Florida Department of Transportation District Six
Transportation Systems Management & Operations
1001 NW 111th Ave, Miami, FL 33172
(305) 470-5757 · SunGuide.info

Monroe County Traffic Incident Management (TIM) Team Meeting

June 12, 2023

FDOT District Six

Agenda

1.	**Purpose of Meeting**
	Provide agency updates from the TIM Team which includes hurricane response, evacuation coordination, special events, and project updates. There will be updates from the FDOT District Six Transportation Management Center, FDOT Traffic Operations Office, FDOT Emergency Operations Center, Florida's Turnpike Enterprise, the National Weather Service, and the FDOT Asset Maintenance Contractor in Monroe County. It also serves as an opportunity to network and share lessons learned to improve interagency coordination and communication.
2.	**Introduction of Attendees**
3.	**District Six Updates**
	Staff Announcements
	Hurricane Update
	Responder Training
	Special Events
4.	**Open Discussion**
5.	**Adjournment**

New TSM&O Engineer – Freeways

Yamilet Diaz, P.E.

- Formerly TSM&O Engineer - Arterials
  - Launched Adaptive Signal Control Technology (ASCT) Project Along SW 8 Street
  - Established Monroe County Traffic Signal System
  - Project Manager for the Florida Keys Connecting Overseas to Advance Safe Travel (Keys COAST) Project

New TSM&O Engineer – Arterials

Ernesto Polo, P.E.

- Formerly Principal Planner - Miami-Dade County Department of Transportation and Public Works
  - Orange Line Phase 3 East-West Corridor
  - Omni Metromover Station and Bus Hub
- Formerly FDOT District Six Assistant District Planning Manager

Asset Maintenance Program Manager

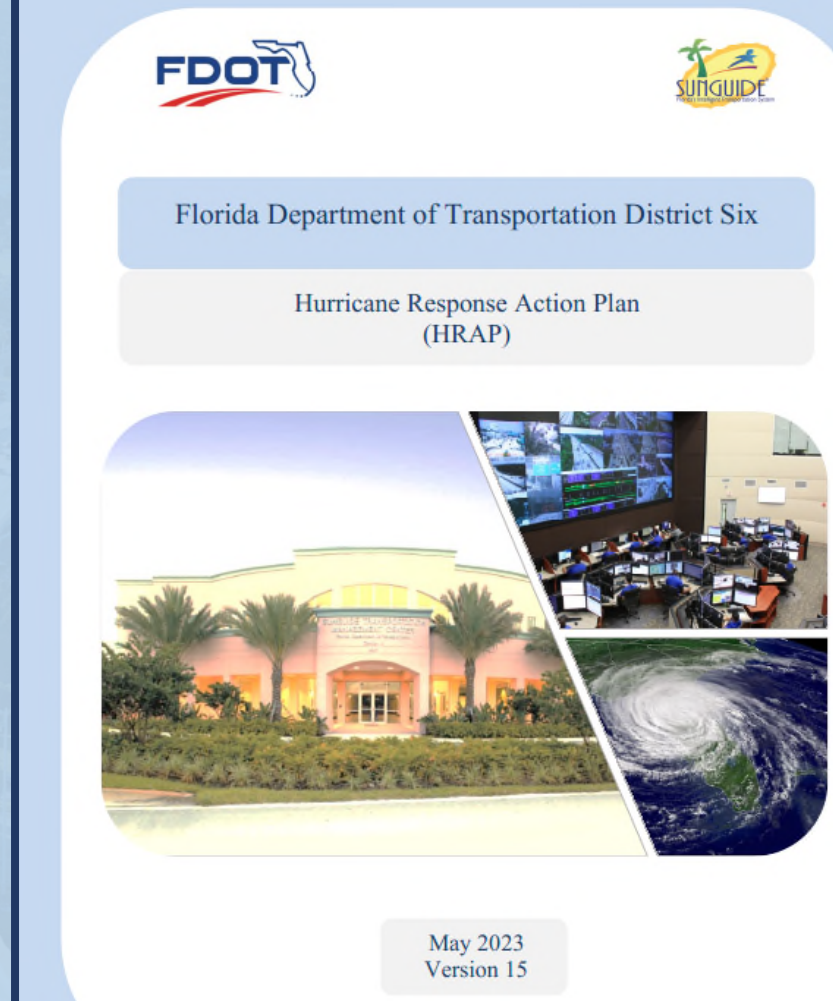
Andres Castineiras

- Asset Maintenance Program Manager
- Port Miami Tunnel Project Manager
- Over 15 Years of Roadway Design and Construction Experience
- Managed a Variety of Projects with Department
  - Resurfacing, Rehabilitation, Construction, Safety Projects, Pushbuttons, Conventional, and Landscaping Contracts

Hurricane Response Action Plan (HRAP)

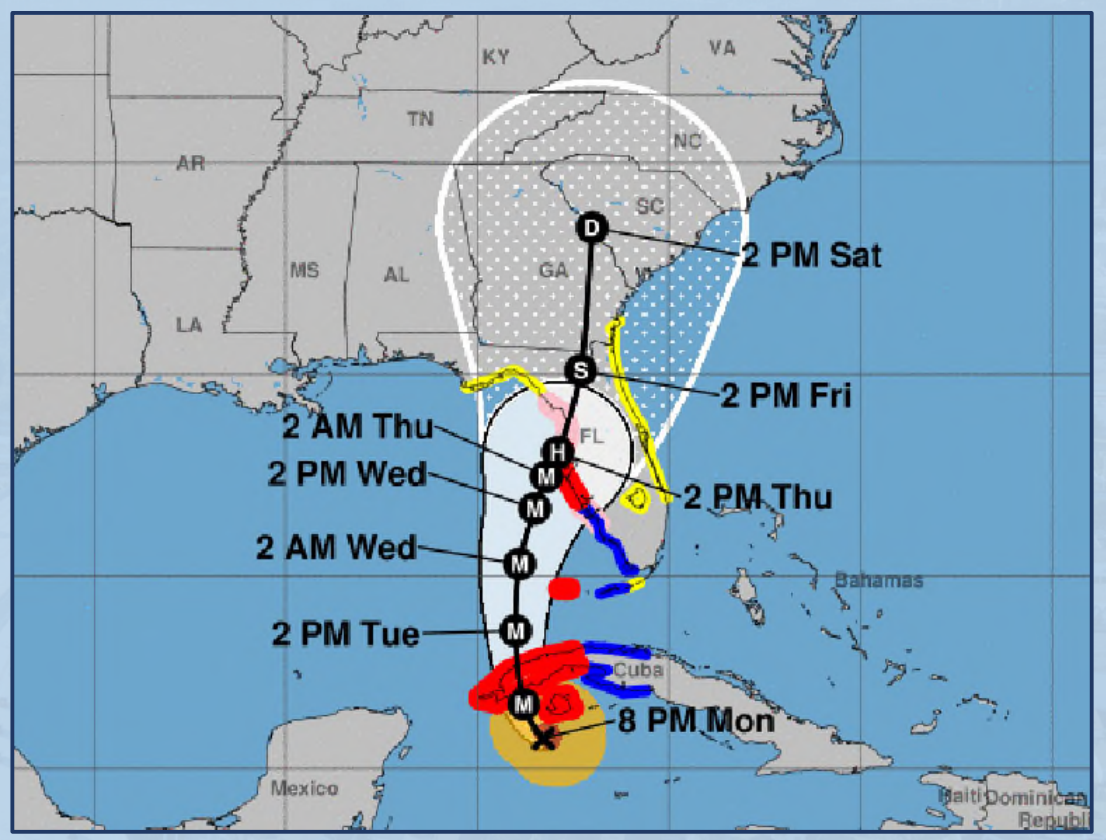
Operational and Planning Strategies

- Updated Yearly (May 2023)
- Policy Activities
  - Identification of TSM&O Critical Staff
  - Backup TMC Locations
- Implementation Activities
  - Photo Database of Field Hub Sites
  - Procurement of Severe Weather Supplies
  - Road Ranger Staging Requirements



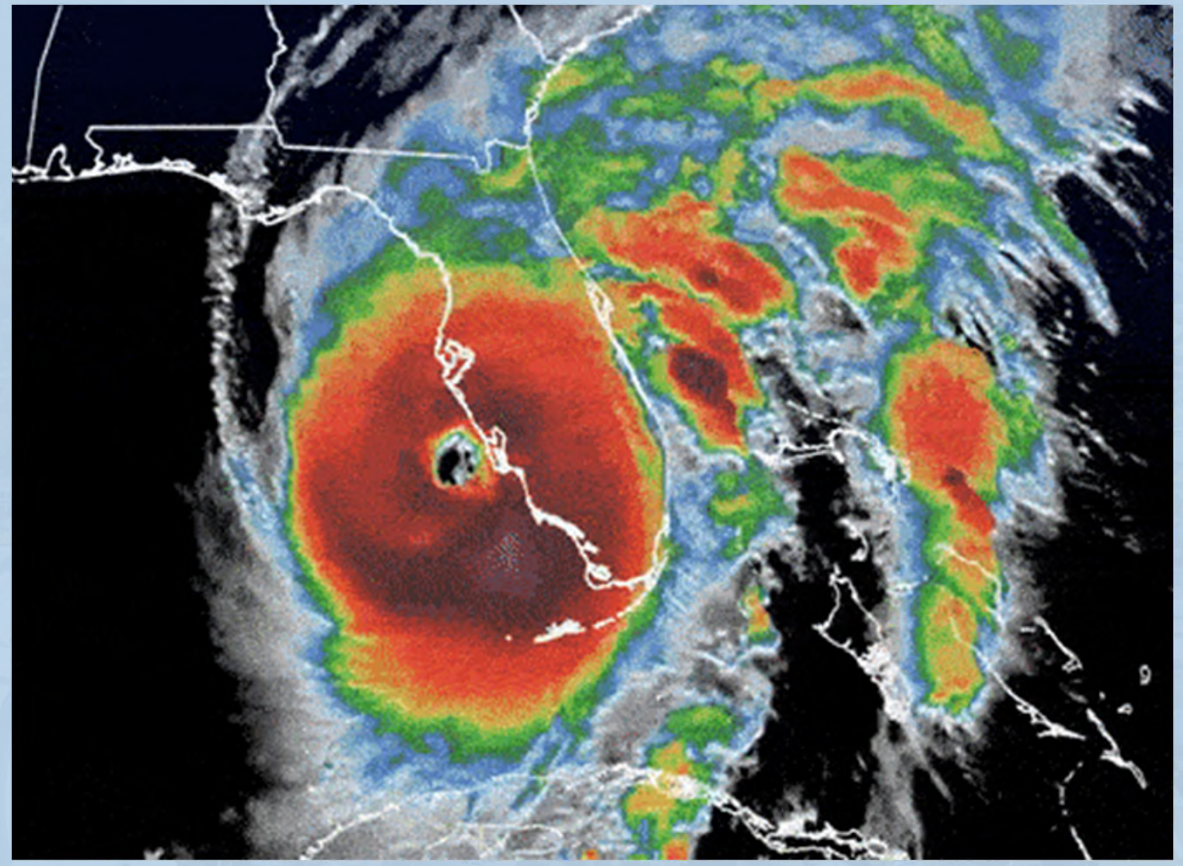
Before the Storm

- FDOT Emergency Operations Center (EOC) and Local Law Enforcement Coordination
- Monroe County Traffic Signal System
  - Facilitate northbound evacuation
  - Implement signal timing plan favoring northbound
- Dissemination of Information
  - Dynamic Messages Signs (DMS)
  - Florida 511 (Website and Mobile App)
  - Emails
- Incident Management Support as Needed
- ITS Maintenance Contractor Coordination
  - Fuel for Backup Generators
  - Spare Parts Inventory



During the Storm

- 35+ MPH Sustained Winds
- TMC Evacuates for Category 3+
- Backup Location - FTE Turkey Lake
- Hourly Updates with EOC
- Checking ITS Devices and Monroe County Traffic Signals System (MCTSS)



