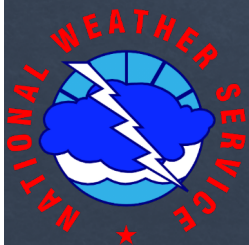


Michael and Harvey

Communications Successes and Challenges

Tom Johnstone, MIC Tallahassee/NOAA Gulf
Collaboration Team Member



What We Will Cover Today

- Brief review of Hurricanes Michael and Harvey
- NWS IDSS review for both storms
- Shared challenges and lessons learned
- A look to the future

Harvey Facts

- ❖ 1st category 4 hurricane to strike Texas since Carla 1961
- ❖ 1st major hurricane to hit U.S. since Wilma 2005 (12 years).
- ❖ Tropical depression to major hurricane in **36 hours!**
- ❖ 16th deepest U.S land-fall
- ❖ Zero direct landfall fatalities!

| RANK | HURRICANE | YEAR | (at landfall) | Millibars | Inches |
|------|----------------------------|------|---------------|-----------|--------|
| 1 | FL (Keys) | 1935 | 5 | 892 | 26.35 |
| 2 | CAMILLE (MS/SE LA/VA) | 1969 | 5 | 909 | 26.84 |
| 3 | KATRINA (SE LA, MS) | 2005 | 3 | 920 | 27.17 |
| 4 | ANDREW (SE FL/SE LA) | 1992 | 5 | 922 | 27.23 |
| 5 | TX (Indianola) | 1886 | 4 | 925 | 27.31 |
| 6 | FL (Keys)/S TX | 1919 | 4 | 927 | 27.37 |
| 7 | FL (Lake Okeechobee) | 1928 | 4 | 929 | 27.43 |
| 8 | DONNA (FL/Eastern U.S.) | 1960 | 4 | 930 | 27.46 |
| 8 | FL (Miami)/MS/AL/Pensacola | 1926 | 4 | 930 | 27.46 |
| 10 | CARLA (N & Central TX) | 1961 | 4 | 931 | 27.49 |
| 11 | S TX | 1916 | 4 | 932 | 27.52 |
| 12 | LA (Last Island) | 1856 | 4 | 934 | 27.58 |
| 12 | HUGO (SC) | 1989 | 4 | 934 | 27.58 |
| 14 | TX (Galveston) | 1900 | 4 | 936 | 27.64 |
| 15 | RITA (SW LA/N TX) | 2005 | 3 | 937 | 27.67 |
| 16 | GA/FL (Brunswick) | 1898 | 4 | 938 | 27.70 |
| 16 | HAZEL (SC/NC) | 1954 | 4 | 938 | 27.70 |
| 18 | SE FL/SE LA/MS | 1947 | 4 | 940 | 27.76 |
| 18 | TX (Galveston) | 1915 | 4 | 940 | 27.76 |
| 20 | N TX | 1932 | 4 | 941 | 27.79 |



- ❖ Peak wind gust 145 mph measured near Rockport.
 - ❖ 151 mph at 15 meters
- ❖ Peak storm surge 12.5 feet Aransas Wildlife Refuge

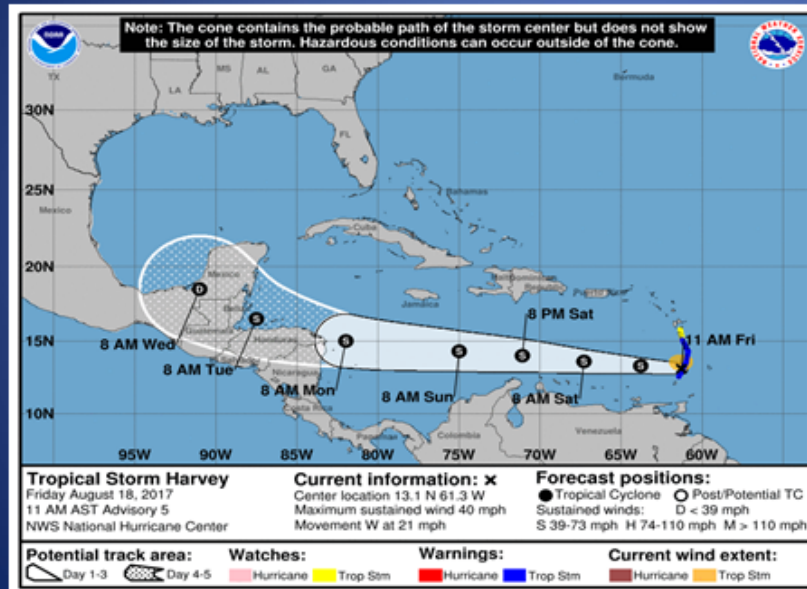
Messaging - Briefing One

Issued Friday August 18, 2017



Tropical Weather Update

Tropical Storm Harvey



Impacts:

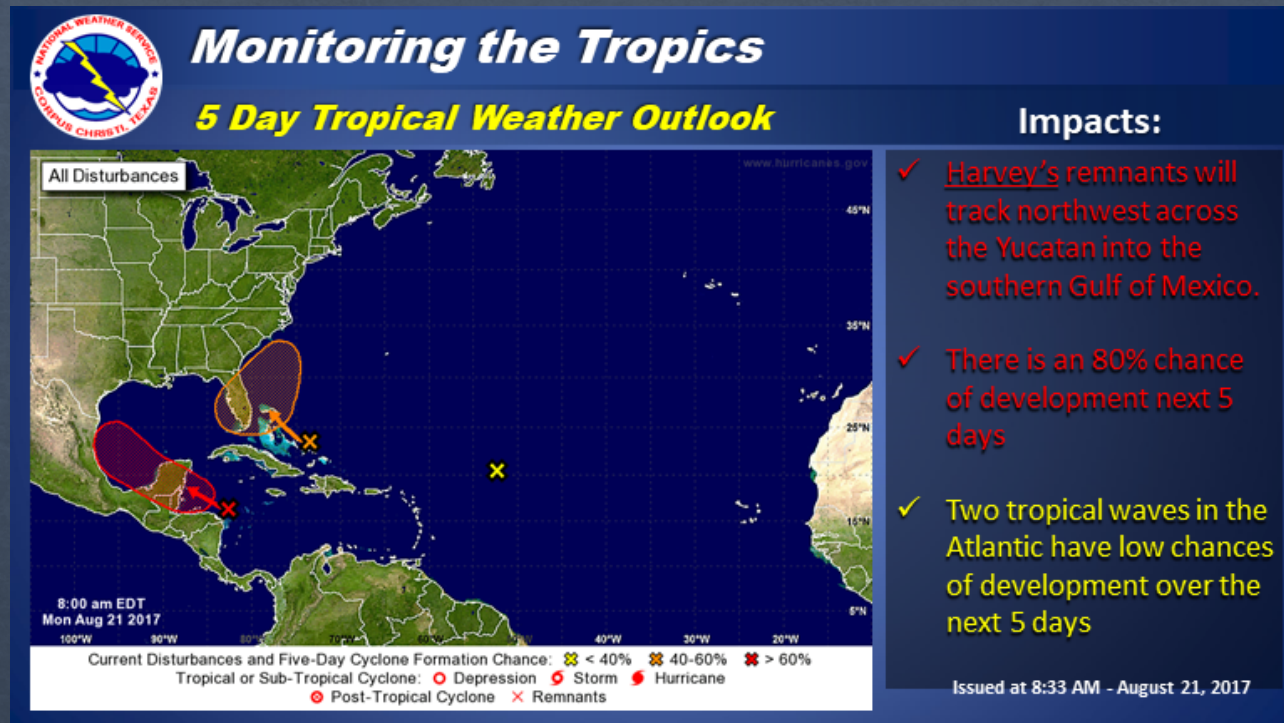
- ❑ As of 12 PM, Tropical Storm Harvey was located in the eastern Caribbean Sea.
- ❑ The system is expected to move west and could reach the Bay of Campeche early next week.
- ❑ Continue to monitor the latest advisories from the National Hurricane Center

Issued at 12:17 PM - August 18, 2017

Beyond the 5-day forecast, there remains considerable uncertainty on where the system may track. Continue to monitor the latest advisories from the National Hurricane Center.

