHS IN THE MID 80S. SOUTHEAST WINDS 20 TO
25 MPH...INCREASING TO 40 TO 50 MPH WITH GUSTS TO AROUND 65 MPH THIS
AFTERNOON. CHANCE OF RAIN 100 PERCENT.
.TONIGHT...VERY WINDY WITH RAIN AND SQUALLS. LOWS IN THE MID 70S.
EAST WINDS INCREASING TO HURRICANE FORCE AND BECOMING VARIABLE.



Potential Track Area:

day 1-3

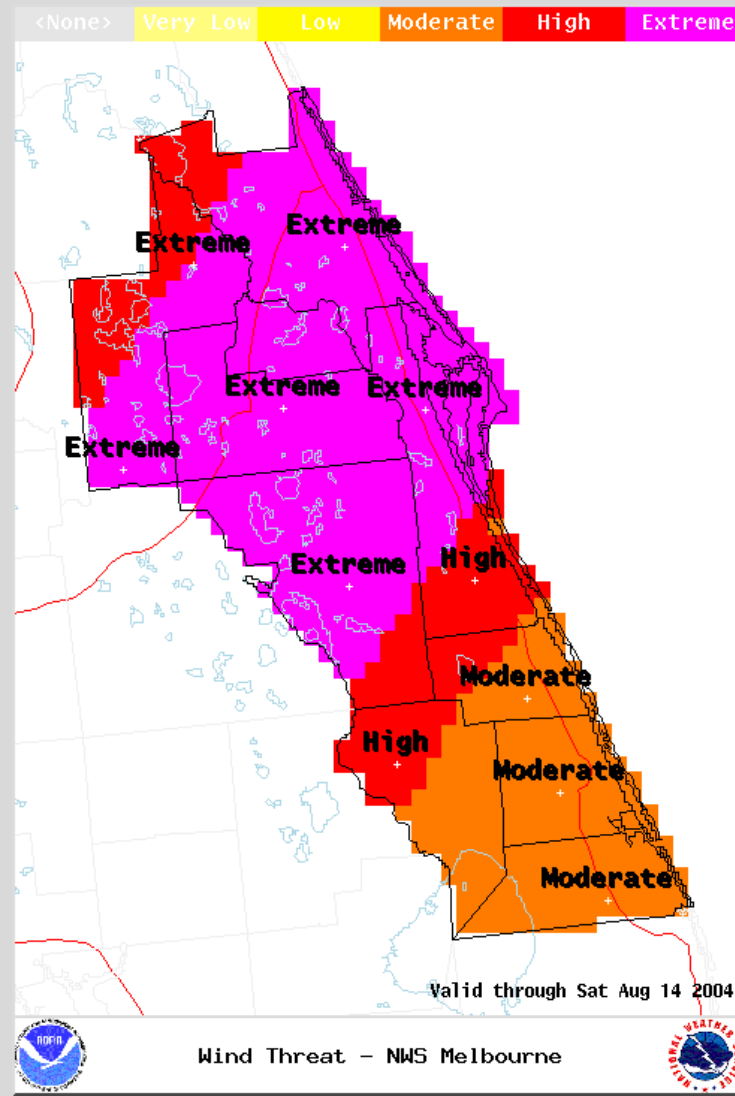
day 4-5

Wind Extents: at current location

Watches: hurricane tropical storm Warnings: hurricane tropical storm

Sustained Wind Speeds: tropical storm ≥ 34 kt/39mph strong tropical storm ≥ 50 kt/58mph hurricane ≥ 64 kt/74mph