TMC Backup Location - FTE Turkey Lake

After the Storm

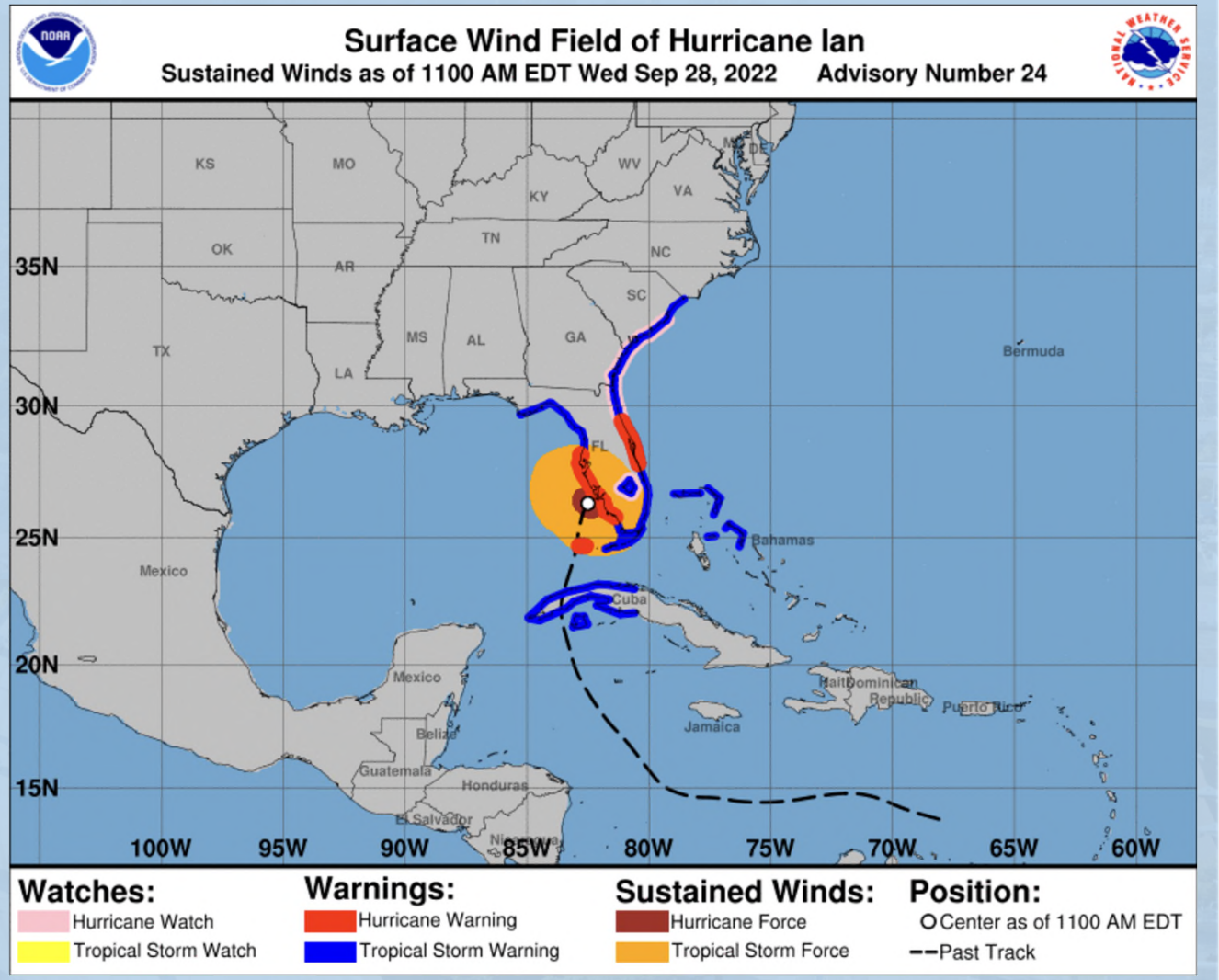
- Below 35 MPH
- Inventory and Situational Awareness of ITS and MCTSS Devices
- Reestablish Power As Needed
- Checking Communications with ITS Staff
- Incident Management Support as Needed
- Monitor Health of Traffic Signals and ITS Devices Using eSTORM

Hurricane Ian

Sanibel Island Bridge

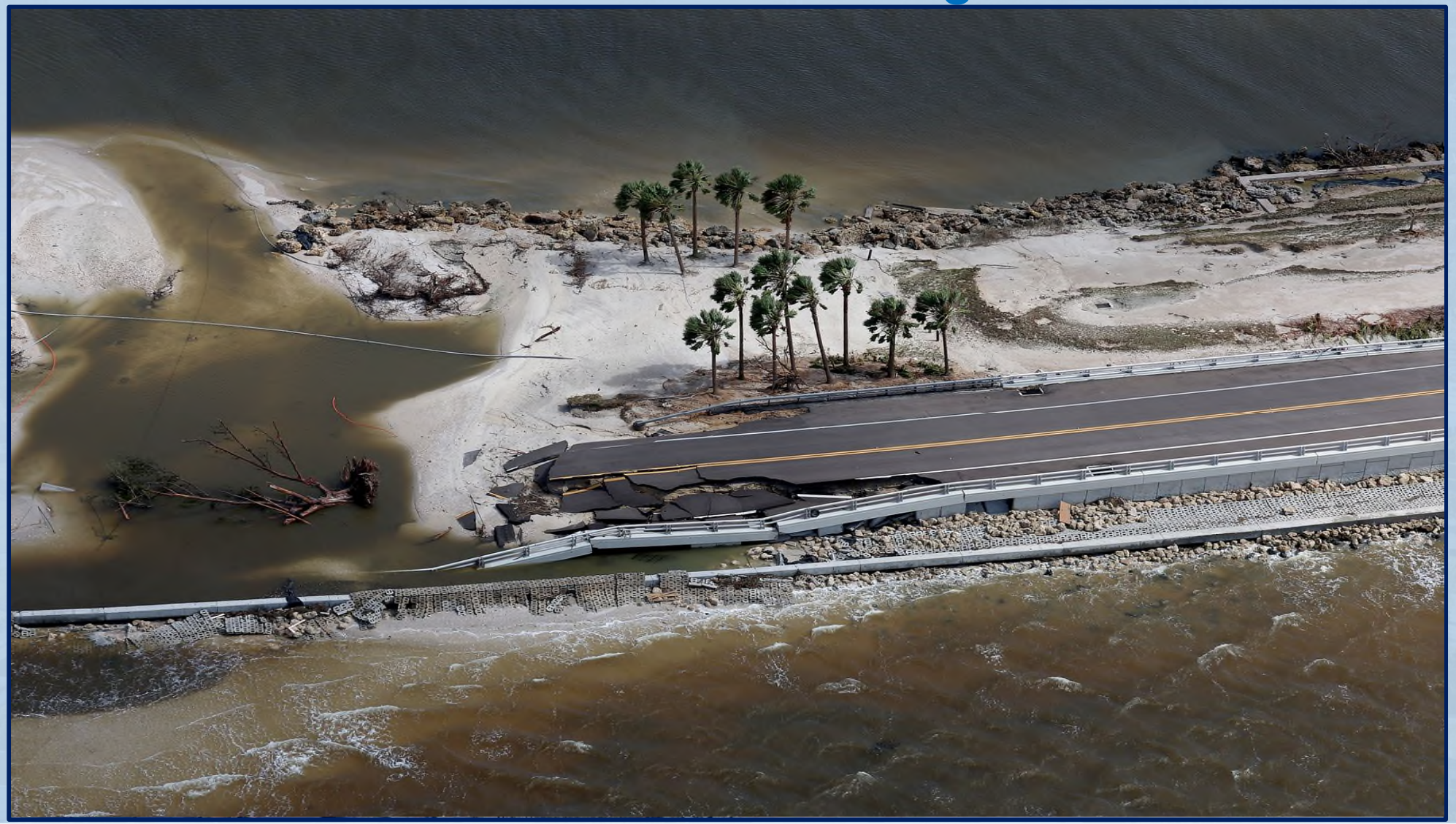
- Category 4 Hurricane
- September 27, 2022, Key West
  - Knocked Down Trees Blocked Roadways
  - Flooded Streets

- September 28, 2022, Fort Myers
  - Major Infrastructure Damages
  - Significant Impact to Locals



Hurricane Ian

Sanibel Island Bridge



Hurricane Ian

Sanibel Island Bridge

- Rebuilt Completed October 19, 2022
- FDOT Secretary Involved
- Support from other Districts
- Water Main and FP&L Repairs

Post Storm Recovery

District Six Monitoring Resources

- 3 ITS Trailers
- CCTV Camera
- Microwave Detector
- Cellular Communication
- Wireless Communication
- Solar Powered
- Power Grid and Generator Compatible

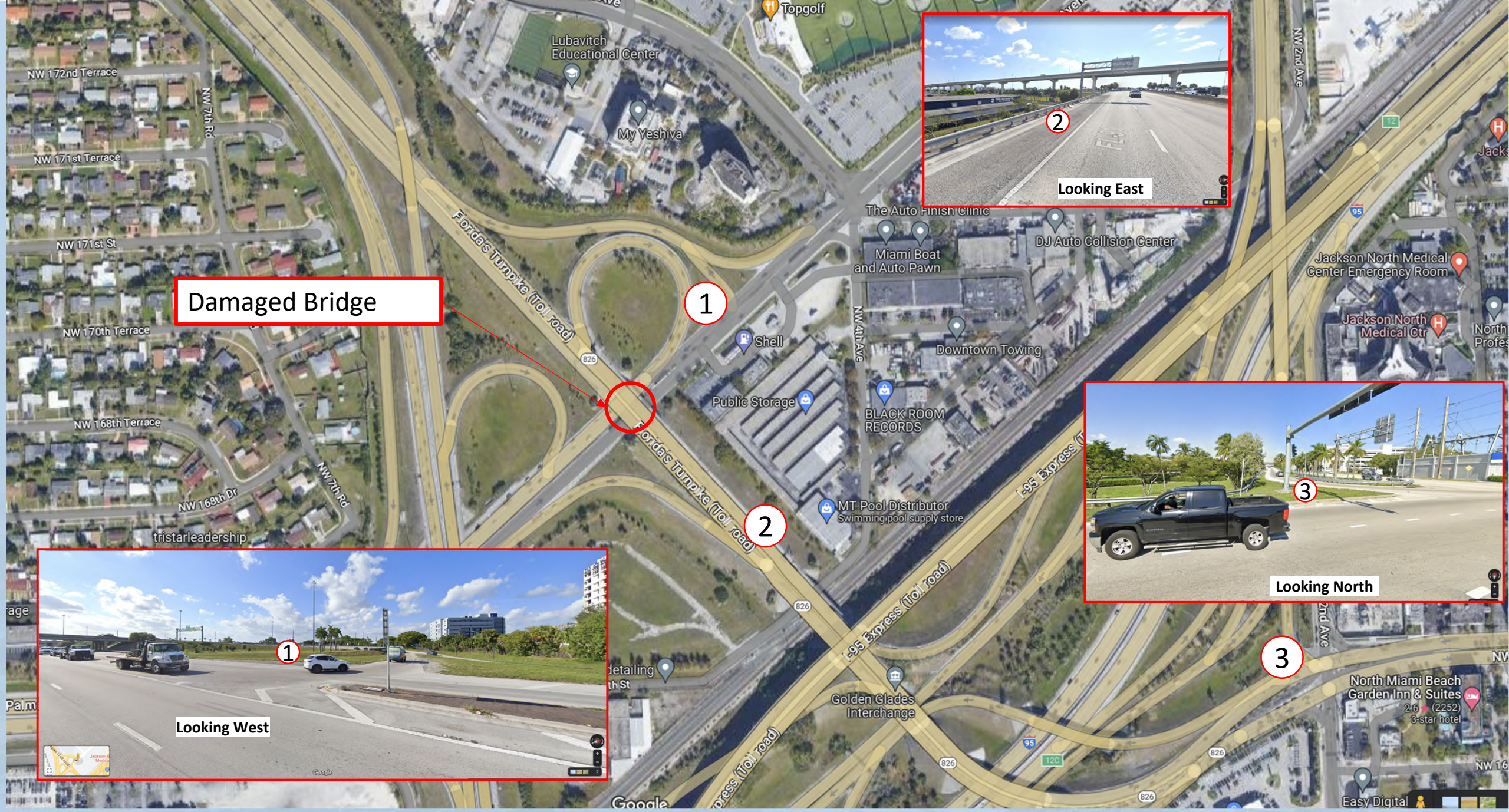
Recent Use in Monroe County

- Cow Key Bridge Rehabilitation
- Traffic Monitoring for Monroe County Signal System – Multiple Locations

Post Storm Recovery

ITS Trailer Example – Turnpike Bridge Over SR 826

- March 17, 2023, at 3:30 PM (Friday)
- Trailer Mounted Crane Severely Damaged 3 Bridge Beams
- Emergency Contract to Replace Beams and Pour New Bridge Deck
- District Deployed 3 ITS Trailers
  - Traffic monitoring
  - View progress of bridge repair
- Repair Completed April 5, 2023


Damaged Bridge
1
2
3
Looking East
Looking North
Looking West
Lubavitch Educational Center
My Yeshiva
Topgolf
NW 172nd Terrace
NW 7th Rd
NW 171st Terrace
NW 171st St
NW 170th Terrace
NW 168th Terrace
NW 168th Dr
tristarleadership
Florida's Turnpike (Toll road)
826
Shell
Public Storage
The Auto Finish Clinic
Miami Boat and Auto Pawn
DJ Auto Collision Center
NW 4th Ave
Downtown Towing
BLACK ROOM RECORDS
MT Pool Distributor
Swimming pool supply store
I-95 Express (Toll road)
Golden Glades Interchange
95
12C
NW 2nd Ave
12
Jackson North Medical Center Emergency Room
Jackson North Medical Ctr
North Profes
North Miami Beach Garden Inn & Suites
2.6 (2252)
3-star hotel
Easy Digital
Google

Post Storm Recovery

FDOT Central Office Resources

- 5 ITS Trailers
  - Strategically Stored throughout State
  - One in Ft. Lauderdale for Districts 4 and 6
  - CCTV Camera
  - Emergency Communications FirstNet
- 2 Mobile Command Trailers
  - Trailers Designed for Multiple People to Work
  - Access to Several Wireless Communication Networks
  - Air Conditioning
  - Stored in Tallahassee

National TIM Responder Training Program

Updates

- District In-person Trainings
- Register on SunGuide.info
- www.nhi.fhwa.dot.gov

Upcoming Trainings

- June 28, 2023
- September 2023
- November 2023

National TIM Responder Training Program Implementation Progress
- As of April 24, 2023

In-Person Responder Training
- **20,873** sessions with **481,179** participants

Web-Based Training (WBT)
- **154,122** Total | **97,902** NHI | **12,683** Other
- **43,537** ERSI Responder Safety Learning Network

Total Trained: 649,285

Special Events

Key Largo Chamber of Commerce Annual Fourth of July Parade

July 4, 2023

- Traffic Impact and Closures Expected

Annual Marathon High School Homecoming Parade

October 2023

- Traffic Impact and Closures Expected

Special Events

Annual Key Largo Bridge Run

November 2023

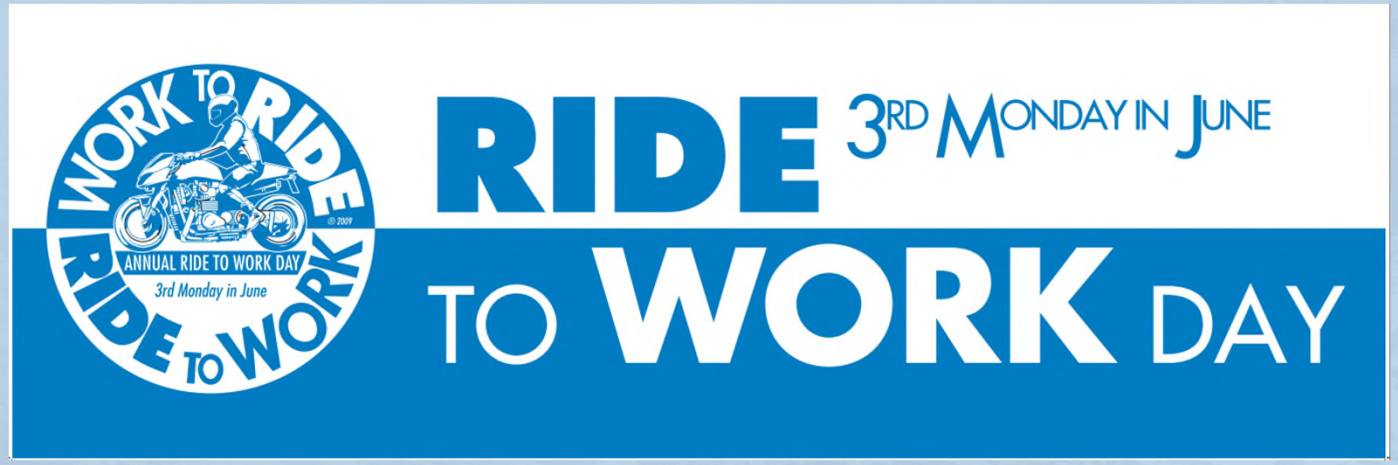
- Traffic Impact and Closures Expected

Annual The SMART RIDE Bicycle Event

November 2023

- Traffic Impact and Closures Expected

Share the Road with Motorcyclists



Thank You!
Questions?