Eclipse Day Briefing

Issued Monday August 21, 2017

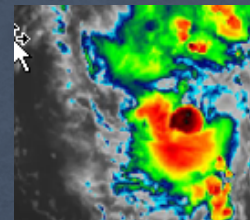


There remains considerable uncertainty on where the system may track. Continue to monitor the latest forecasts or advisories from the National Hurricane Center.

Message Evolution

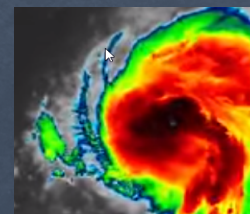
BULLETIN
Tropical Depression Harvey Advisory Number 12
NWS National Hurricane Center Miami FL AL092017
1000 AM CDT Wed Aug 23 2017

...HARVEY REGENERATES INTO A TROPICAL DEPRESSION...
...HURRICANE AND STORM SURGE WATCHES ISSUED FOR PORTIONS OF THE TEXAS COAST...



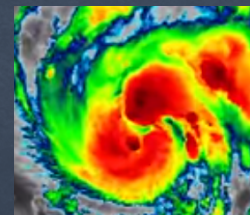
BULLETIN
Tropical Storm Harvey Advisory Number 15
NWS National Hurricane Center Miami FL AL092017
400 AM CDT Thu Aug 24 2017

...HARVEY FORECAST TO STRENGTHEN IN THE GULF OF MEXICO...
...HURRICANE WARNING ISSUED FROM PORT MANSFIELD TO MATAGORDA...



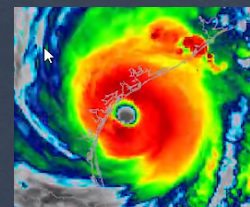
BULLETIN
Tropical Storm Harvey Advisory Number 16
NWS National Hurricane Center Miami FL AL092017
1000 AM CDT Thu Aug 24 2017

...HARVEY QUICKLY STRENGTHENING AND FORECAST TO BE A MAJOR HURRICANE WHEN IT APPROACHES THE MIDDLE TEXAS COAST...
...LIFE-THREATENING STORM SURGE AND FRESHWATER FLOODING EXPECTED...



...6 PM CDT POSITION AND INTENSITY UPDATE...
...HARVEY BECOMES A CATEGORY FOUR HURRICANE...
...SUSTAINED HURRICANE-FORCE WINDS SPREADING ONTO THE MIDDLE TEXAS COAST...

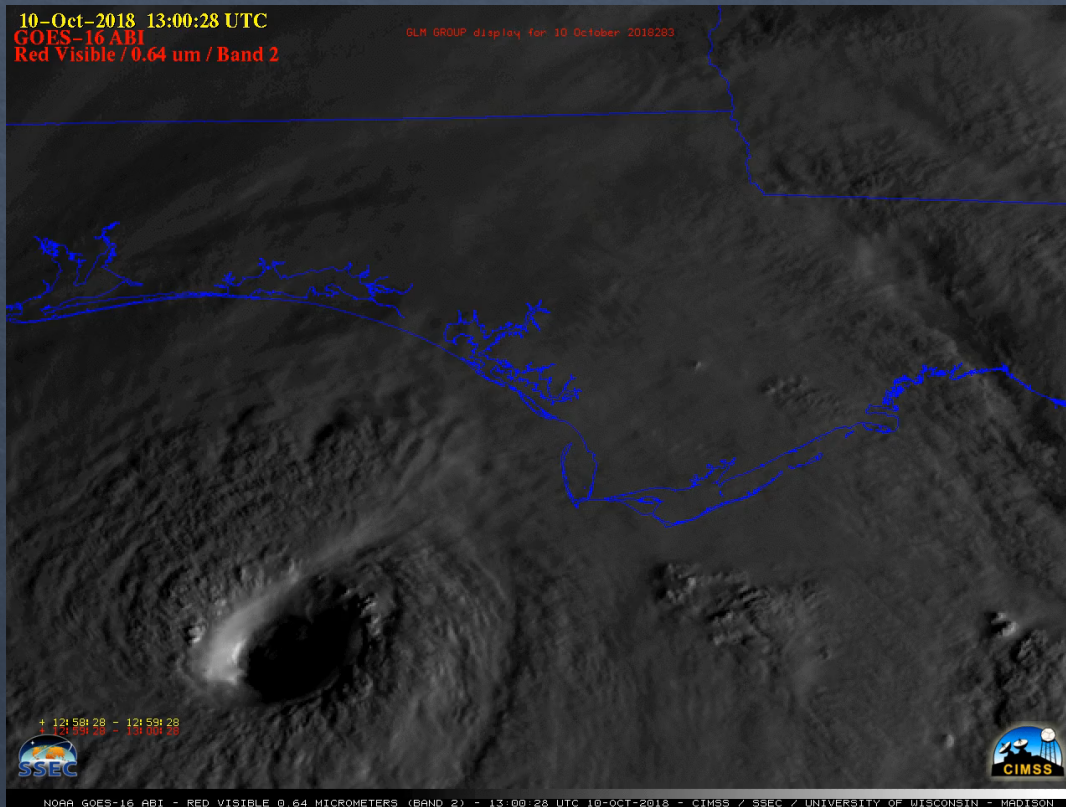
Air Force Reserve Reconnaissance aircraft data indicate that Harvey has become a category 4 hurricane with maximum sustained winds of 130 mph (215 km/h).



NWS Corpus IDSS for Harvey

- Meteorologists deployed to Corpus and Victoria EOCs for the duration
- 40 email briefing packages sent
- Led 25 Webinars
- Participated in dozens of other calls
- 55 personal Core Partner briefings
- Over 500 text messages to core partners
- Nine individual EM briefings...
 - In the eye!!!