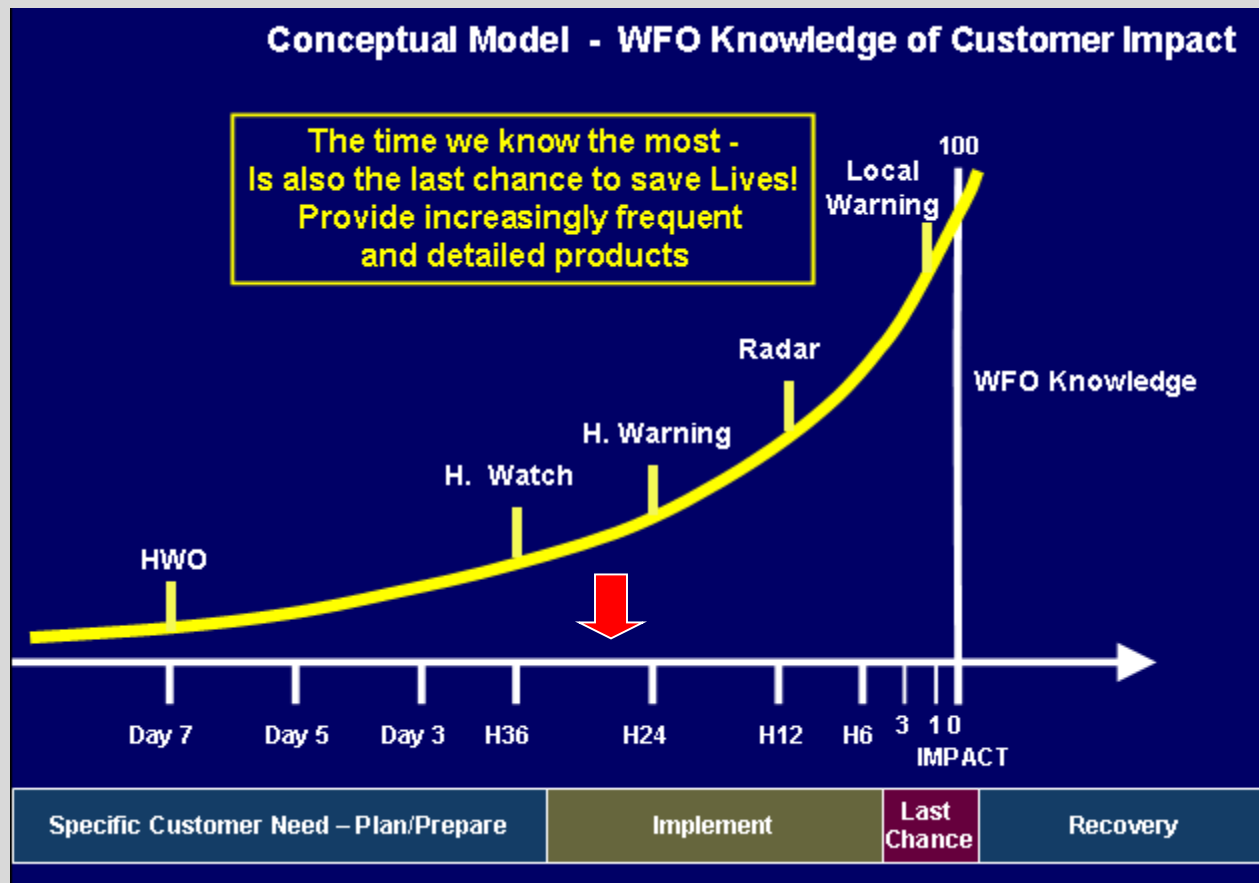
Category 4 Hurricane Charley makes landfall along the SW Florida coast on 13 August and is forecast to move rapidly across the peninsula at 20+ mph. An **extreme wind threat exists for much of the WFO Melbourne CWA, including Metro Orlando.**



During the hours when Major Hurricane Charley moved inland toward the MLB CWA, WFO MLB staff made the following assessments...