Florida’s Turnpike Incident Management

FDOT

TARGET ZERO
FATALITIES & SERIOUS INJURIES

Responder Safety

- 15 Responders Nationally killed in 2023 (ResponderSafety.com)
  - LEO - 2
  - Fire/EMS - 4
  - Tow Operators- 8
  - Road Service - 0
  - Technicians DOT/SSP Total – 1

  - Six Florida Responders in 2022

Road Ranger Safety

- Six Road Rangers Killed, 52 Crashes – 2016
- Road Ranger Safety Review & Initiatives
  - Tactical Training and Refresher Training
  - Dual Response to Scenes
  - Move Over Messaging
  - Advanced Motorists Travel Alert Messaging
  - Synchronized LED Scene Lighting
  - Rear-facing Red-Light Usage
  - Road Ranger Vehicle Color
  - Arrow Board Usage
  - Debris Clearance Equipment
  - Truck Mounted Attenuators for Scenes

Evacuation Plans

- Family and personal safety first
- Maximize flow of existing lanes
- One-Way not part of our plans
- ESU – North end and South end Mainline and Beachline plans
- New Toll 528 Beachline ESU

Keys to Success:

- Incident Management
- Prevention
- Flexibility
- Preparation
- Execution
- Innovation

Evacuation Plans

- Toll Suspension
- Fuel Plan
- Road Ranger Safety Patrol
- Wrecker Plan (STARR)
- Rapid Incident Scene Clearance (RISC)
- ITS & Traffic Monitoring (TMC & SEOC)
- Traffic Management Plans
- ESU

Pre-storm Operations

- Suspension of non-emergency work
- Increase Traffic Monitoring
- Increase Road Ranger patrols
- STARR wrecker plan deployment

Pre-storm Operations

- EOC Activation
- Fuel Monitoring and Plans
- Traffic Management Plans
- Toll Suspension
- ESU

US 1 / Palm Drive Plan

US 1 / Palm Monitoring

View from Turnpike Camera located @ MP 0.3
District 6 camera and DMS visible in the background.

ESU Plan Overview

- The Turnpike has 3 separate plans:

1. Our Southern end plan which runs from North of Boynton Beach to Osceola Parkway (MP 88-249)

2. Northern end plan which runs from SR 50 Winter Garden to US 301 Wildwood (MP 270-304)

3. Beachline (SR 528) West Plan (MP 35.5-17) I-95 to SR 417

- In the event of a mass evacuation of Southeast Florida due to a hurricane, large numbers of evacuees are expected to use the Turnpike to head north toward Central Florida and beyond.
- There is a reduction of Northbound thru lanes on the Turnpike system north of Lantana (Palm Beach County) continuing to Osceola Parkway (Osceola County).
- To mitigate this, the Turnpike has created an Emergency Shoulder Use Plan that uses the existing outside shoulder to add an additional travel lane.
- This will allow reduced travel times for evacuees.
- The ESU plans exist where we reduce from 3 to 2 thru lanes and continue until we regain the 3rd lane.

Evacuation Plans (Cont.)

- All plans can run independently or simultaneously
- All plans on the Turnpike use the outside shoulder
- We do not have plans for returning traffic.

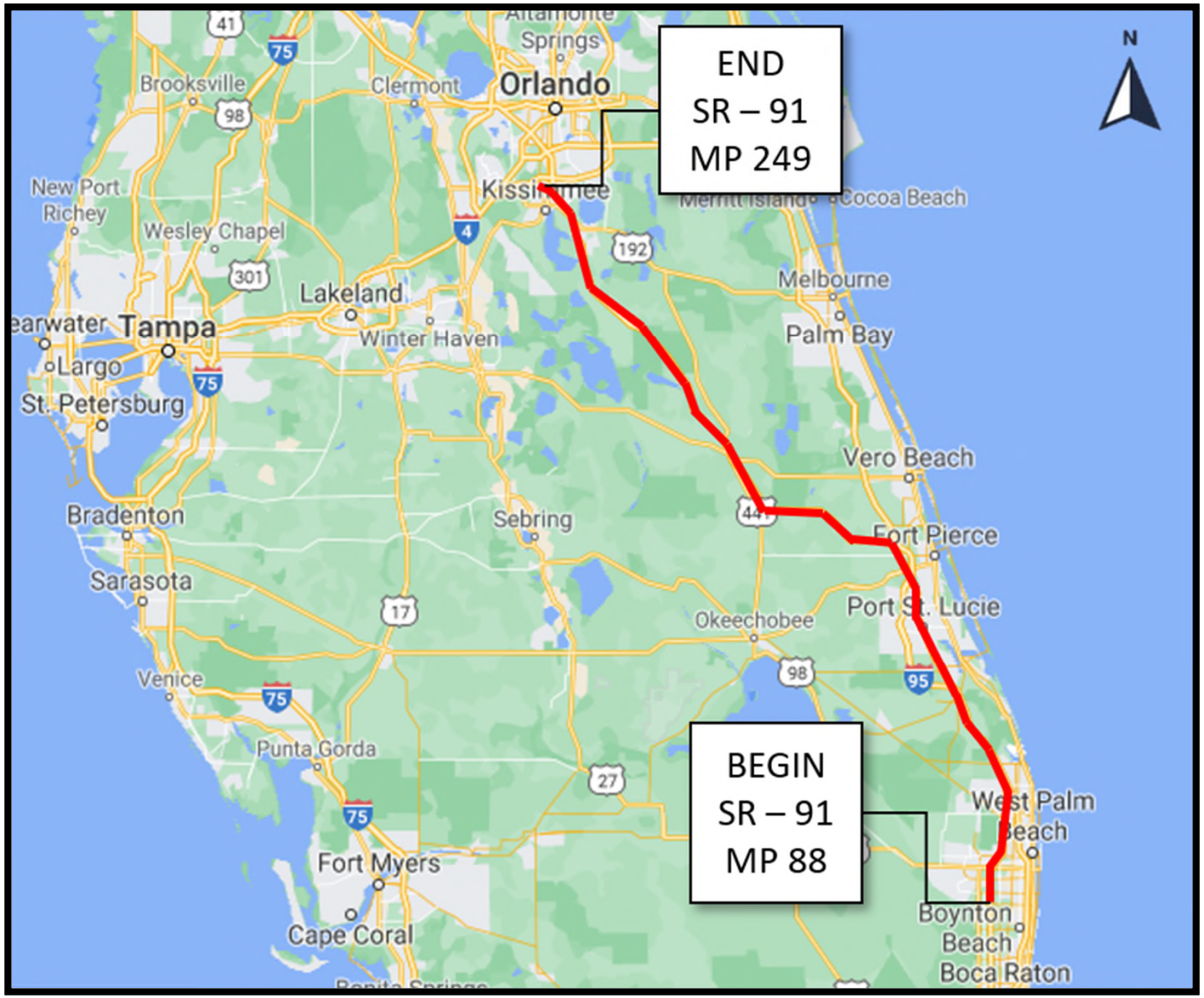
Turnpike Northern Plan

- Orlando to US 301
  (Exit 272 – Exit 304)

- Total Miles – 32
- Staff – 12
- FHP – 12
- Toll Barrier / Interchanges – 7
- Service Plazas – 1

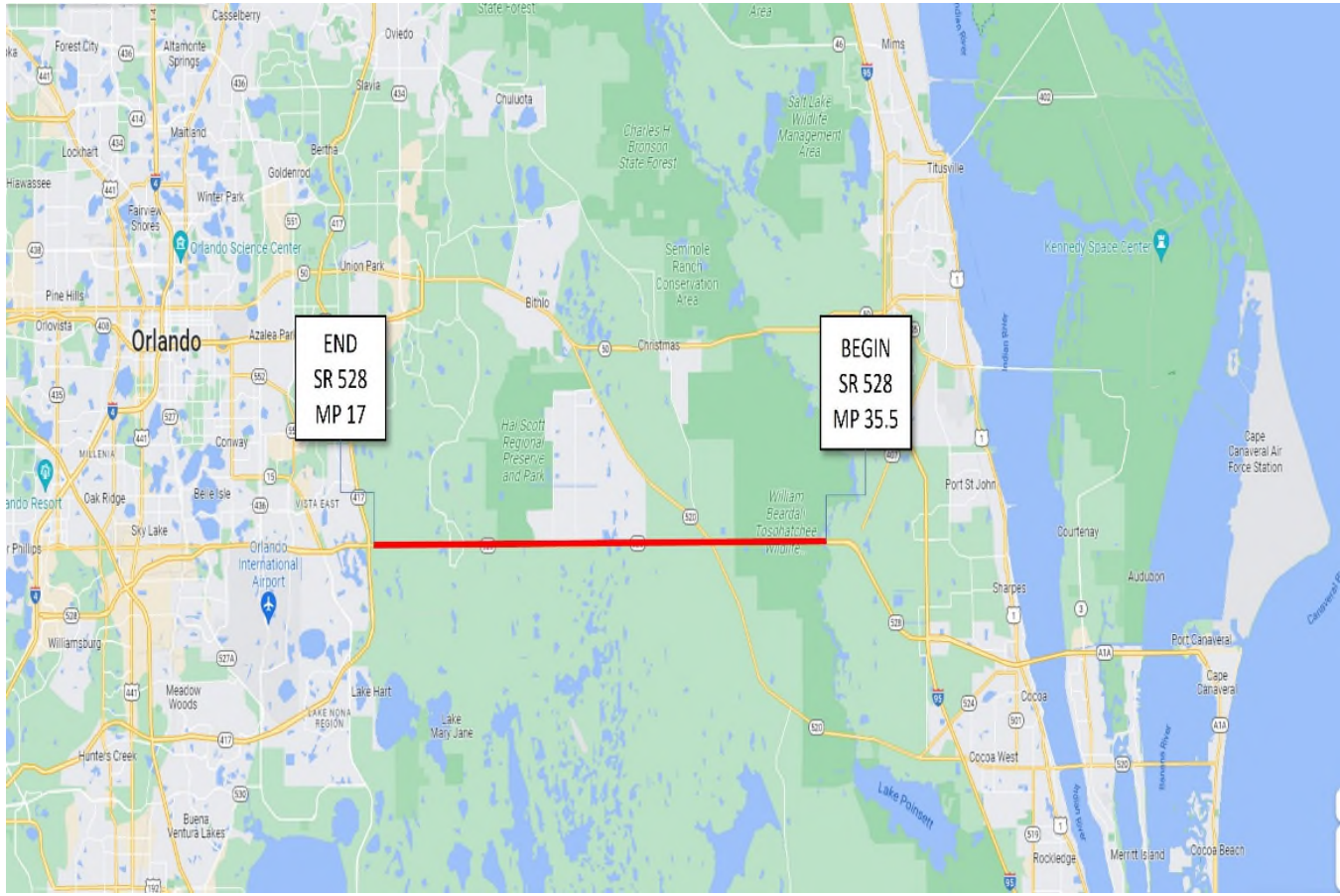
Turnpike Southern End Plan

- Lantana – Osceola Parkway(MP 88 to Exit 249)
- Total Miles – 161
- Staff – 34*
- FHP – 34*
- Toll Barrier – 2
- Interchanges – 18
- Service Plazas – 4



SR 528 Beachline WB

- Total Miles – 18.5
- Staff – 8
- FHP – 8
- Toll Barrier / Interchanges – 3



The shoulders will be cleaned so traffic can use.

Emergency Service units will also be able to utilize the shoulder to respond to incidents if needed.