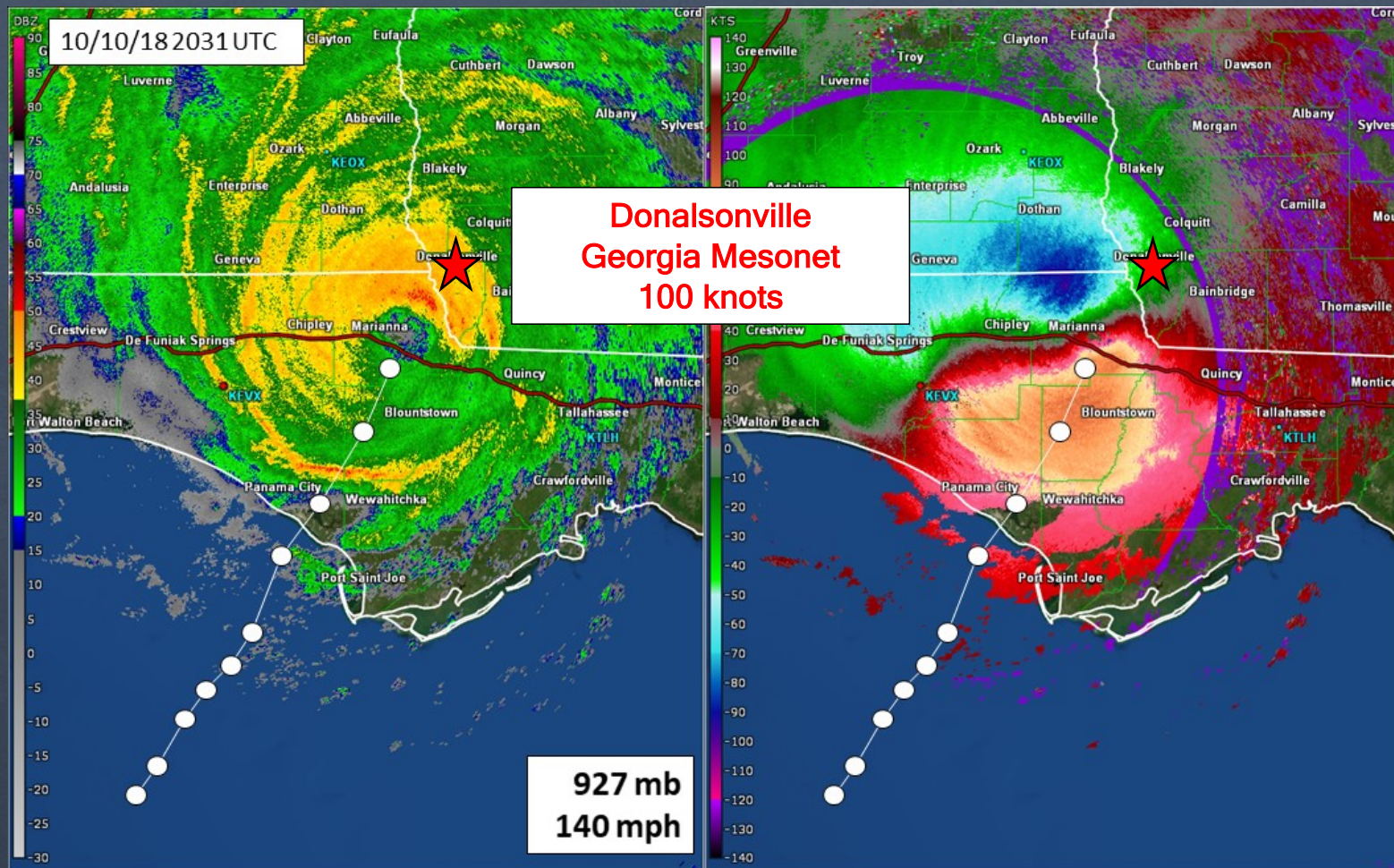
Michael - One for the Record Books*



- 1st category 4 or 5 hurricane on record to make landfall in the Florida Panhandle
- Latest in season to make landfall as Cat-5
- First GA Major Hurricane since 1898
- 3rd strongest hurricane at U.S. landfall based on pressure (behind 1935 unnamed FL Keys hurricane and Camille 1969)
- 4th strongest hurricane at U.S. landfall based on wind (160 mph) behind the 1935 Keys, Camille (1969) and Andrew (1992)
- 46 mb drop in 24 hours before landfall - 9 mb drop in final three hours

* Based on NHC Advisories and preliminary best track data.

Peak Measured Gusts*



*No known site with complete wind data for storm core.

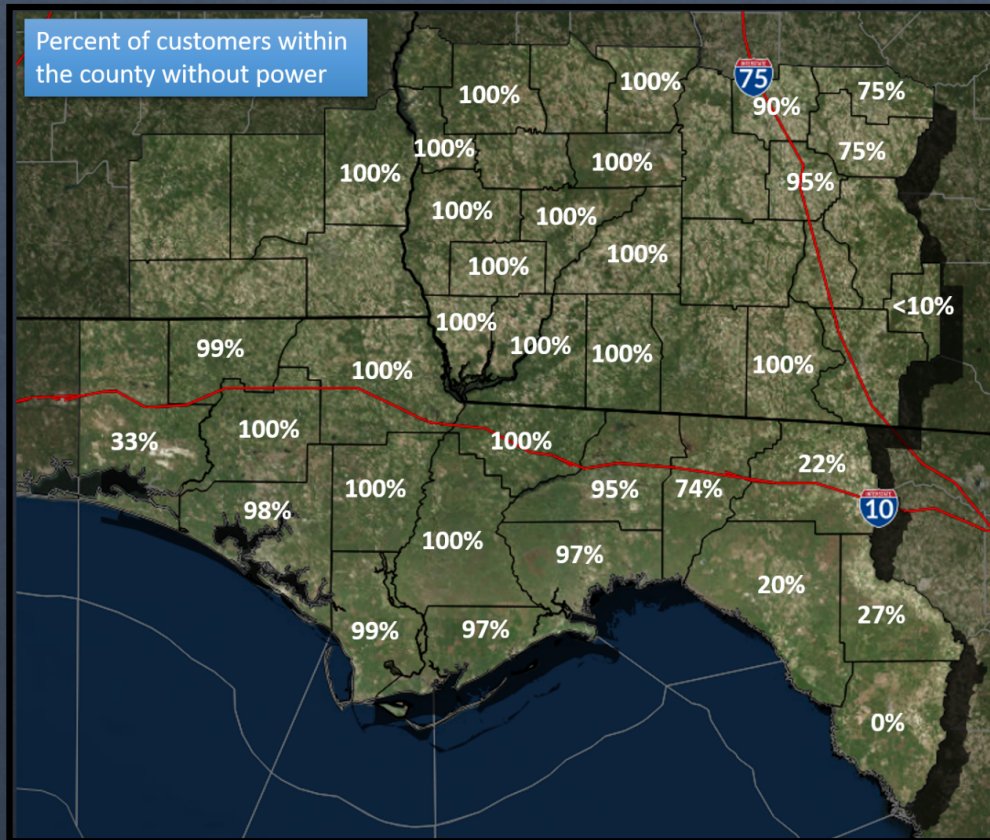
Surge

| Location | Preliminary Peak Storm Surge Inundation (AGL) |
|--------------------------------------|---|
| Mexico Beach to Indian Pass | 9 to 14 feet |
| Indian Pass to Lanark Village | 6 to 9 feet |
| Lanark Village to Ecofina State Park | 9 to 11 feet |
| Ecofina State Park to Steinhatchee | 6 to 8 feet |
| Steinhatchee to Suwanee River | 4 to 6 feet |