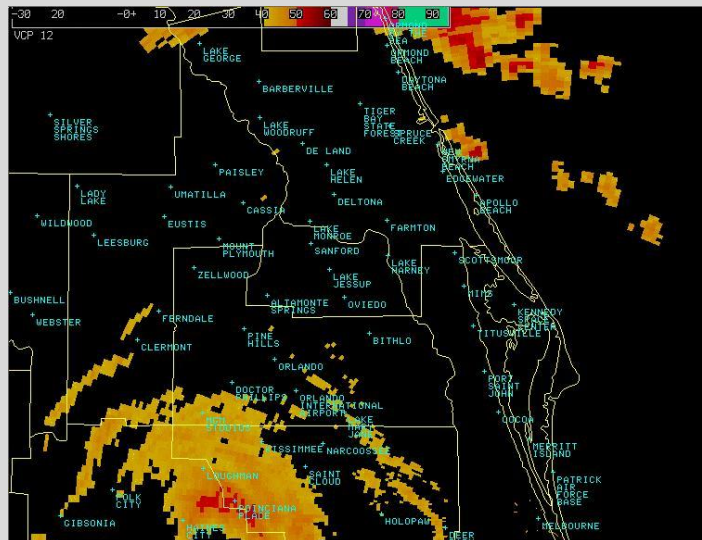
- Radar analyses revealed little deterioration of the inner core, with elevated radial velocities over 140 mph.**
- The previous highest documented wind gust to affect metro Orlando from a tropical cyclone was 73 mph (Hurricane Donna, 1960).**
- The onset of (unprecedented) extreme hurricane winds, over 100 mph, was becoming imminent for Metro Orlando.**
- Monitoring of Orlando media suggested a heightened concern for the region, but generally not to the level warranted by the imminent onset of extreme winds and related impacts.**

NWS Melbourne staff consensus was that a **unique, highly-visible message** needed to be generated, capable of **EAS activation** to guarantee **universal dissemination**. This message would provide a **final opportunity to protect lives** prior to the onset of destructive eye-wall winds.



A **TORNADO WARNING** was chosen as the product to deliver the message, for multiple reasons:

- Persistence of intense reflectivity core (>50 dBZ) & downward momentum transfer, suggesting high probability of localized extreme wind damage.
- Fast translational motion (20-25 mph), adding to wind threat and causing rapid onset.
- Very small radius of maximum winds (~ 6 miles), confining extreme damage swath to narrow corridor.
- Previous documentation of 'streaks' of extreme **tornado-like damage** associated with passage of inner core convection (Fujita 1992, Wakimoto & Black 1994).
- EAS activation & ability to **prompt immediate protective actions** identical to those taken for tornadoes (media, EMAs, and public).



Tornado Warning for destructive winds over 100 mph issued 1-hour prior to leading edge of inner core rainbands.

BULLETIN - EAS ACTIVATION REQUESTED
TORNADO WARNING
NATIONAL WEATHER SERVICE MELBOURNE FL
645 PM EDT FRI AUG 13 2004

THE NATIONAL WEATHER SERVICE IN MELBOURNE HAS ISSUED A

* TORNADO WARNING FOR...
SOUTHERN LAKE COUNTY
ORANGE COUNTY
NORTHWESTERN OSCEOLA COUNTY
IN EAST CENTRAL FLORIDA

* UNTIL 745 PM EDT

AT 642 PM EDT...THE NATIONAL WEATHER SERVICE HAS ISSUED A TORNADO WARNING FOR DESTRUCTIVE WINDS OVER 100 MPH AND TORNADOES IN THE EYE WALL AND INNER RAIN BANDS OF HURRICANE CHARLEY.

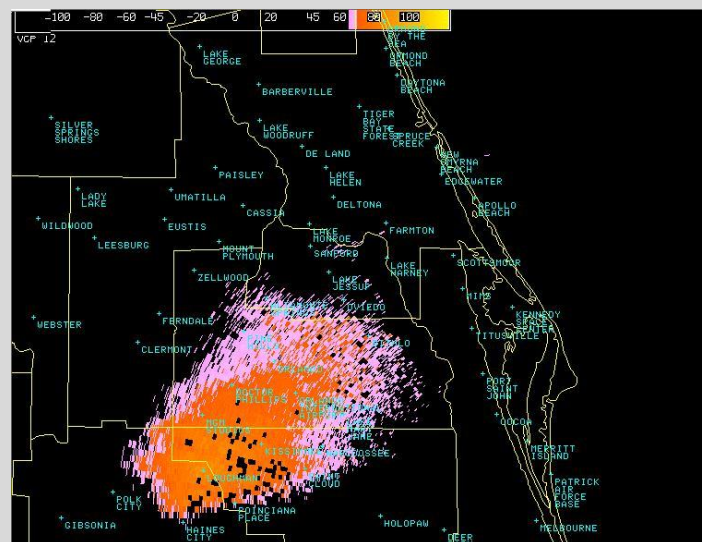
THE LEADING EDGE OF HURRICANE CHARLEY'S DESTRUCTIVE WINDS IS EXPECTED TO MOVE INTO THE KISSIMMEE AND GREATER ORLANDO AREA BY 715 PM.