Motorists Assistance/Disabled Vehicles

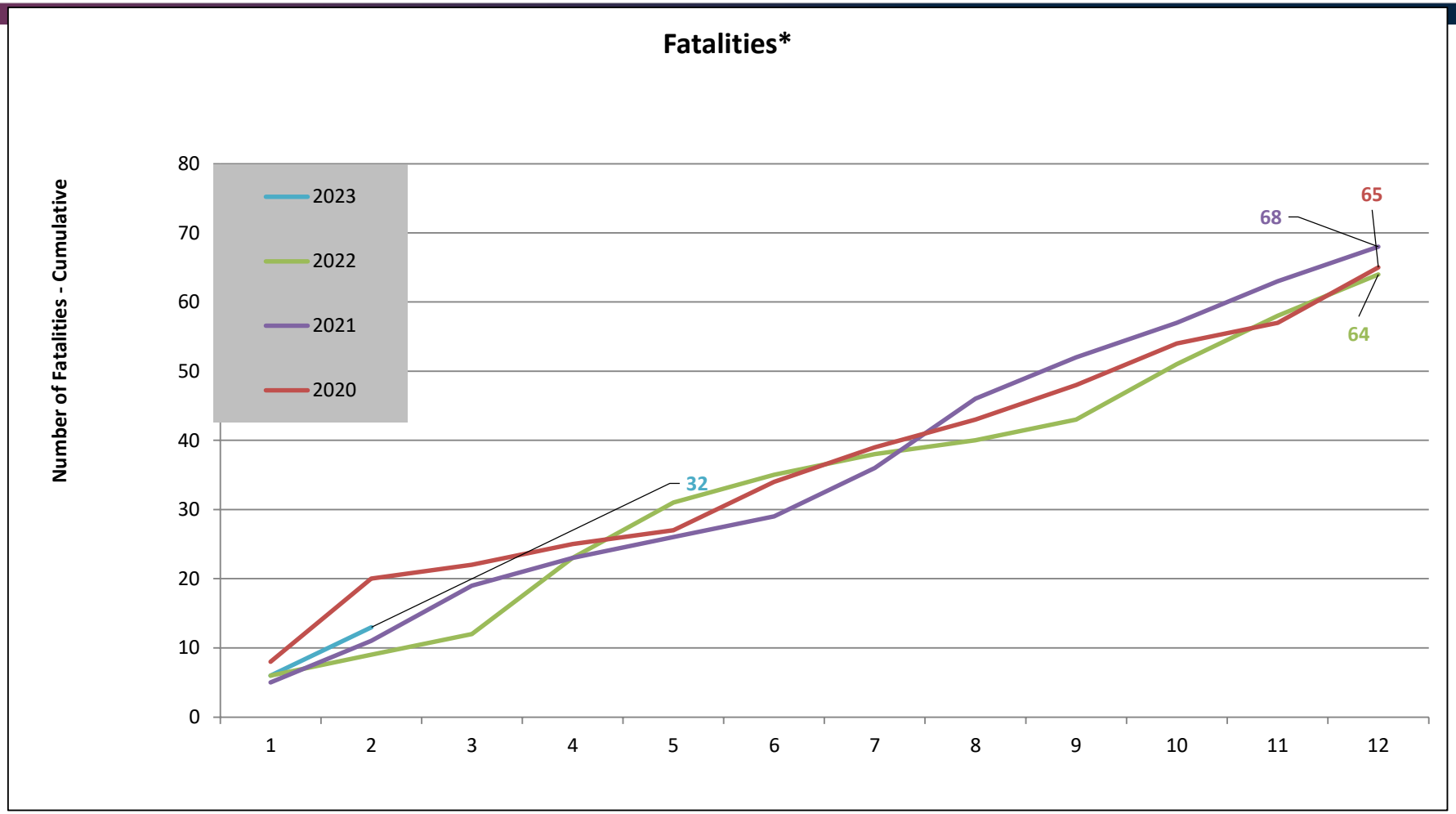
- Road Rangers (RR) patrol this corridor for motorist assists and will increase their presence during evacuation and ESU.
- The Turnpike STARR wrecker program will be used to remove disabled vehicles from travel lanes and to transport motorists of disabled vehicles to the nearest rest area or exit facility to ensure the free flow of traffic as much as possible.
- Both Road Rangers and STARR towers will provide a minimum amount of fuel to get motorists to commercial facilities if stranded.

Post-Storm Operations

- Cut and Toss
- Damage assessment and recovery
- Re-entry Coordination

Performance Measures

Fatalities

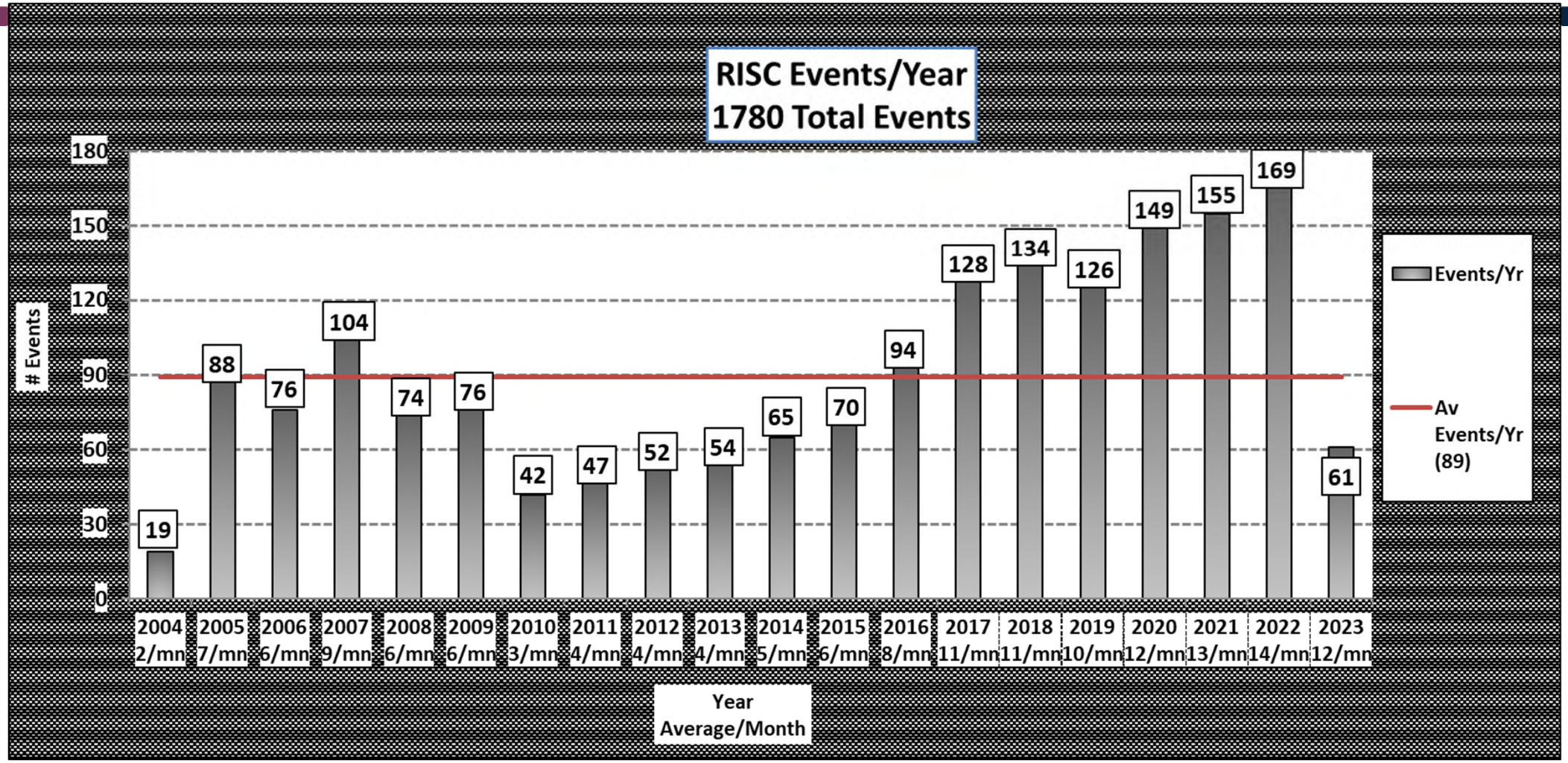


- 30 Fatals in 2023-

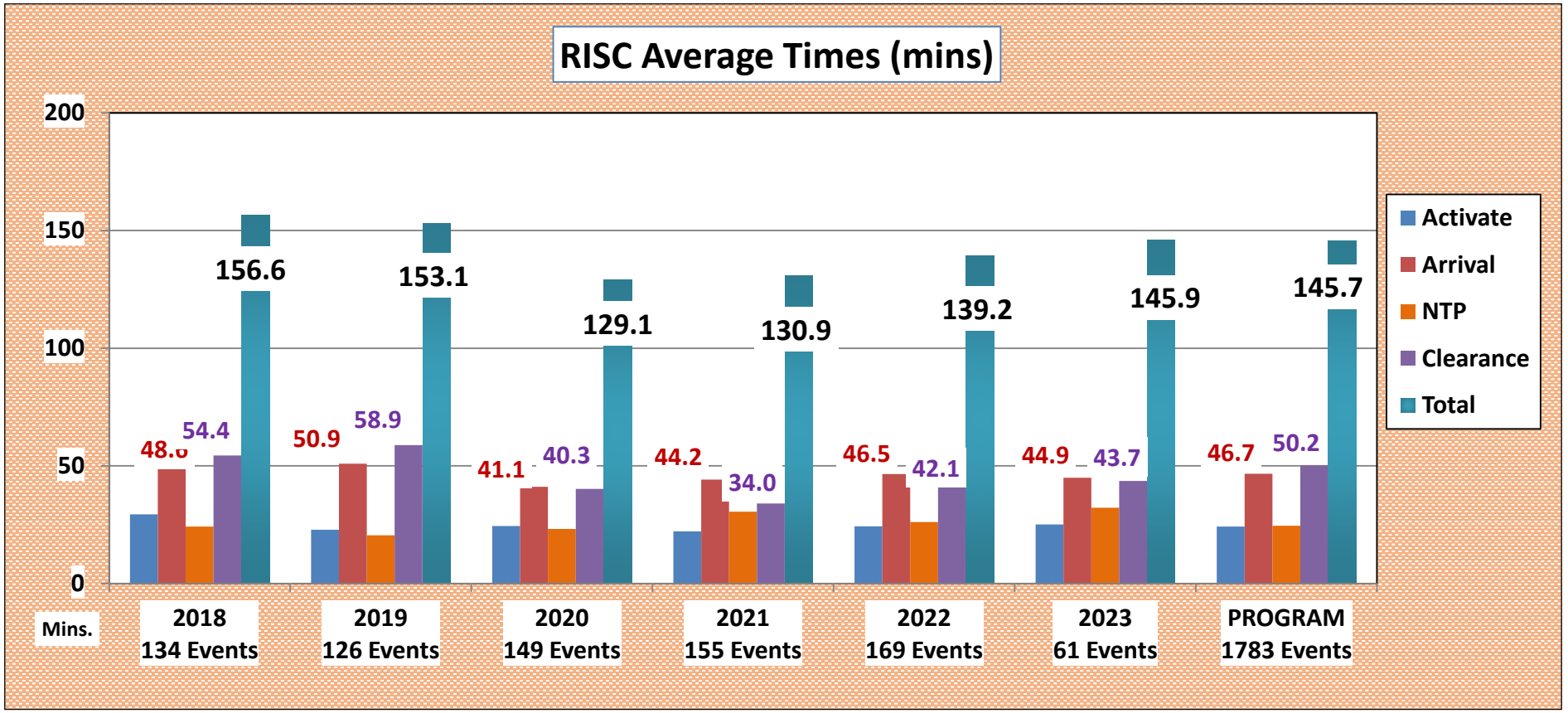
Road Ranger Assists

July 2022 through June 2023											
Yr/Month	Accident	Abandoned Vehicle	Debris	Disabled Vehicle						Other Event	Totals
					Gas	Tire	Jump	Minor Repair	No Assistance		
2022											0
July	817	724	632	5571	605	1436	160	89	858	1,321	**9,065**
August	931	706	683	5476	564	1414	187	113	1026	1,312	**9,108**
September	1058	617	628	4598	490	1174	154	100	890	1,271	**8,172**
October	974	770	656	5012	538	1282	155	98	868	1,314	**8,726**
November	1037	666	548	4561	510	1164	161	72	600	1,251	**8,063**
December	883	668	544	4487	556	1144	149	54	718	1,283	**7,865**
2023											-
January	748	638	609	4698	596	1134	137	69	728	1,340	**8,033**
February	807	514	524	4069	509	1019	138	80	713	1,221	**7,135**
March	941	552	566	4652	575	1102	170	94	826	1,326	**8,037**
April	986	515	496	4693	565	1215	144	100	806	1,314	**8,004**
May	1003	619	564	4878	544	1308	142	92	815	1,354	**8,418**
June											**0**
											-
Grand Totals	**10,185**	**6,989**	**6,450**	**52,695**	**6,052**	**13,392**	**1,697**	**961**	**8,848**	**14,307**	