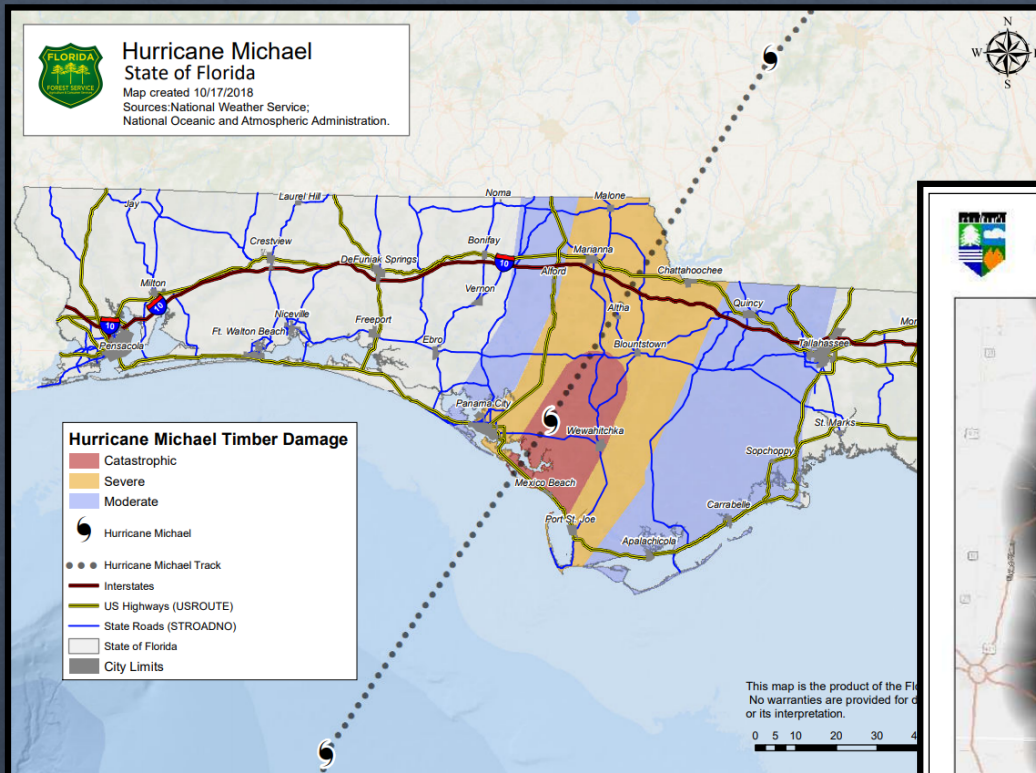
Impacts



Estimated Maximum Power Outages



Timber Industry



Georgia - 2,368,226 acres of forestland was impacted by Hurricane Michael; estimated value of \$762,683,909

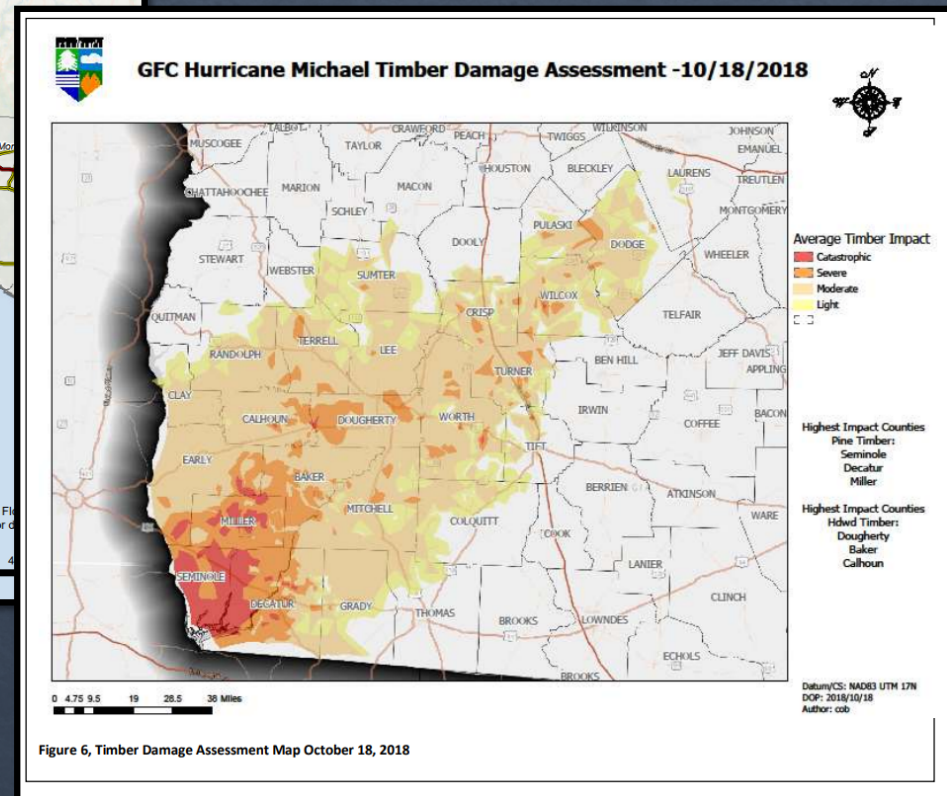


Figure 6, Timber Damage Assessment Map October 18, 2018

Florida - almost 3 million acres of forested land was damaged; costs estimate of \$1.29 billion

Sources: Georgia Forestry Commission/Florida Department of Agriculture

Other Agriculture

- Florida

- Cotton: \$50 million
- Cattle: \$43 million
- Peanuts: \$23 million
- Poultry and eggs: \$10 million
- Pecans: \$4 million
- Other ag: \$33 million

- Georgia

- Cotton: \$550-600 million
- Pecans: \$560 million
- Vegetables: \$480 million
- Poultry: \$28 million
- Peanuts: \$10-20 million
- Other ag: \$28 million



Credit: National Geodetic Survey



Credit: Georgia Department of Agriculture

Sources: Georgia Department of Agriculture/Florida Department of Agriculture

Mexico Beach, Florida



Source: NOAA/National Geodetic Survey

Panama City, Florida



Source: National Weather Service

Lynn Haven, Florida (Panama City Area)