THE THREAT FOR DAMAGING WINDS AND TORNADOES WILL LAST THROUGH 9 PM OR LONGER.

PEOPLE IN THE PATH OF THIS ADVANCING STORM ARE URGED TO QUICKLY PREPARE FOR ITS APPROACH. THIS IS A DANGEROUS SITUATION! ACT NOW.

IF YOU ARE IN THE PATH OF THIS STORM...THE SAFEST PLACE IS IN A STRONG BUILDING ON THE LOWEST FLOOR. MOVE TO AN INTERIOR ROOM SUCH AS A BATHROOM OR CLOSET. KEEP AWAY FROM WINDOWS. IF NECESSARY...GET UNDER A WORKBENCH OR OTHER PIECE OF STURDY FURNITURE. USE BLANKETS OR PILLOWS TO COVER YOUR BODY. ABANDON YOUR MOBILE HOME OR RV FOR MORE SUBSTANTIAL SHELTER.

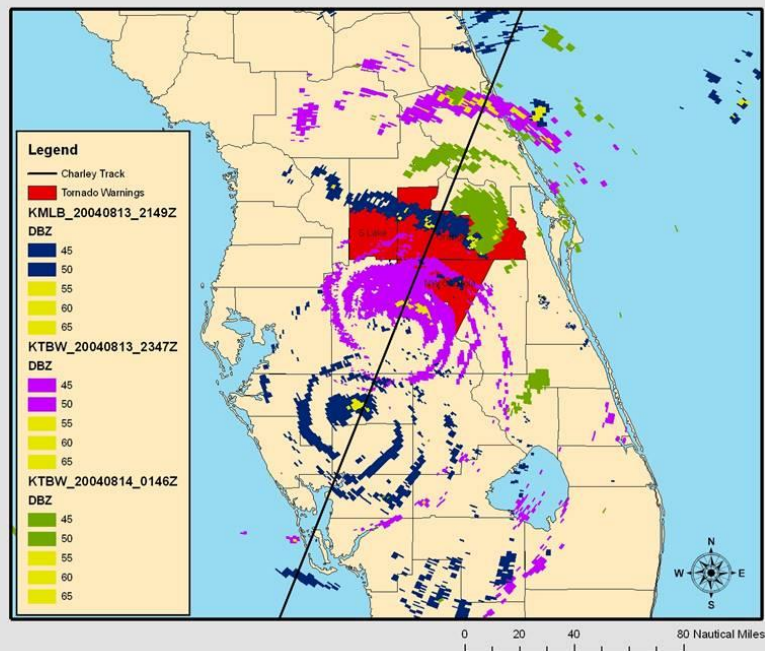
806 PM KMLB Base Reflectivity >39 dBZ, with leading edge spreading through SW portion of warning area