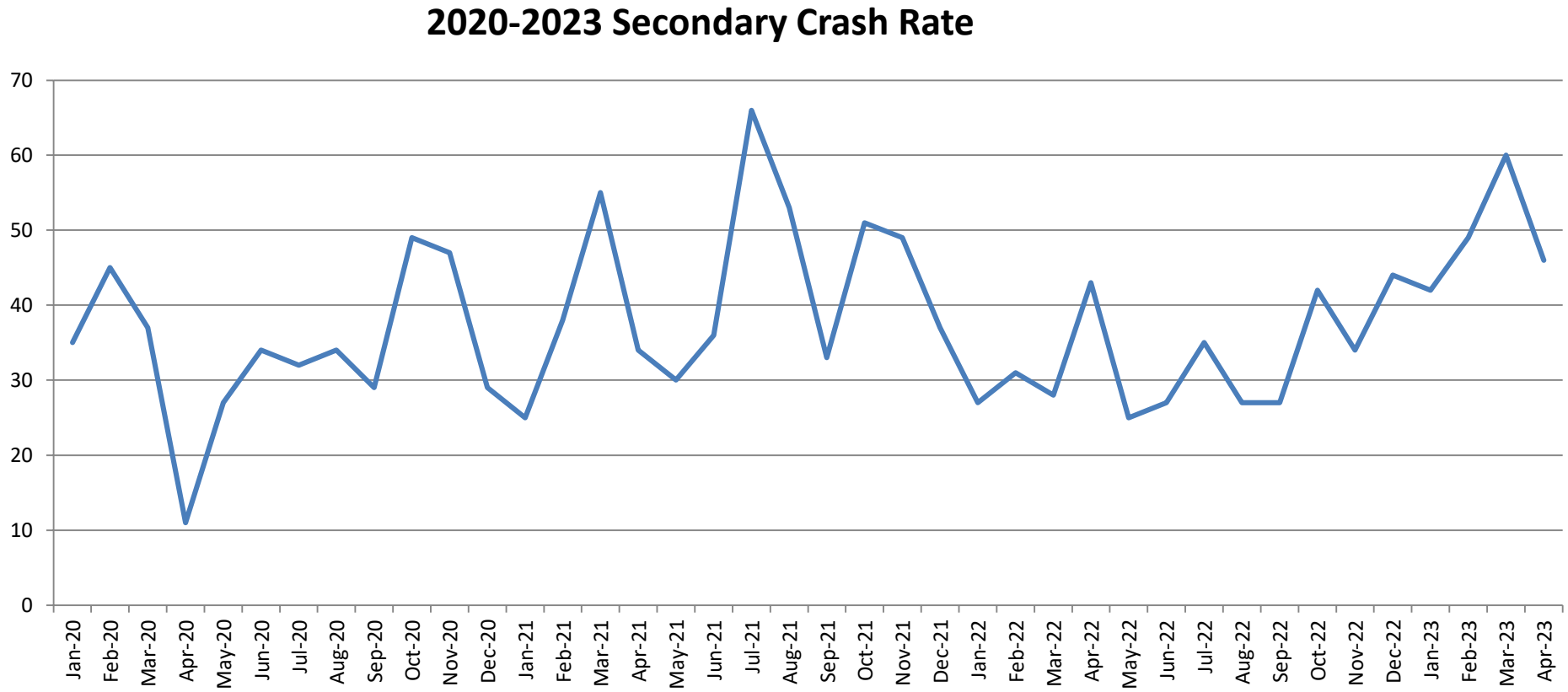
Rapid Incident Scene Clearance (RISC)



Rapid Incident Scene Clearance (RISC)

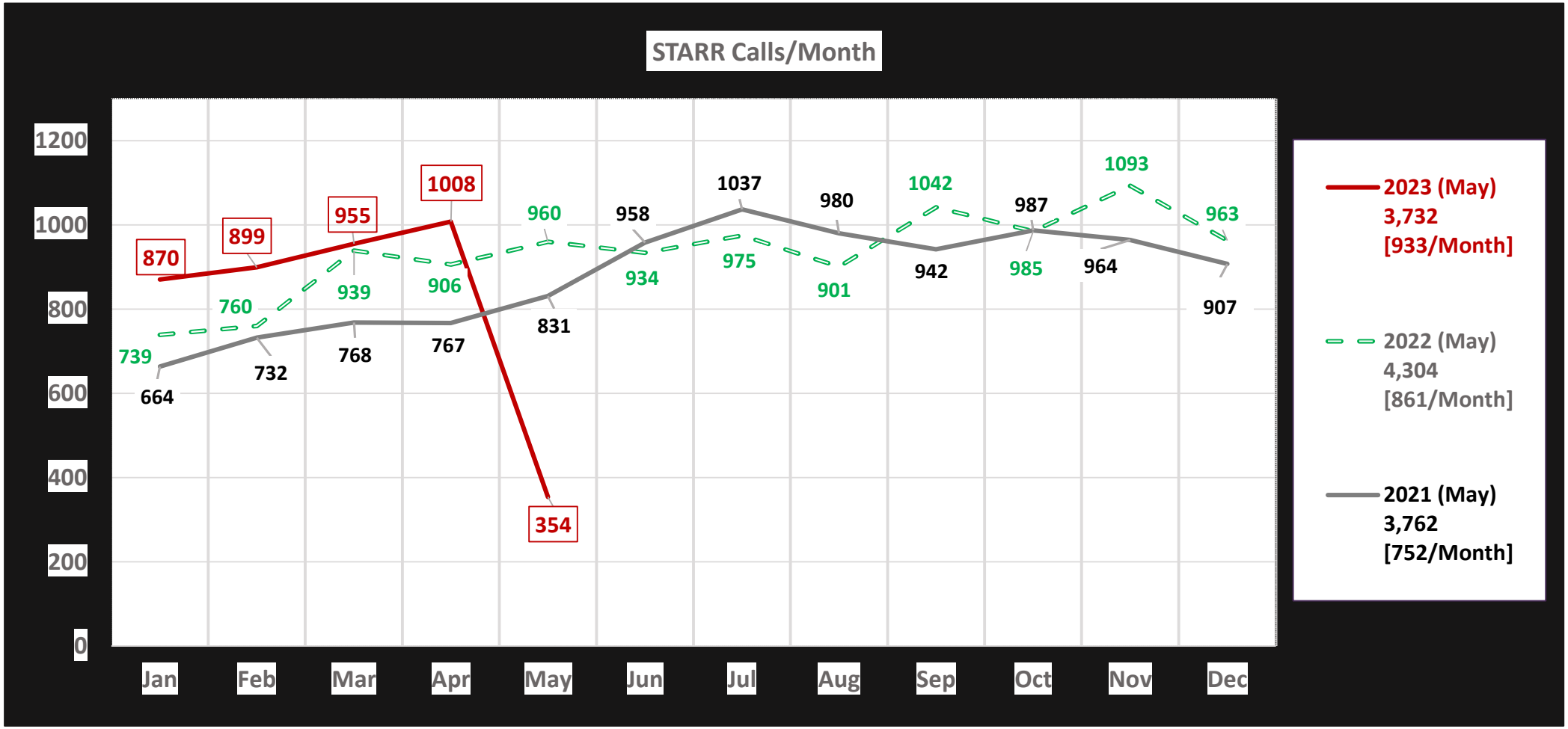


Incident Management Performance Measures



Feb-23	4.8%	49
Mar-23	5.1%	60
Apr-23	3.9%	46

Specialty Towing & Roadside Repair (STARR)



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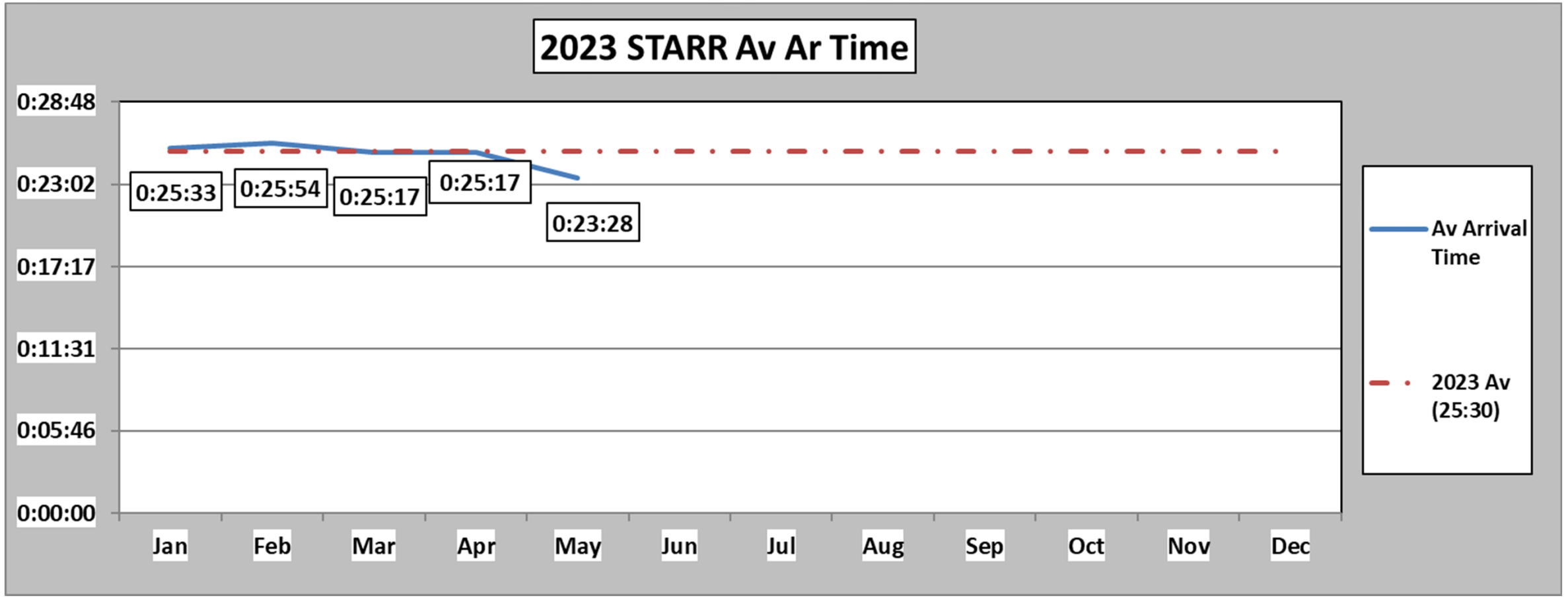


Thank You!

TRAFFIC MANAGEMENT PLAN (TMP)

OPERATIONAL PLAN

FOR US 1 AT PALM DRIVE (SW 344 ST)

Version 1.2

LAST UPDATE: JUNE 2023

Presented by SAUD KHAN

OPERATIONAL PLAN

The FHP, FDOT District , FDOT T/Pike and Miami Dade County have developed a TMP to maximize the northbound traffic flow on US 1 thru the Palm Drive (SW 344th Street) intersection. This choke point if left unattended during a Keys evacuation could result in unsafe backups for the evacuees. If this plan is implemented before the backup takes place it has a strong chance of prevented unnecessary delays.

The operational plan will define triggers, assign responsibility, identify team members and provide a sequence order of implementation (STAGES).

PRESENTATION OUTLINE

- TRIGGER (S)
- NOTIFICATIONS
- MANAGEMENT
- STAGES
- MONITORING MOT DEVICES
- DURATION
- EMERGENCY COORDINATING OFFICERS (ECO)

TRIGGER (S)

1. Mandatory Evacuation of any group or section of the Florida Keys.

2. State, County, or Traffic Operations Request.

NOTIFICATION

- **FDOT DISTRICT 6 MONROE COUNTY EOC LIAISON** will normally be the first person to become aware of an ordered or planed evacuation. The liaison will notify the Palm Drive TMP Management Team via email (or by phone if internet is unavailable).

- Upon receiving the notification/request the members will first respond back to the liaison (as well as all others copied on the original email) or other requestors that:
  - A) The notification/request has been received.
  - B) That they will relay the decision of the team as well as start time of the implementation of the TMP as soon as possible.
- If the requestor does not receive any receipt email within 15 minutes, they shall contact the members via phone until they reach a management team member.

MANAGEMENT TEAM

The Management Team is responsible for the decision to implement any Stage of the TMP and/or the optional closure. The team members will take into consideration all available information including staff, time of day, special events, timing, equipment availability, etc. to make the decision to initiate the Stage.

COMMAND STAFF:

- FHP Troop E Miami-Dade County Commander
- FDOT District 6 Maintenance Engineer
- FDOT Turnpike Maintenance Engineer

- In addition to making the decision to implement the plan they will be responsible for notifying all other stakeholders under their area of responsibility of the activation.
- Also included in the Management Team Email group are members of FHP, Miami-Dade County and FDOT who will provide information and critical support in the event of a request.