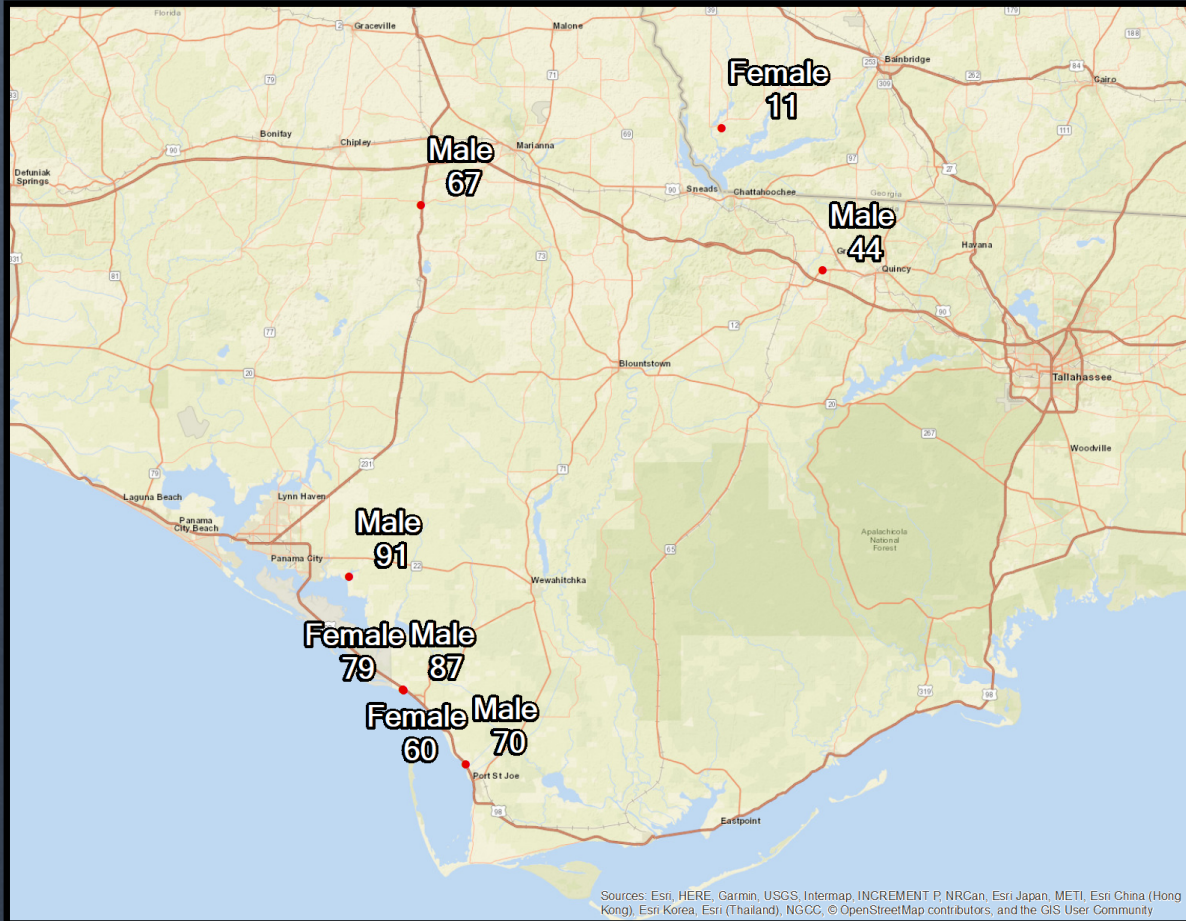
Marianna, Florida

- 56 miles inland from landfall point



Source: National Weather Service

Fatalities



- 8 Direct Fatalities Locally
 - 16 nationwide
- 3 Wind Related
- 5 Surge Related
- 5 Male
- 3 Female

Agnes Vicari, 79 – Bay County



Found in Mexico Beach, moved by storm surge

Agnes Vicari's Conversation With Her Niece

TALLAHASSEE — In the final hours before Hurricane Michael crumbled her Mexico Beach home around her, Agnes Vicari was on the phone with her niece with a promise.

"I made a mistake. I won't make a mistake again," she told Joanne Garone Behnke the morning the storm hit. Vicari, 79, who lived in a small one-story home just yards from the Gulf of Mexico, promised she'd evacuate the next time a storm came, that she'd see them soon to celebrate Behnke's husband retiring.

"Aunt Aggie, you can still go to a shelter," Behnke begged.

"There are no shelters in Mexico Beach," Vicari said, before the call ended.

When Hurricane Michael began to churn into the Gulf two weeks ago, her family begged her to leave. Her pilot nephew called the day before the storm. Her granddaughter, who evacuated north to Wewahitchka, asked her to do the same. Even a police officer stopped by. She chuckled at them, Behnke remembered.

"She was still struggling with the concept of getting in her car and going somewhere," she said. "She's an old-time Italian, kept her money in her house, very stubborn."

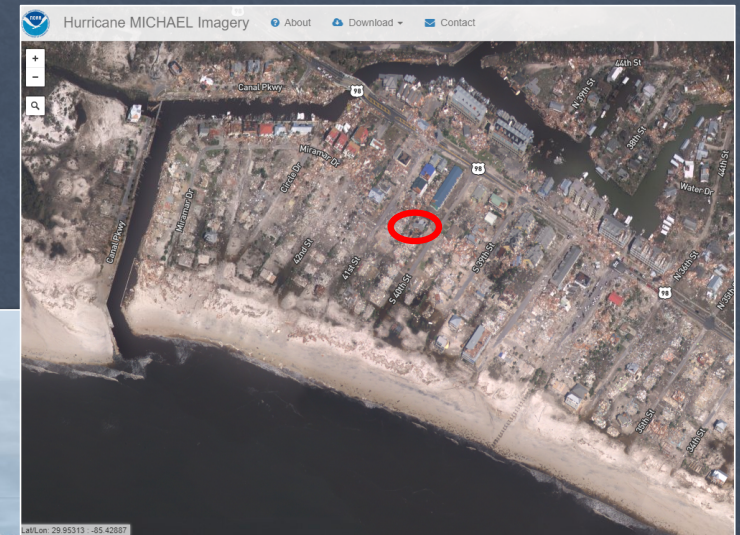
Her somewhat reclusive aunt might also have not wanted to go to a shelter, she added, "probably afraid of leaving her home where she had her sense of security."

The Wednesday the storm hit, Behnke called Vicari around 11 a.m. Vicari worried about the storm, which had strengthened to a Category 4 overnight. But as it approached, she sounded hopeful she would see her family soon.

"My aunt didn't want to die," Behnke added. "She didn't think she was going to die."

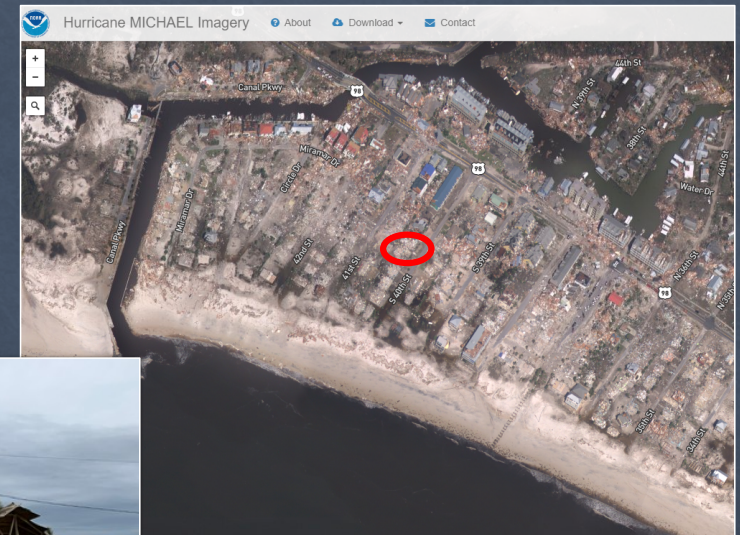
<https://www.miamiherald.com/news/weather/hurricane/article220412065.html>