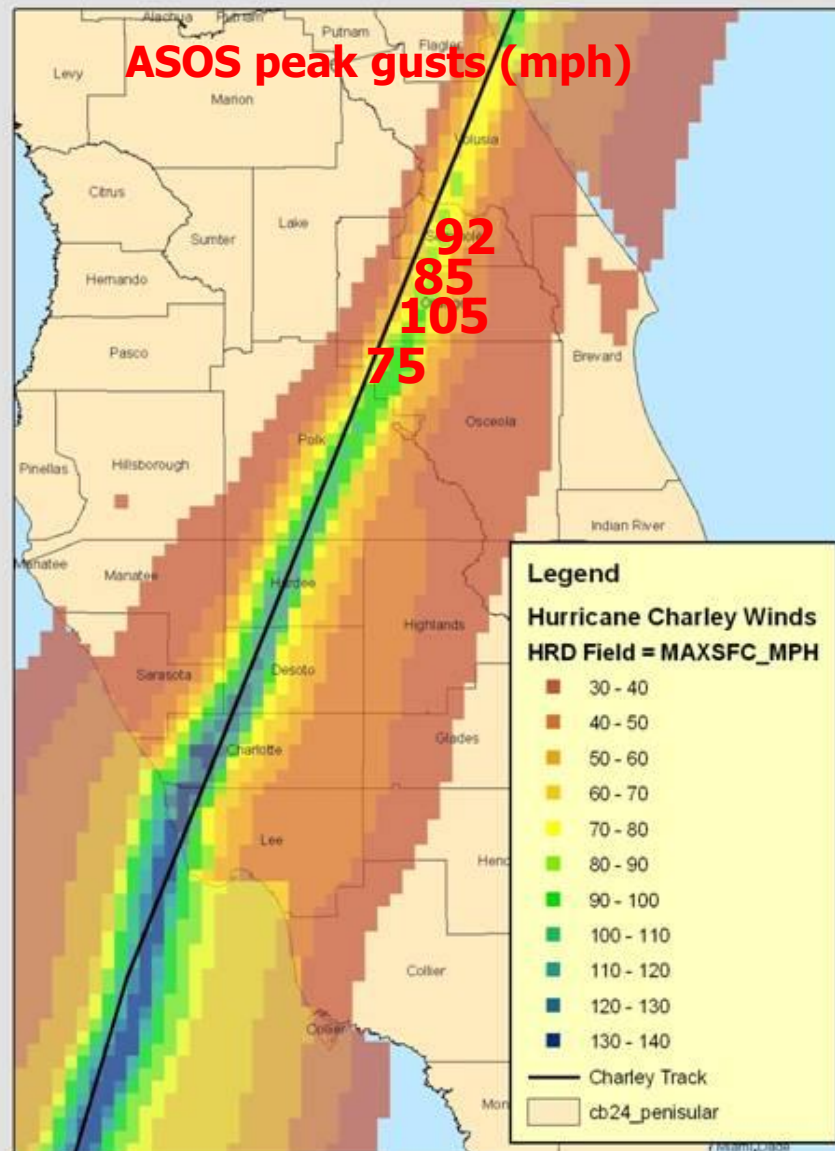
Radial Wind Velocities > 73 mph)

Tornado Warning area (below, red shading) relative to the hurricane track and inner rain-bands.

Charley (2004) Tornado Warnings for Destructive Hurricane Winds



Surface Wind MAX (MPH) Hurricane Charley (2004)



Preliminary composite wind swath from
NOAA/HRD H*WND analyses.