SUPPORT STAFF:

- Miami-Dade Miami-County Traffic Engineer
- FHP Troop E Miami-Dade County
- FHP Troop K Miami-Dade County Alternate
- FDOT District 6 South Dade Maintenance Engineer
- FDOT District 6 South Dade Operations Manager
- FDOT District 6 Emergency Coordinating Officer
- FDOT District 6 TMC Manager
- FDOT District 6 Monroe County EOC rep.
- FDOT District 6 Maintenance of Traffic Specialist
- FDOT Turnpike Emergency Coordinating Officer
- FDOT Turnpike TMC Manager

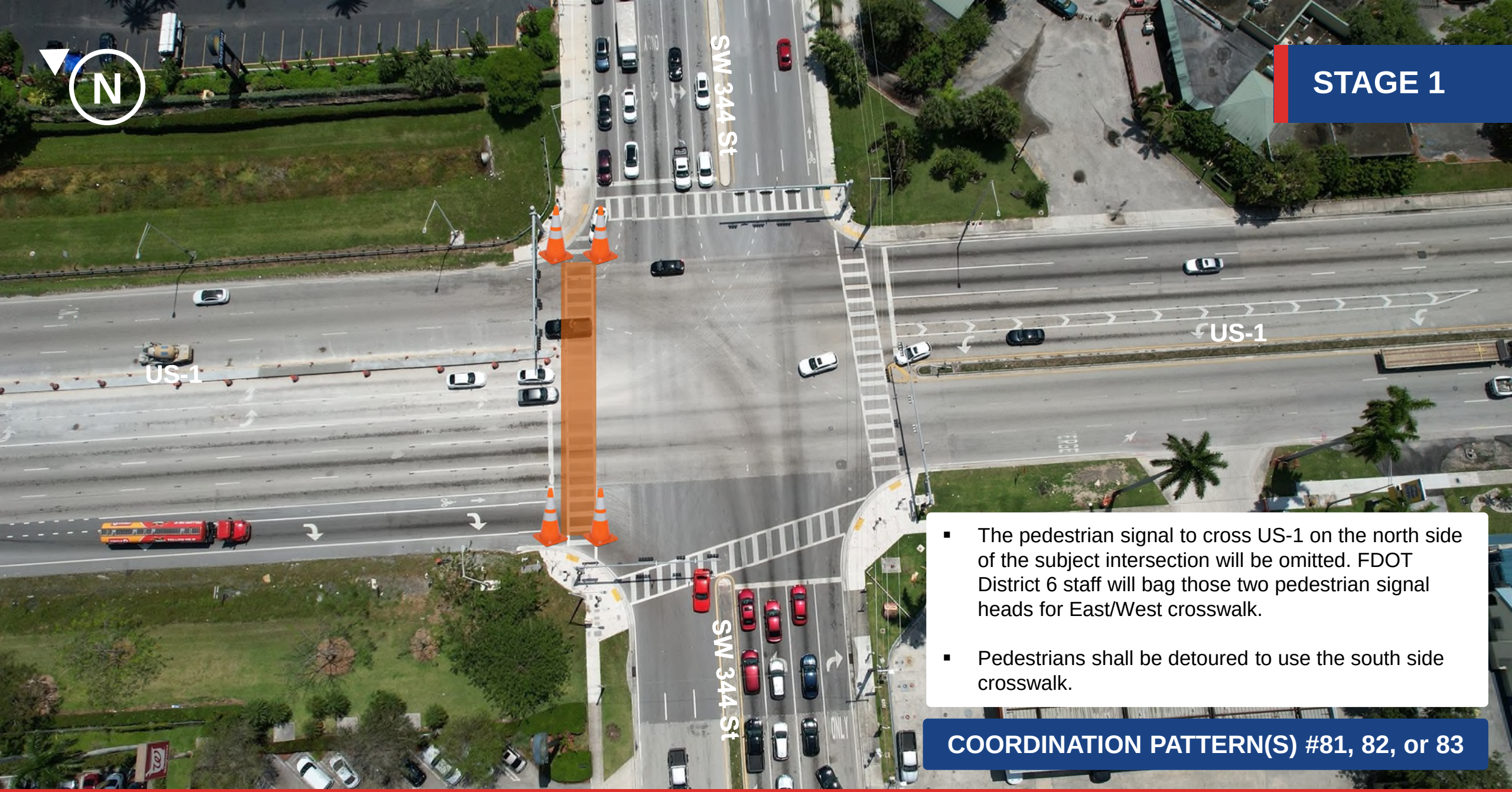
STAGE 1 (ACTIVATION)

- The Miami- Dade County Traffic Engineer will have staff implement special signal timing and provide estimated time that this will begin.

- FHP will assign and deploy staff to the site. They will notify the team of the name and contact information of the Officer in Charge (OIC) as well as estimated time of arrival.

- FDOT D-6 Maintenance Staff will stage all needed MOT devices supplied by T/Pike to pre-determined locations as direct by the FHP OIC and close the North leg pedestrian crossing.

- FHP will monitor and evaluate the need to close the northbound left turn lane to Krome Avenue as per the plan.



STAGE 1

- The pedestrian signal to cross US-1 on the north side of the subject intersection will be omitted. FDOT District 6 staff will bag those two pedestrian signal heads for East/West crosswalk.
- Pedestrians shall be detoured to use the south side crosswalk.

COORDINATION PATTERN(S) #81, 82, or 83

PEDESTRIAN SIGNAL TO CROSS US-1 ON THE NORTH SIDE WILL BE OMITTED

STAGES 2-6 (ACTIVATION)

- Activation of all additional phases is at the direction of the FHP OIC with Traffic Control Devices installed by FDOT staff.

STAGE 2

Monitor the northbound left-turn lane at US 1 and Krome Avenue, if left turning vehicles spill onto the through lane affecting evacuation traffic flow, the north US 1 to north Krome Avenue left-turn lane shall be closed to traffic.

REQUIRED MOT TO CLOSE TURN LANE

Approximately 15 to 20 Traffic Cones

Portable "No Left-Turn" Signs (R3-2) to be Placed in the Median (2 or 3 signs)

COORDINATION PATTERN(S) #84, 85, or 86

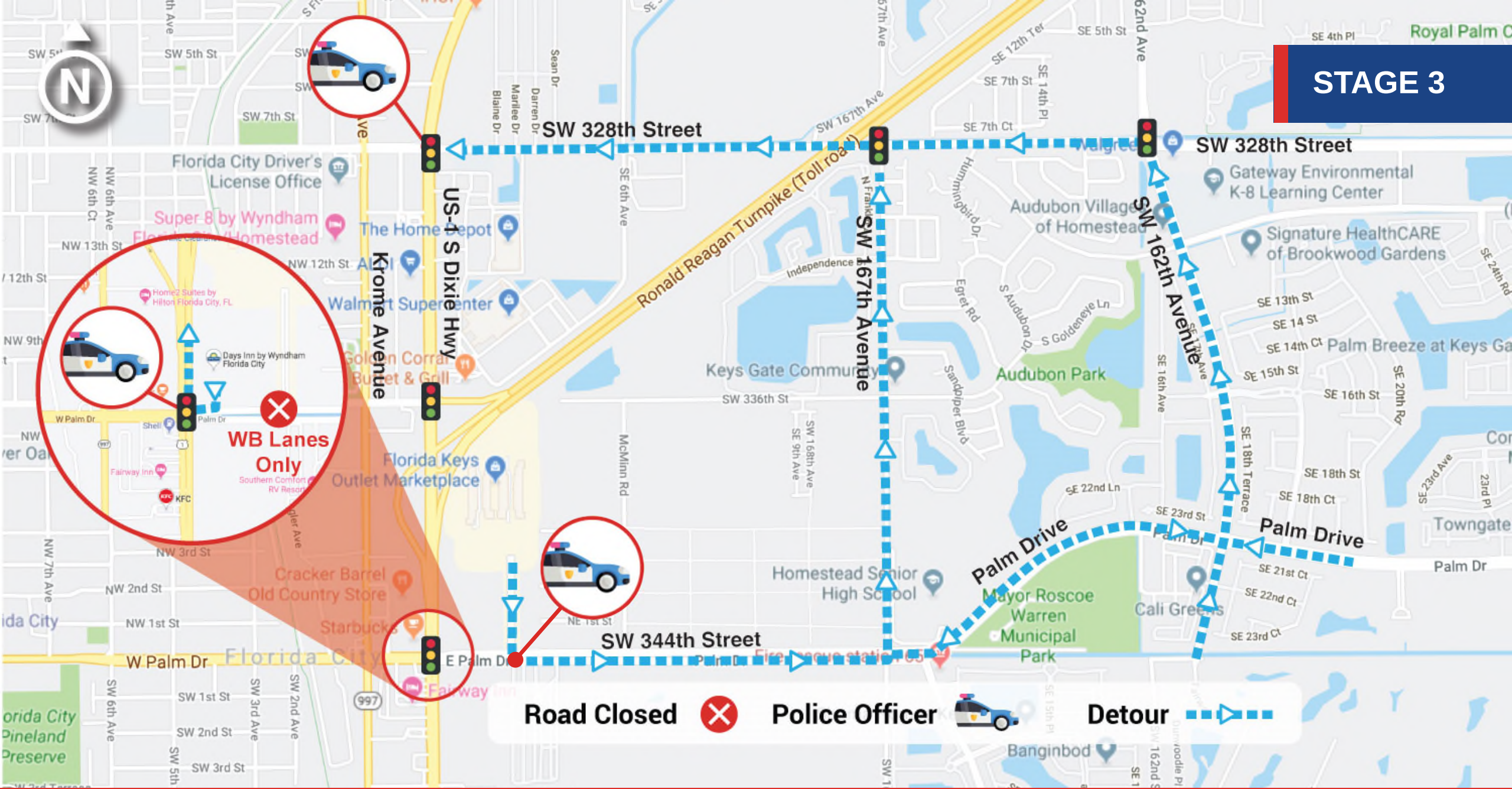
MONITOR NORTH US-1 TO NORTH KROME AVENUE LEFT-TURN LANE

STAGE 3

- All the closed/omitted movement(s) in the previous Stage(s) will also be implemented in this Stage.
- The westbound approach will be closed to traffic. Barricades and cones will be installed by FDOT District 6 and Turnpike staff. The traffic from this approach will be detoured to SW 328th St. via SW 167th Avenue.
- A short westbound right turn bay will remain open to provide access to the property in the northeast corner of the subject intersection so vehicles may leave the site and make a right turn northbound onto US-1. This movement will not be signal controlled, and vehicles will turn by available gaps in northbound traffic.

COORDINATION PATTERN #87

ELIMINATE TRAFFIC FROM EAST APPROACH AT THE US-1/PALM DRIVE INTERSECTION


STAGE 3
SW 328th Street
SW 328th Street
US-1 S Dixie Hwy
Krome Avenue
Ronald Reagan Turnpike (Toll road)
SW 167th Avenue
SW 162nd Avenue
WB Lanes Only
SW 344th Street
Palm Drive
Palm Drive
Florida City Driver's License Office
Super 8 by Wyndham Florida City/Homestead
The Home Depot
Walmart Supercenter
Florida Keys Outlet Marketplace
Keys Gate Community
Audubon Park
Audubon Village of Homestead
Gateway Environmental K-8 Learning Center
Signature HealthCARE of Brookwood Gardens
Palm Breeze at Keys Ga
Homestead Senior High School
Mayor Roscoe Warren Municipal Park
Cracker Barrel Old Country Store
Starbucks
Towngate
Banginbod
Road Closed
Police Officer
Detour

MONITORING

- The FHP Troop E on site constantly monitor traffic conditions.

- Miami Dade County, FDOT D6 TMC Manager and Florida Turnpike Manager will remotely monitor the Palm Drive intersection as well as the US-1 corridor. They will relay traffic conditions to the OIC as well as other management staff. FHP Troop E will also monitor on site.

MOT DEVICES

- Supply and placement of Traffic Control Devices by the FDOT D-6 South Dade Maintenance Engineer (or designee).
- Additional support, if required, will be supplied by the Turnpike. The South Dade ME will provide the contact information of district field staff to the OIC as soon as it is known.

DURATION

- The duration shall be decided by the command staff based on field observations as well as other factors. They will inform the entire Team of their decision. The signalization component of STAGE 1 can run unattended and will be monitored remotely. OIC may also dispatch officers to monitor off-site.

EMERGENCY COORDINATING OFFICERS

- The individual Emergency Coordinating Officers (ECO) will track the progress and report the status to State and outside agencies as needed. As well proved support as requested by the command staff.

Thank you!

FDOT

EMERGENCY MANAGEMENT

Crystal Schaefer

District Emergency Management Specialist

Our Values

- One FDOT - We are one agency, one team.
- INTEGRITY - We always do what is right.
- RESPECT - We value diversity, talent and ideas.
- COMMITMENT - We do what we say we are going to do.
- TRUST - We are open and fair.
- CUSTOMER DRIVEN - We listen to our customers.

Our Mission

- The department will provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities.

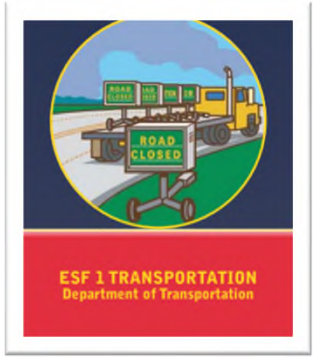
Our Vision

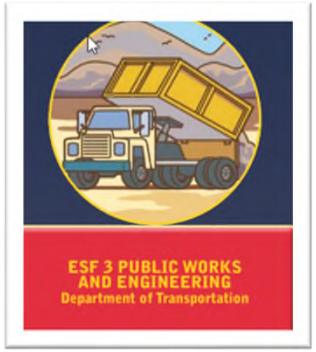
- As one FDOT team, we serve the people of Florida by providing a transportation network that is well planned, supports economic growth, and has the goal of being congestion and fatality free.

FDOT

EMERGENCY MANAGEMENT

- FDOT Emergency Management provides expertise, programs, and services to help the department prepare for, respond to, recover from, and mitigate against natural disasters and other emergencies affecting the agency and Florida's intermodal transportation systems.
- FDOT EM also provides the agency and its local, state, and federal partners with situational awareness twenty-four hours a day.
- FDOT EM is a critical element of the State Emergency Response Team (SERT) is the lead agency for two SERT emergency support functions: **ESF 1 transportation** and **ESF 3 public works and engineering**.





FDOT
EMERGENCY MANAGEMENT

FLORIDA EMERGENCY SHOULDER USE

Emergency Shoulder Use (ESU) is Florida's innovative strategy to temporarily increase traffic flow and capacity during major hurricane evacuations using existing paved shoulders. First developed in 2017 and covering key corridors within the state, ESU replaced the former one-way plans, also known as contraflow and lane reversal.

ESU has many benefits, especially when compared to one-way operations.

- ESU provides additional capacity and improves traffic flow.
- ESU may be used all day and night, while one-way operations are restricted to daytime only.
- Far fewer resources such as cones, signs, barriers, law enforcement officers, and FDOT personnel are required to implement ESU.
- Shorter notice is required for implementation and deactivation of ESU.
- Flexibility exists to implement ESU by corridor or section as needed.
- ESU does not impact opposing traffic flow, such as first responders travelling toward an incident.
- Arterial and local roadways are not disrupted during ESU operations.

Federal Highway Administration (FHWA) Emergency Relief (ER) Program

ER Program

Repair or reconstruction of highways, roads, and trails that have suffered serious damage as a result of (1) natural disaster over a wide area or (2) catastrophic failures from any external cause.

Restore essential traffic

Restoring essential traffic is defined as the minimum repairs necessary to open the roadway to emergency vehicles, utility and/or construction vehicles and roadways that lead to emergency facilities (if no detours are available).