Donald Vonderhaar, 87 - Bay County



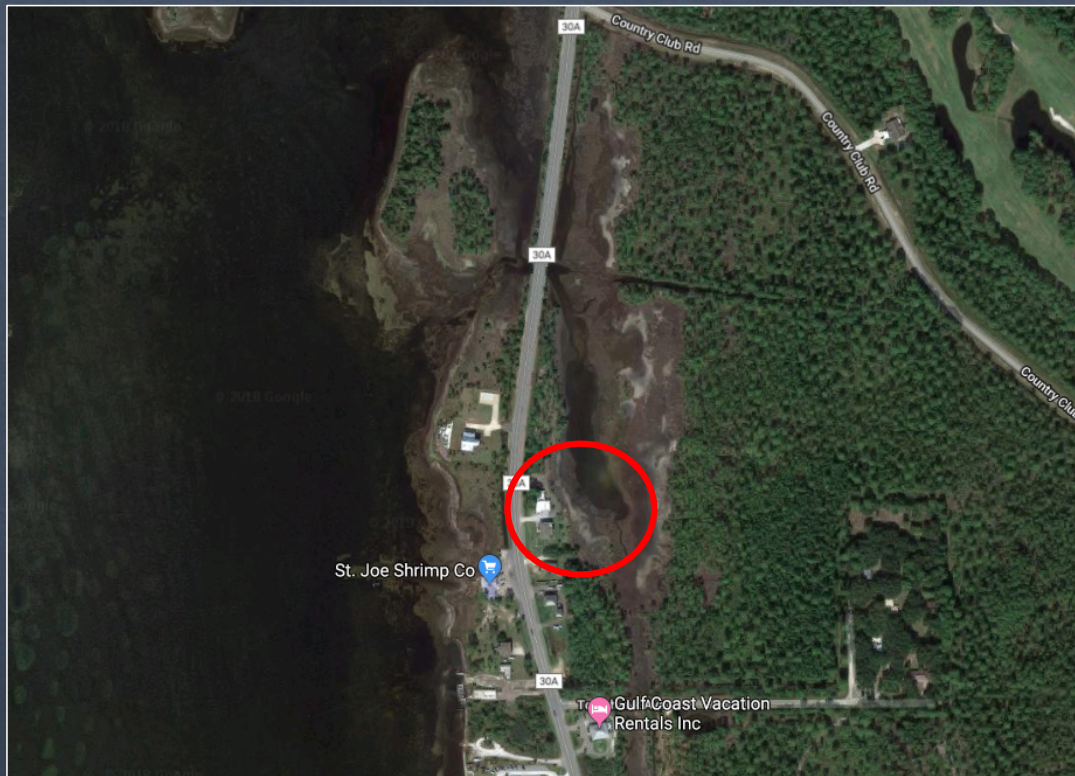
Swept away by house during the storm

Sandra Lucas Detrick, 60 – Bay County



Found in Mexico Beach rubble, moved by storm surge

William McConnell, 70 – Gulf County



MATIAS J. OCNER/Miami Herald

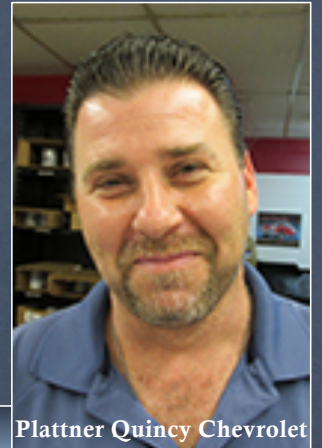
Found in Cape San Blas debris - was fleeing in truck

John Gombos, 67 – Jackson County



Tree collapsed on mobile home, roof collapsed onto decedent

Steve Sweet, 44 – Gadsden County



Plattner Quincy Chevrolet



Due to trauma following a tree falling on a home

Local WFO Response and Communication

Forecast Max Wind Speed (mph)

5

4

3

2

1

69

63

75

81

98

98

109

121

121

121

121

127

127

132

144

144

155

Had to ramp up messaging quickly!

OCT 6 -
5PM

OCT 6 -
11PM

OCT 7 -
5AM

OCT 7 -
11AM

OCT 7 -
5PM

OCT 7 -
11PM

OCT 8 -
5AM

OCT 8 -
11AM

OCT 8 -
5PM

OCT 8 -
11PM

OCT 9 -
5AM

OCT 9 -
11AM

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5PM

OCT 9 -
11PM

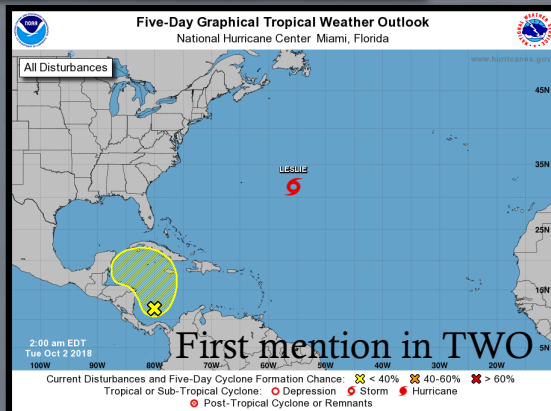
OCT 10 -
5AM

OCT 10 -
11AM

LANDFALL

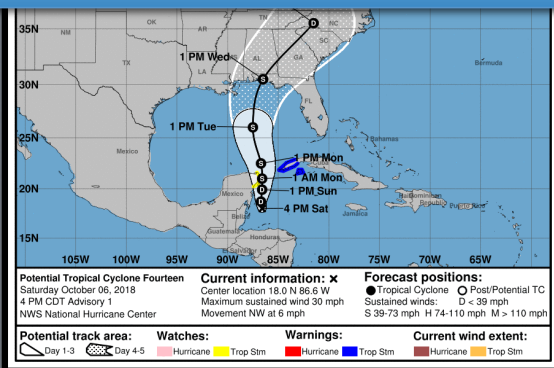
October 2, 2018 2AM EDT

First mention of potential for Michael in 5 day TWO



October 6, 2018 4PM EDT

Potential Tropical Cyclone Fourteen

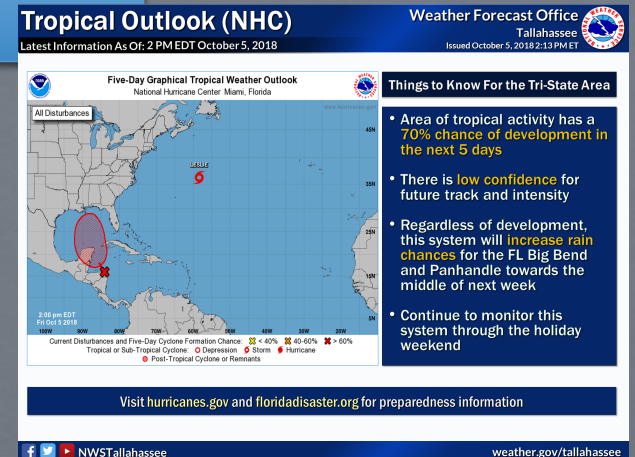


TS expected

Tuesday - Saturday

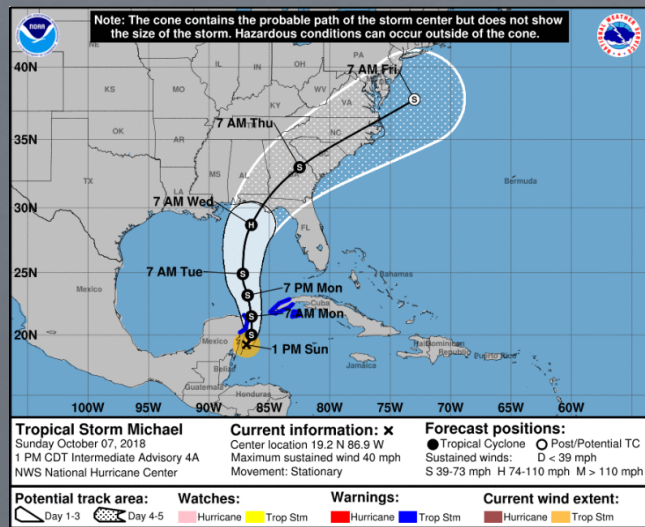
**October 5, 2018
2:51PM EDT**

First email to partners



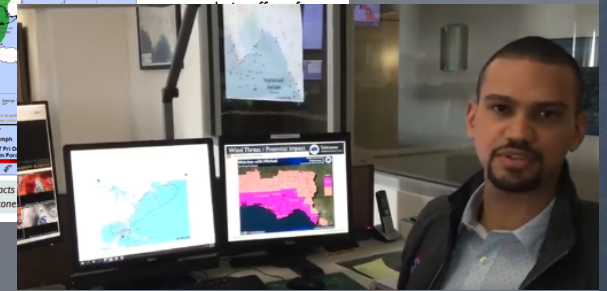
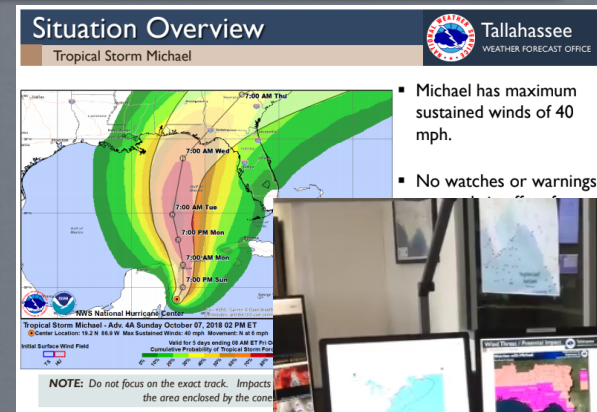
October 7, 2018 11:30AM EDT
Pow-Wow with MIC

October 7, 2018 2PM EDT
Becomes TS Michael



Sunday

October 7, 2018 2:30PM EDT
First webinar for partners



Monday

October 8, 2018 5:16 AM EDT

Watches issued for CWA

October 8, 2018 Afternoon

Decision made to deploy forecasters to three EOCs



Hurricane expected

Major hurricane expected

October 8, 2018 11AM EDT

Becomes Hurricane Michael

US National Weather Service Tallahassee Florida
Published by Joe Gempak (?) · October 8 at 12:18 PM · 📍

⚠️ 11AM UPDATE KEY MESSAGES.