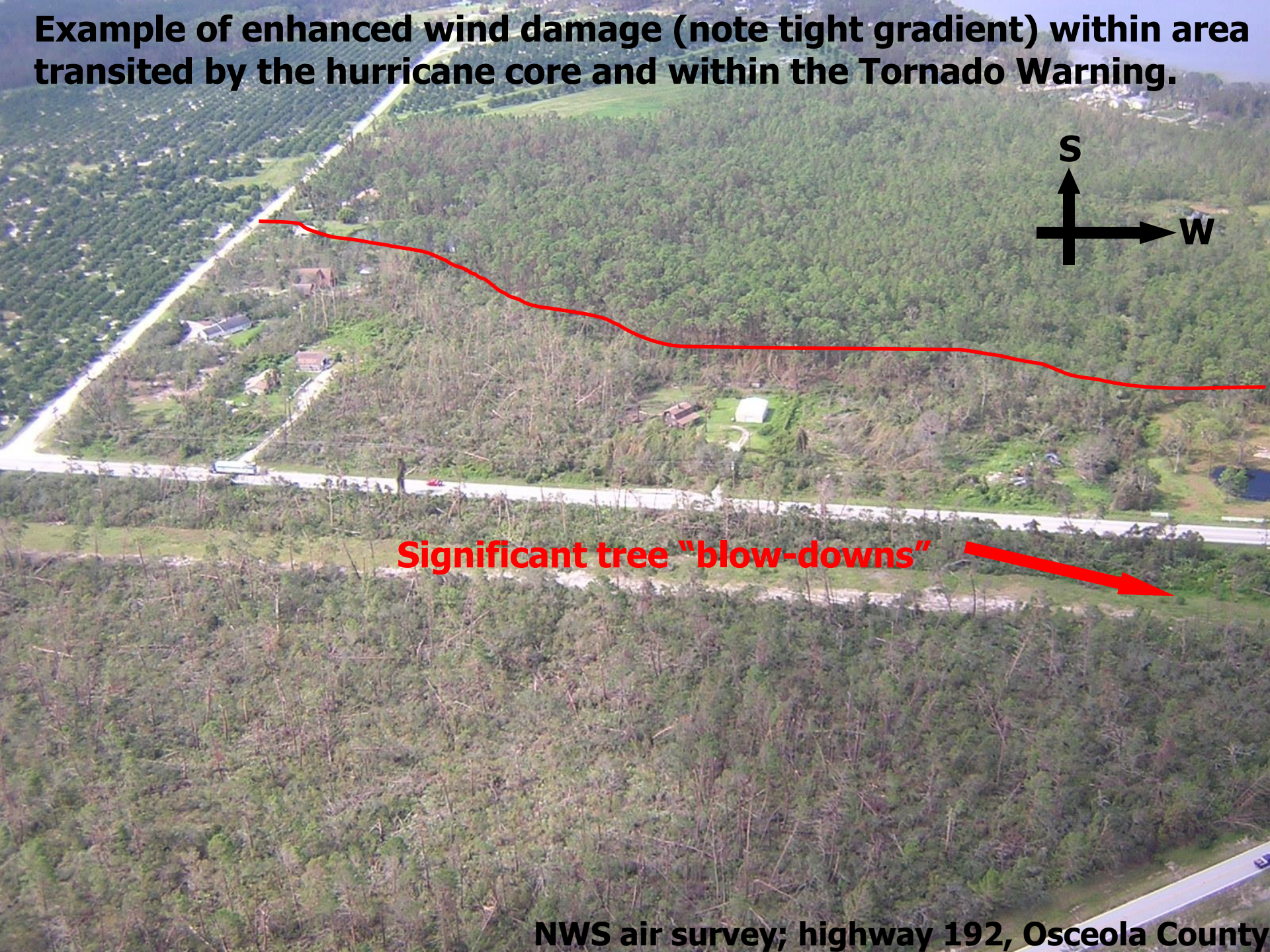
ORLANDO, FL

City located well-inland;
city of refuge for coastal
evacuees; previously
highest recorded wind
gust was 73 mph
(Donna, 1960); **media
attention still focused
on landfall story.**



Short-fused warning can
help focus partnership
attention at critical times;
with a growing
population it is becoming
necessary to find safer
ways to shelter in place
from the wind;
information stream must
be timely and specific.

Example of enhanced wind damage (note tight gradient) within area transited by the hurricane core and within the Tornado Warning.



Significant tree "blow-downs"

NWS air survey; highway 192, Osceola County



Despite widespread extensive property damage along the tracks of Hurricane Charley, **no direct wind-related fatalities occurred across east-central Florida** (intense focus and communication of extreme eye-wall wind hazard, effectiveness of unique warning strategy).

Favorable feedback was obtained from Orlando area weather customers and partners, e.g., specific comments concerning the special Tornado Warnings:

"Fantastic, they gave me almost to the minute locations, and were really helpful." (County Emergency Manager)

"Stroke of genius for getting onto EAS." (EAS Node Radio Station)

"The Eyewall Tornado Warning was awesome – I did a double take for a moment. This told me to treat it differently than other 100 mph wind gust through area." (TV Meteorologist)

Warning strategy cited as "best practice" in Hurricane Charley NWS Service.



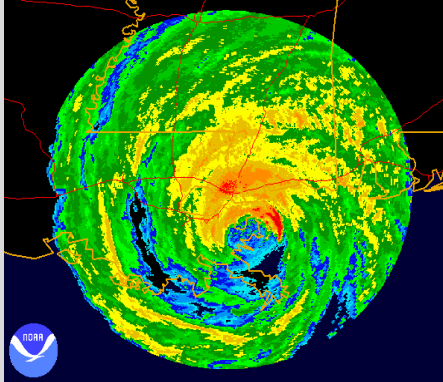
Unofficial “Eyewall Warning” of 2004 evolved to official, mandatory “Extreme Wind Warning” by 2006.