FHWA ER Program Agency Role

- Request Emergency Relief Funding
- Participate on Detailed Damage Teams
- Identify Damaged Sites
- Complete the Detail Damage Inspection Reports (DDIR)
- Complete Emergency Repairs (ER)
- Administer Permanent Restoration (PR) Projects
- Coordinate Locally Administered Projects

Debris Removal

First Push

Initial effort to clear roadway includes cut & toss operations to push debris out of traveled way.

First Pass

Initial effort to collect debris pushed aside during first push operations.

All debris (vegetative & non-vegetative) must be collected at the same time as first pass operation must be within **debris clearing limits**.

Debris Clearing Limits

- Traveled Way
- Clear Zone

Additional Limits:

Eligible for Emergency Relief


KELLY BROTHERS

Any Questions?
Recommendations?

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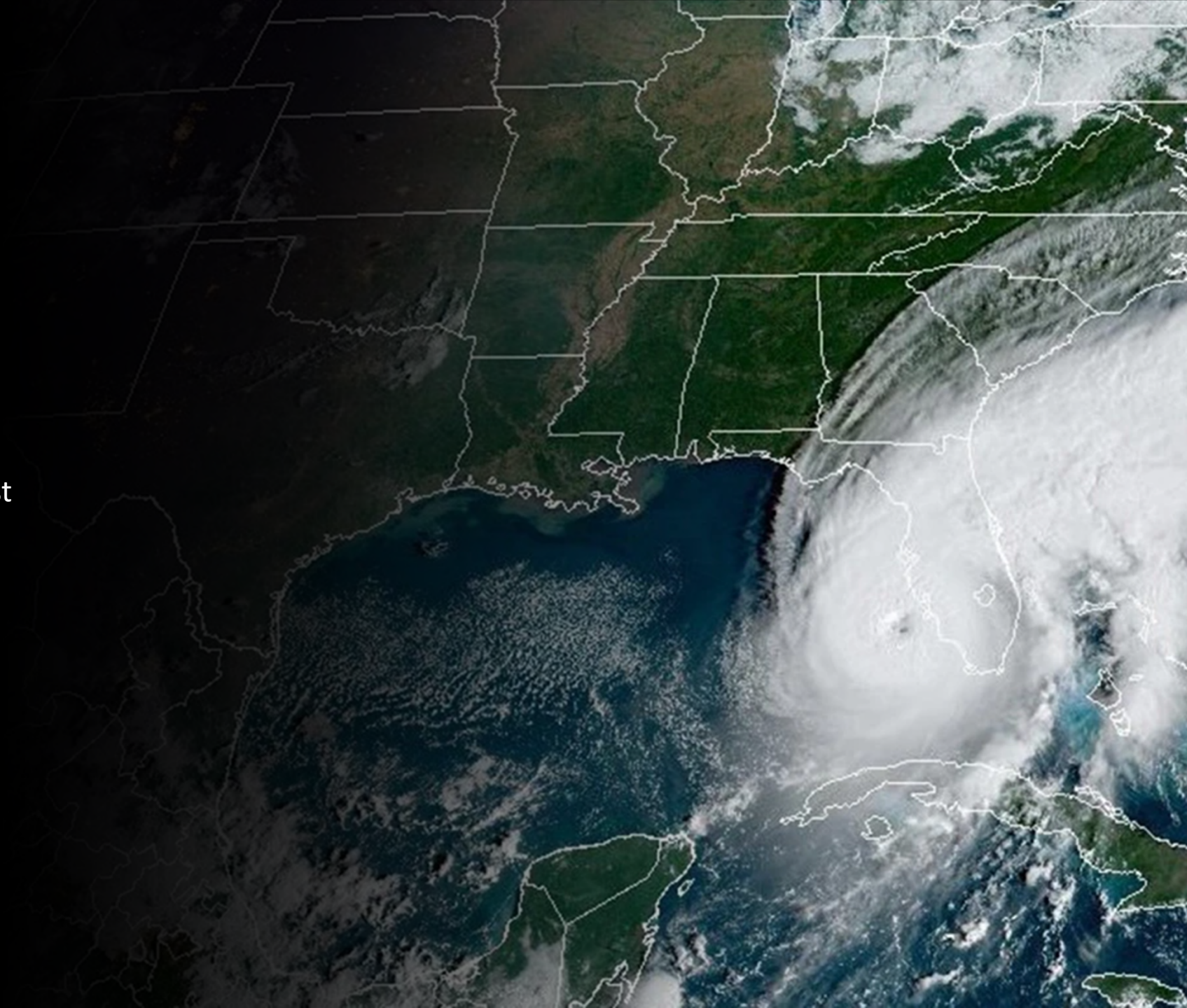
District Emergency Management Specialist
Office: 305-470-5130
Cell: 786-295-7047
Email: Crystal.Schaefer@dot.state.fl.us



Hurricane Season 2023

Lessons Learned about Season Forecasts, Storm Surge & Rapid Intensification

Jon Rizzo
Warning Coordination Meteorologist
NOAA / NWS Florida Keys

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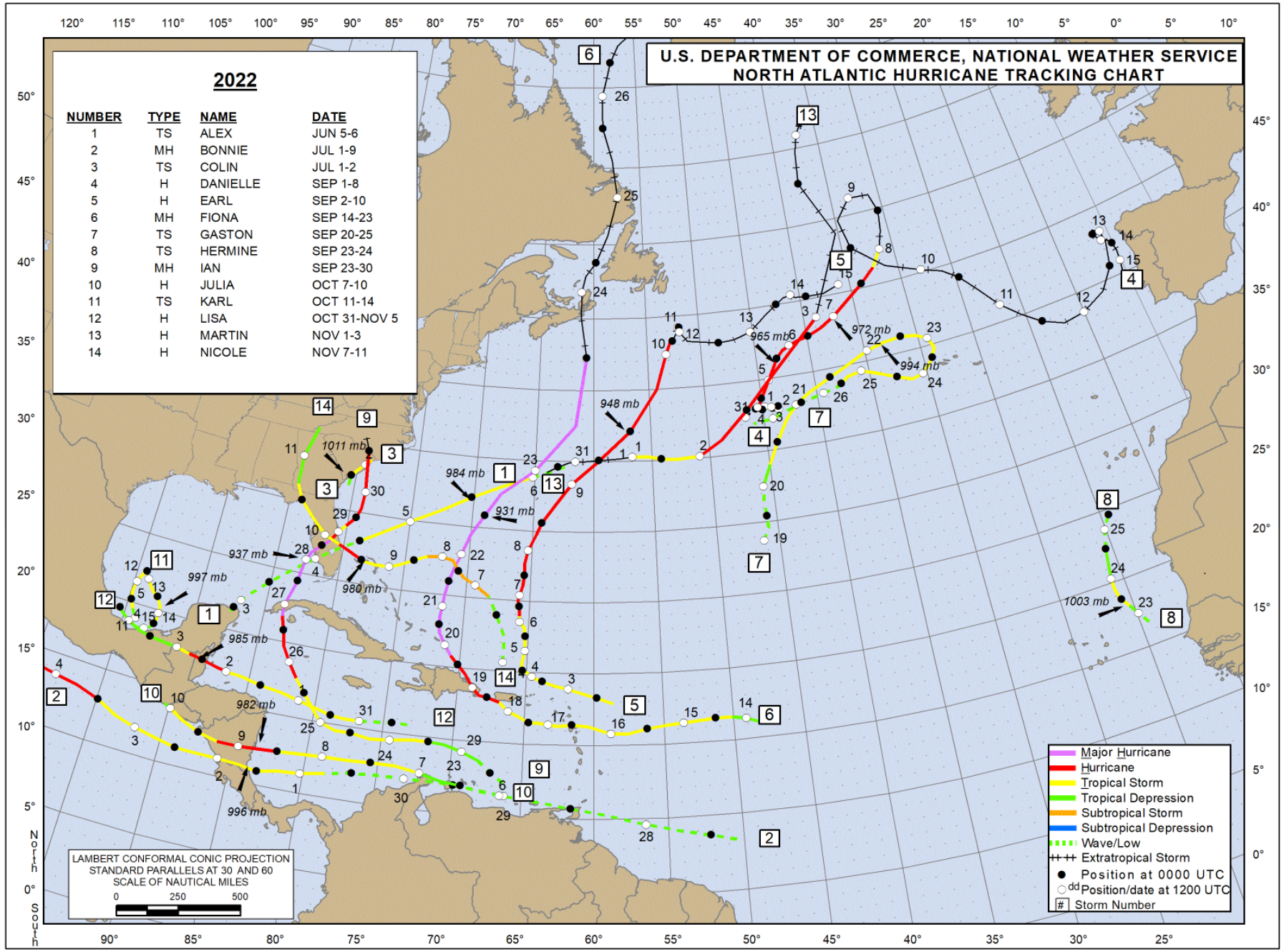
C: (305) 240-0248


U.S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
2022
NUMBER TYPE NAME DATE
1 TS ALEX JUN 5-6
2 MH BONNIE JUL 1-9
3 TS COLIN JUL 1-2
4 H DANIELLE SEP 1-8
5 H EARL SEP 2-10
6 MH FIONA SEP 14-23
7 TS GASTON SEP 20-25
8 TS HERMINE SEP 23-24
9 MH IAN SEP 23-30
10 H JULIA OCT 7-10
11 TS KARL OCT 11-14
12 H LISA OCT 31-NOV 5
13 H MARTIN NOV 1-3
14 H NICOLE NOV 7-11
1011 mb
997 mb
985 mb
982 mb
996 mb
937 mb
980 mb
984 mb
931 mb
948 mb
965 mb
972 mb
994 mb
1003 mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30 AND 60
SCALE OF NAUTICAL MILES
0 250 500
Major Hurricane
Hurricane
Tropical Storm
Tropical Depression
Subtropical Storm
Subtropical Depression
Wave/Low
Extratropical Storm
Position at 0000 UTC
dd Position/date at 1200 UTC
Storm Number

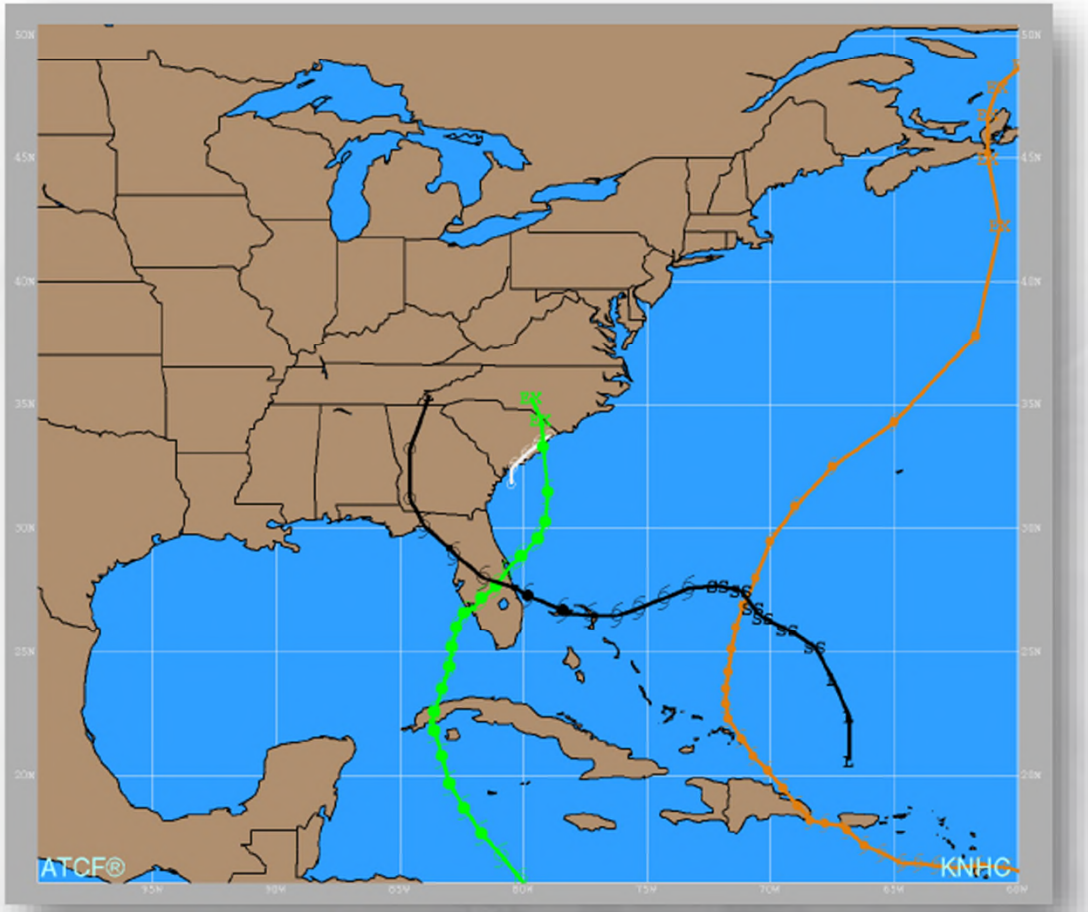
Season 2022 Review

- 14 named storms; 8 hurricanes; 2 major hurricanes
- 3 hurricanes made U.S. mainland landfalls, with Ian tied for the 5th strongest U.S. landfall (Cat 4, 150 mph).
- NOAA Hurricane Hunter Aircraft flew over 582 mission hours, including passing through hurricane eyes 65 times including 1,700 instrument deployments
- NOAA Gulfstream IV flew NOAA's furthest east research mission from the Cabo Verde Islands
- The NOAA Altius 600 uncrewed aircraft system flew into Ian several hours before landfall, measuring a peak wind of 216 mph at 2,150 feet.