1. #Michael now forecast to be a MAJOR hurricane at landfall.
2. Life-threatening storm surge along the FL Panhandle and Big Bend.
3. Tropical Storm Force winds arrive as early as Tues Eve.
4. Widespread Heavy Rain.

#FLwx #GAwx #ALwx #HurricaneMichael

PLEASE FOLLOW US ON TWITTER (www.twitter.com/NWSTallahassee) FOR MORE RAPID UPDATES OF CURRENT INFORMATION.

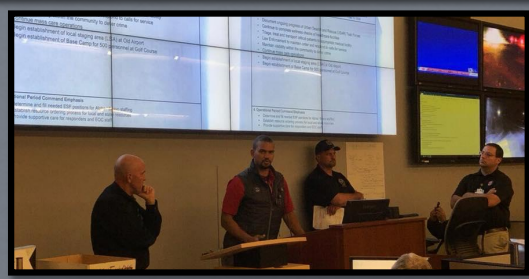
- Hurricane and Tropical Storm Watches have been issued for much of the area.
- Life threatening storm surge possible along the coast

October 8, 2018
5:42 PM EDT

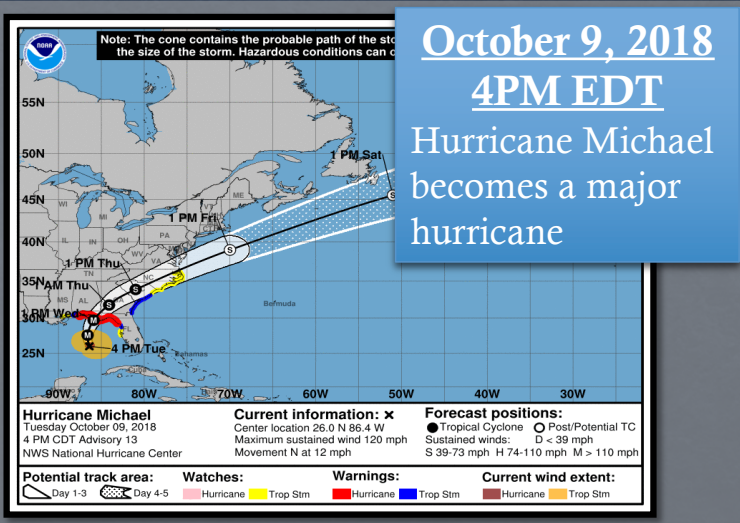
Warnings issued for CWA



October 9, 2018 Morning
Forecasters arrive at respective EOCs



**October 9, 2018
12:55PM EDT**
First Facebook Live



**October 9, 2018
4PM EDT**
Hurricane Michael becomes a major hurricane

October 9, 2018 7PM EDT
Midnight shift arrives for the duration of the event



October 9, 2018 Evening
~250 people left in Mexico Beach

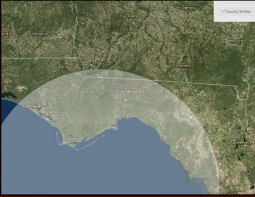
October 9, 2018 10:15PM EDT
“Pull out all the stops”



Messaging Avenues and Severity

Unprecedented Event Unfolding Weather Forecast Office Tallahassee
Issued October 10, 2018 1:06 AM ET

We searched the historical database for category 4 hurricanes that have made landfall in the Florida Panhandle and Big Bend. This map says it all – it's **BLANK** – this situation has NEVER happened before.



This is your **LAST** chance to get to a safe place and the time for that is closing. This storm will bring deadly surge to the Florida anything we have seen before. If you risk your life or that of your family.

NWS Tallahassee @NWSTallahassee

Social Media

NWS Tallahassee @NWSTallahassee

5AM EDT update: This is as **SERIOUS** as it gets. Major #HurricaneMichael has continued to intensify over the Gulf of Mexico. We want everyone to know this is an **EXTREMELY** dangerous storm and unfortunately the time for preparation is ending!

5:16 AM - Oct 10, 2018

919 713 people are talking about this



Facebook Live

EMERGENCY ALERTS now

Emergency Alert
LIFE THREATENING STORM EVACUATE ZONES A B C AND LOW LYING AREAS AND MOBILE HOMES NOW

Wireless Emergency Alerts

LIVE HURRICANE MICHAEL

HURRICANE MICHAEL ALERTS

80 mph
Pressure 978 mb
Intensity 4.5 on S scale
22.2°N 85.2°W

FL: STATE OF EMERGENCY IN 35 COUNTIES

NEXT MIC ADVISORY AT 8PM EDT/7PM CST

ATHENS TONIGHT

| 7PM | 8PM | 9PM | 10PM | 11PM | 12AM |
|-----|-----|-----|------|------|------|
| 0% | 15% | 15% | 15% | 15% | 5% |

Breaking News

MICHAEL NOW MOVING ON TO THE CAROLINAS
Bringing tropical storm-force winds and flooding rains