Current **Extreme Wind Warning Criteria:**

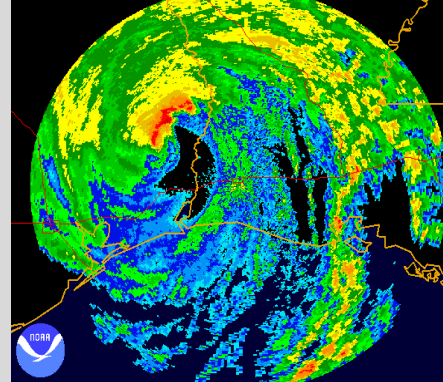
- **Imminent onset of, or initial occurrence of tropical cyclone related sustained winds, greater or equal to 100 kt (115 mph)**
- **Expected to occur with a WFOs CWA within an hour**

Extreme Wind Warnings will:

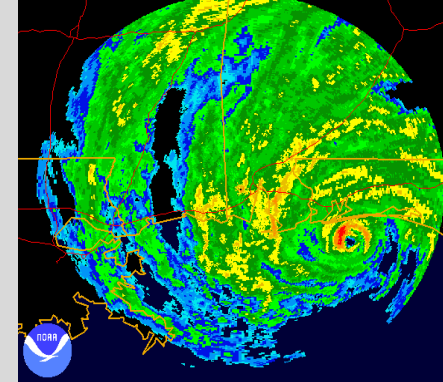
- **be issued for the smallest geographic area possible, encompassing the extreme wind conditions**
- **be valid for two hours or less**
- **not be issued for the same location (if conditions persist, follow-up information will be provided within Severe Weather Statements)**



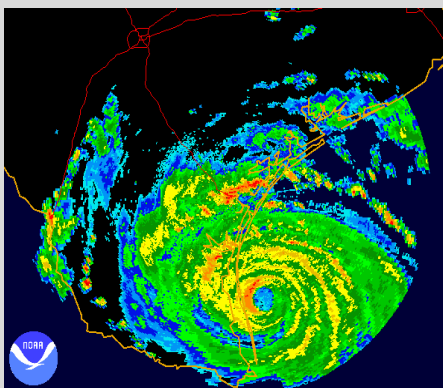
Katrina (04)



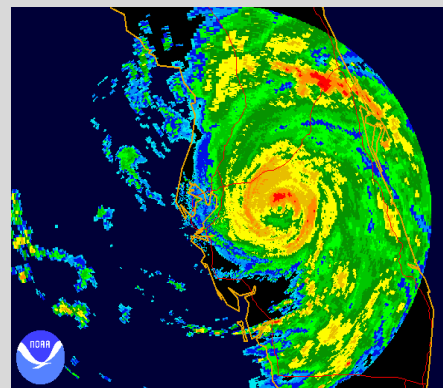
Rita (05)



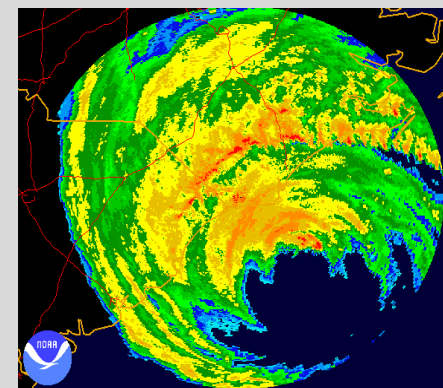
Dennis (05)



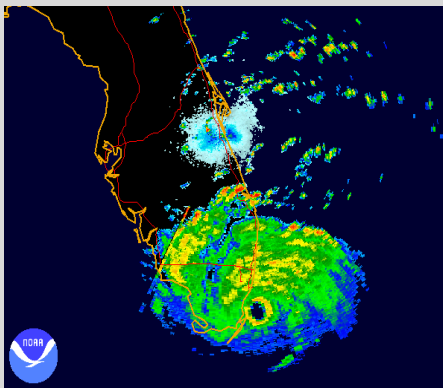
Bret (99)



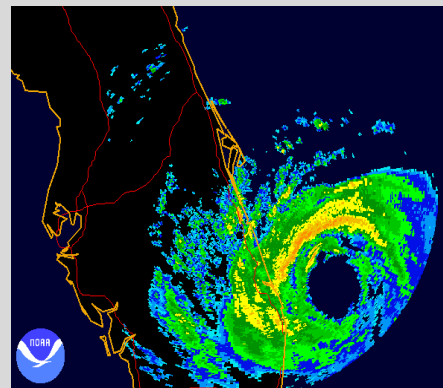
Charley (04)