TROPICAL STORM MICHAEL mph 0

200

DE" ALONG ITS PATH, NATL. HURRICANE CENTER SAYS

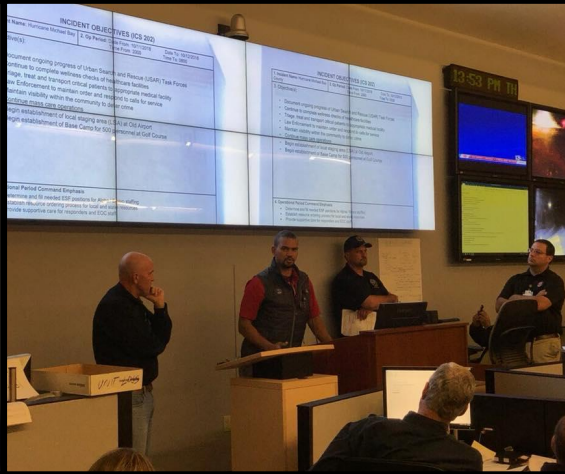
EARLY STA

Skype Interviews

Deployed Meteorologists



Leon County

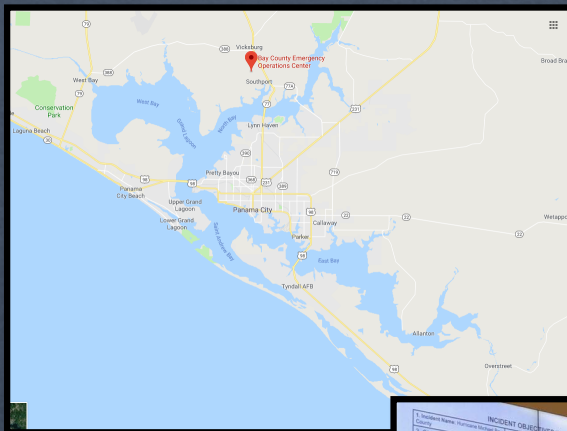


Bay County

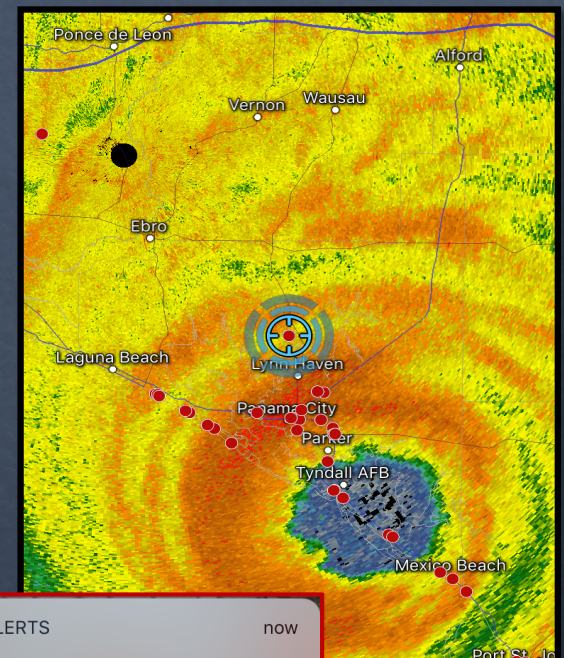


Florida State University

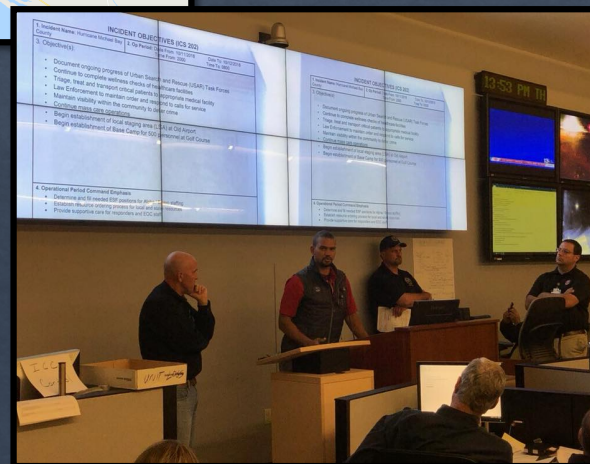
Bay County Deployment



Communicator between Bay County and Leon County due to loss of comms



Provided briefings to partners that centered around logistical decisions




EMERGENCY ALERTS
now

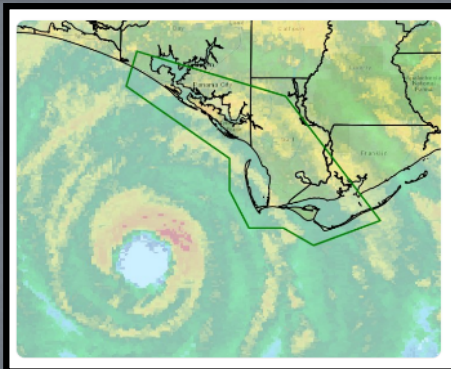
Emergency Alert
 Dangerous winds are beginning to occur in Bay County shelter in place now

Helped to craft hard hitting messages

Pre-Event

Wednesday

October 10, 2018 11:11AM EDT
First Extreme Wind Warning issued



October 10, 2018 Morning
50 people left in Mexico Beach

October 10, 2018 1:30PM EDT
Hurricane Michael makes landfall - winds of 155 mph



Major hurricane expected

October 10, 2018 1:30PM EDT
NWS Tallahassee comms fail and operations
are passed to NWS Jacksonville

TO: All Southern Region Offices

FROM: WFO Jacksonville

SUBJECT: Service Backup

WFO Jacksonville has initiated full service backup for WFO Tallahassee.

NASA SPORT - NOAA GOES-EAST ABI - 0.64 UM - OCT 10, 2018 16:01:58Z

Lessons Learned – Looking Ahead

Michael/Harvey - Similar Challenges

- Accelerated timeline associated with rapid intensification
- Staff lockdown
- Communications
 - No Hurricane Hotline for either storm
 - Lost Internet/Awips in Michael
 - No HAMS for either event
- Post hurricane surveys
 - 2000+ data points surveyed in Michael
 - Lack of coastal survey experience
 - EF Scale does not work for hurricanes
- Lack of reliable real time wind information

Lessons Learned/Applied

- Prepare for one category stronger
- All hands on deck/12 hour shifts
- “Survive the aftermath” Mike Brennan
- IT expertise and Management on duty 24/7
- ET and facility personnel here throughout
- Backup internet critical – FSU and hot spots
- 10 hotel rooms reserved
- Internal coordination document and DSS schedule

More Lessons Learned/Applied

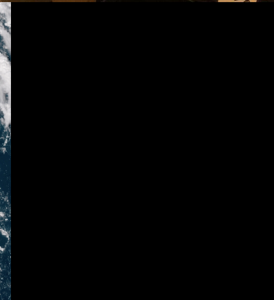
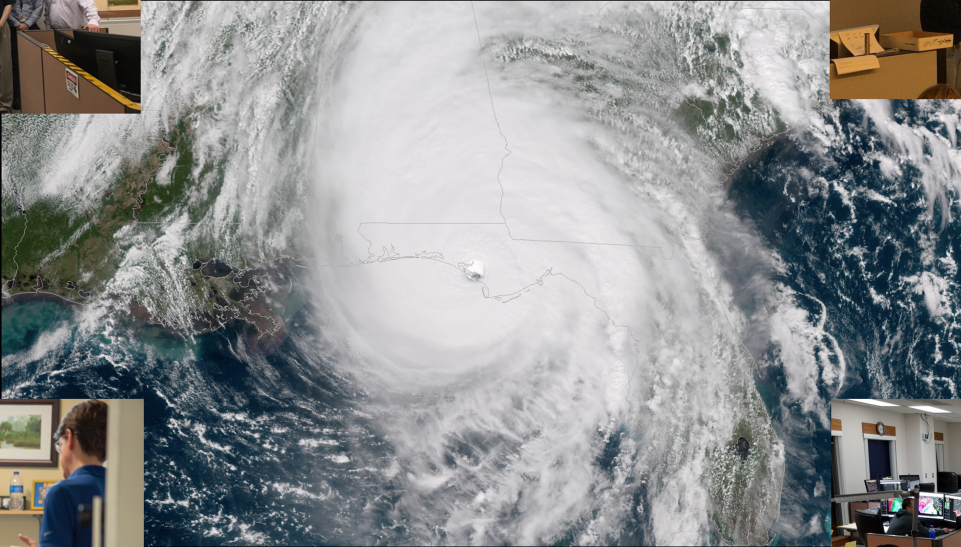
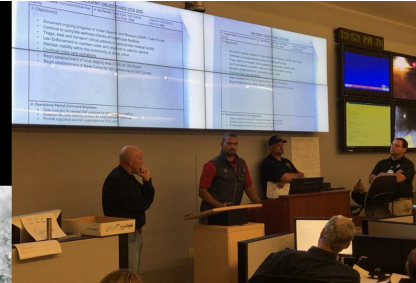
- One person dedicated to supporting deployees
- Use DAT to coordinate internal and partner surveys
- Coastal survey support from NOAA and HCFCD
- Late season tropical training
- COOP and service backup???

Next Time?

- Redundant operational internet
- Time of departure graphics
- Robust/reliable observing equipment
- Tropical messaging training for inland WFOs
- Two person deployments to EOCs for tropical ops
- Apply Dr. Myers' post-Michael social science findings

Team Effort





Thank You!
Tom Johnstone
Thomas.Johnstone@noaa.gov