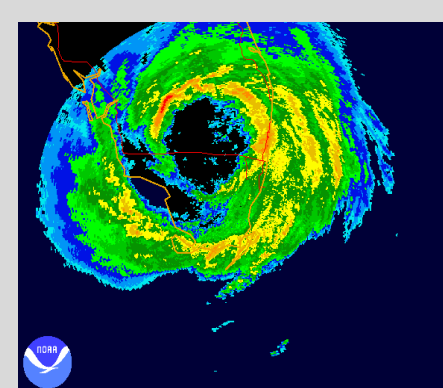
Fran (96)



Andrew (92)



Jeanne (04)



Wilma (05)

The Forecaster creates the **Extreme Wind Warning** by choosing a basis for the warning: **"Doppler radar indicated eyewall..."** and **"Locations in warning"**. The Call-to-Action statement is **"Safe places to be"**.

Forecast Systems Laboratory D-2D (fxa)

File View Options Tools Local Tools Volume Obs NCEP/Hydro Upper Air Satellite km1b tmco Radar SCAN Maps Help

Valid time seq WFO Clear Frames: 12 Mag: 1 Density: 1

WarnGen

Backup
Partial: MLB Full: MLB

Track type
One Storm
Line of Storms

Edit
Box
Track
Box and Track

Redo Box Show Hatching

Product type
Tornado - generic
Severe Thunderstorm
Areal Flood (FLW)
Special Marine (MLB only!)
Other: Extreme Wind Warning (TOR)

Time range
Duration: 60 min
00:55 Sun 26-Sep to 01:55 Sun 26-Sep Change...

Optional bullets:
***** BASIS FOR WARNING *****
generic basis...
Doppler radar indicated eyewall...
Locations in warning
***** CALLS TO ACTION (CHOOSE 1 OR MORE) *****
Specific wind values
CTA - Take cover now
CTA - Safe places to be

Instructions:
Adjust box around Warning Area

Create Text Restart Close

Interactive WarnGen (Editable) Sun 00:52Z 26-Sep-04
km1b 0.5 Reflectivity (dBZ) 8bit Sun 00:52Z 26-Sep-04

Status: Radar: Frames: 12 Time: 00:55 Z 26-Sep-04

WFUS KMLB 260106
EWWMLB
FC085-111-260200-
/O.NEW.KMLB.TO.W.0001.040926T0058Z-040926T0200Z/

BULLETIN - EAS ACTIVATION REQUESTED
EXTREME WIND WARNING
NATIONAL WEATHER SERVICE MELBOURNE FL
858 PM EDT SAT SEP 25 2004

THE NATIONAL WEATHER SERVICE IN MELBOURNE HAS ISSUED AN

* EXTREME WIND WARNING FOR THE ONSET OF SUSTAINED WINDS OF 115 MPH OR
GREATER FOR...
MARTIN COUNTY IN EAST CENTRAL FLORIDA
ST. LUCIE COUNTY IN EAST CENTRAL FLORIDA

* UNTIL 1000 PM EDT

* AT 855 PM EDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED
THE LEADING EDGE OF THE HURRICANE EYEWALL APPROACHING THE WARNING
AREA.

* THESE EXTREME WINDS WILL AFFECT...
JUPITER ISLAND...NORTH RIVER SHORES...PORT SALERNO...PORT SAINT LUCIE...
SAINT LUCIE WEST...NETTLES ISLAND...WHITE CITY...AND WALTON

THE SAFEST PLACE TO BE DURING A MAJOR LANDFALLING HURRICANE IS IN A
REINFORCED INTERIOR ROOM AWAY FROM WINDOWS. GET UNDER A TABLE OR
OTHER PIECE OF STURDY FURNITURE. USE MATTRESSES...BLANKETS OR PILLOWS
TO COVER YOUR HEAD AND BODY. REMAIN IN PLACE THROUGH THE PASSAGE OF
THESE LIFE THREATENING CONDITIONS.

LAT...LON 2755 8029 2697 8008 2695 8060 2755 8070

\$\$

scott.spratt@noaa.gov