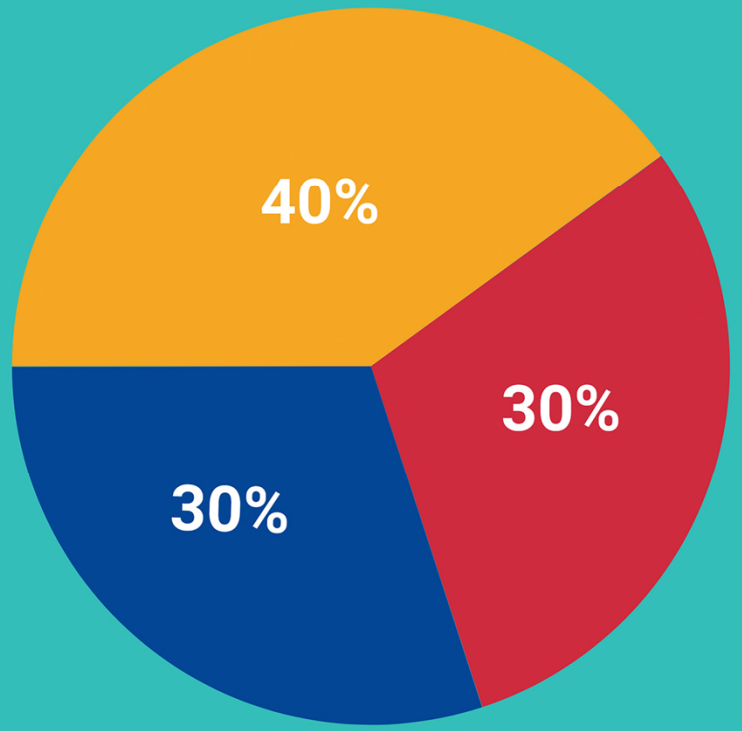

U.S. AIR FORCE

2022 Seasonal Impacts – United States

- 5 U.S. landfalls - 2 from Ian
  - TS Colin in South Carolina
  - Fiona (category 1) in Puerto Rico
  - Ian (category 4) in SW Florida and as a category 1 hurricane in South Carolina
  - Nicole (category 1) in Florida
- Direct U.S. fatalities: 72 (66 from Ian)
- Indirect U.S. fatalities: 111
  - Fiona: 21 (PR), Ian: 90
- $112.9B in U.S. damage from Ian



2023 Atlantic Hurricane Season Outlook



Above normal Near normal Below normal

Season probability

Named storms
12 - 17

Hurricanes
5 - 9

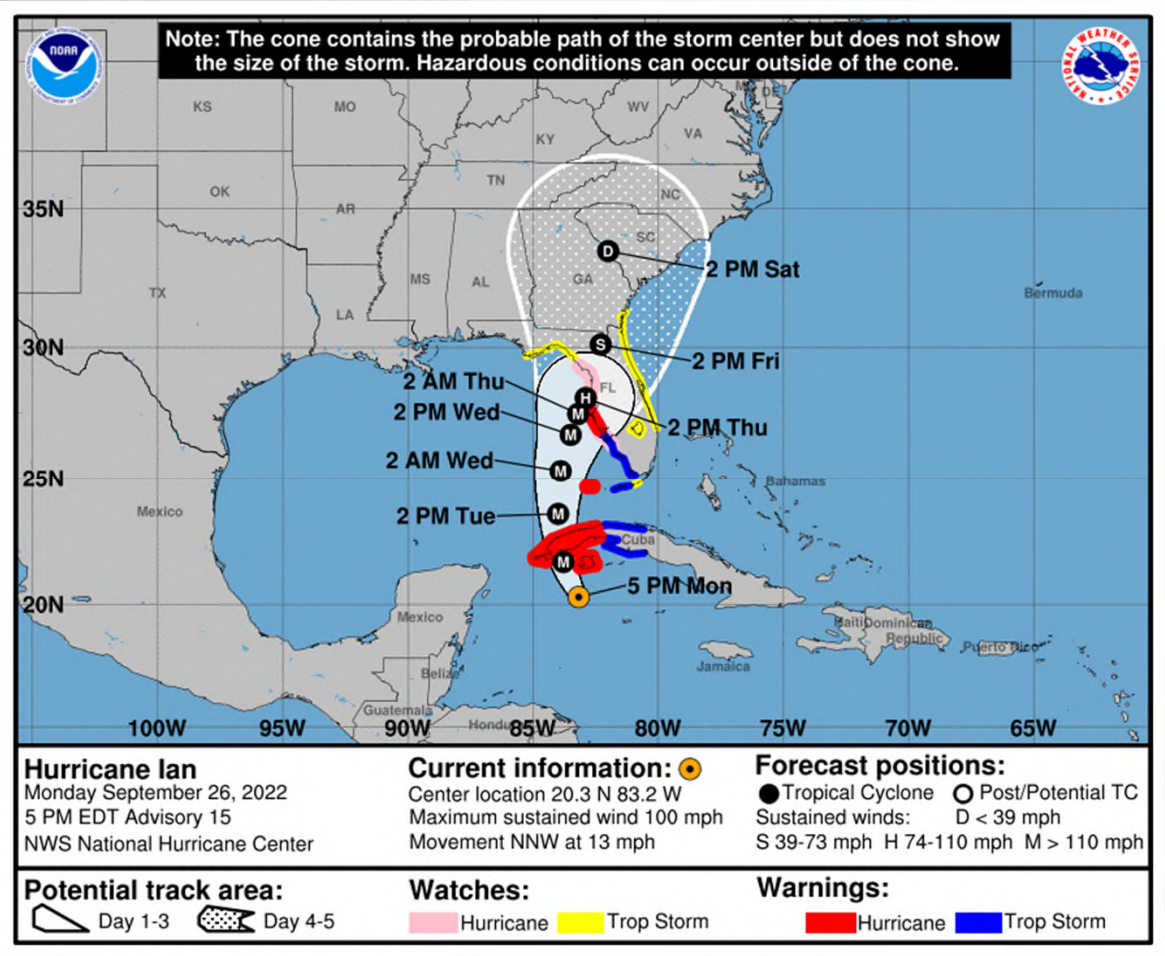
Major hurricanes
1 - 4

Be prepared: Visit hurricanes.gov and follow @NWS and @NHC_Atlantic on Twitter.

May 2023

NOAA

Hurricane Ian Recap – Florida Keys

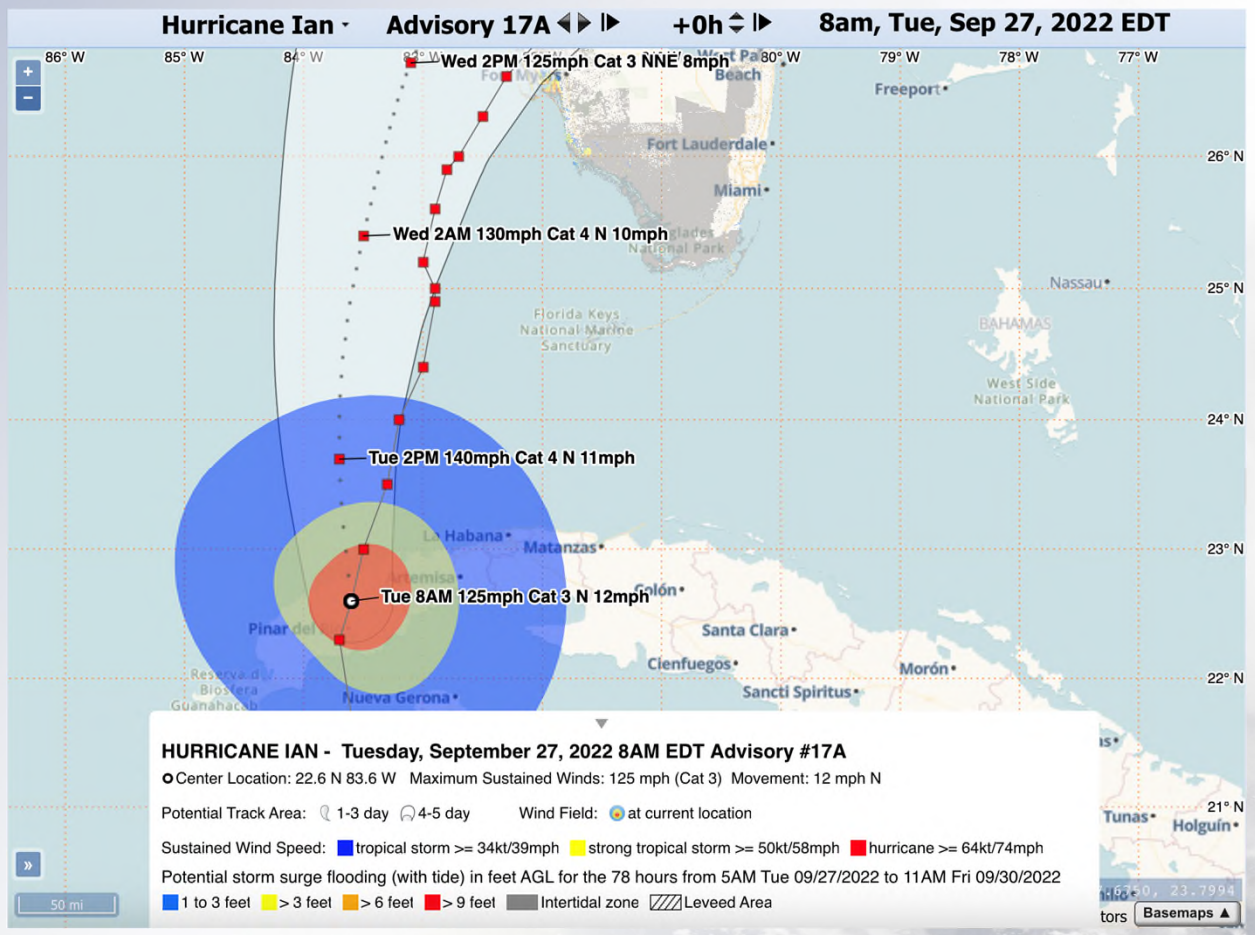


Public focused on the “track cone” and NOT on the warnings nor potential threats

Even threats and warnings are not the “whole story"

RISK, which includes THREAT + VULNERABILITY, must be included, and this will be different for each resident and business owner

Hurricane Ian Recap – Florida Keys



Note the actual track (ahead) – solid line with red boxes – strays outside the track cone.

All this means is that Ian took the 1/3 chance of leaving the forecast cone.

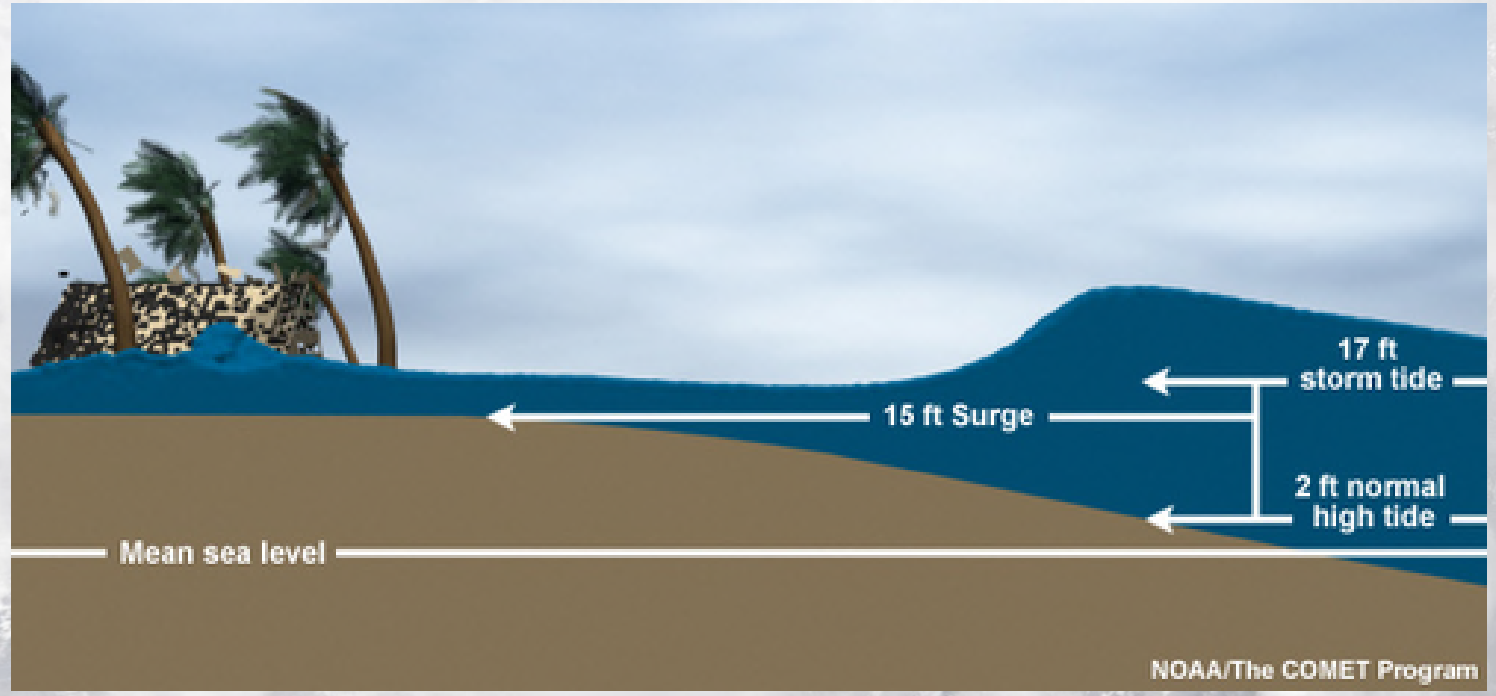
Ian's center and radius of hurricane-force winds passed closer to the Florida Keys than had been forecast as of early Tuesday morning

Storm Surge Review

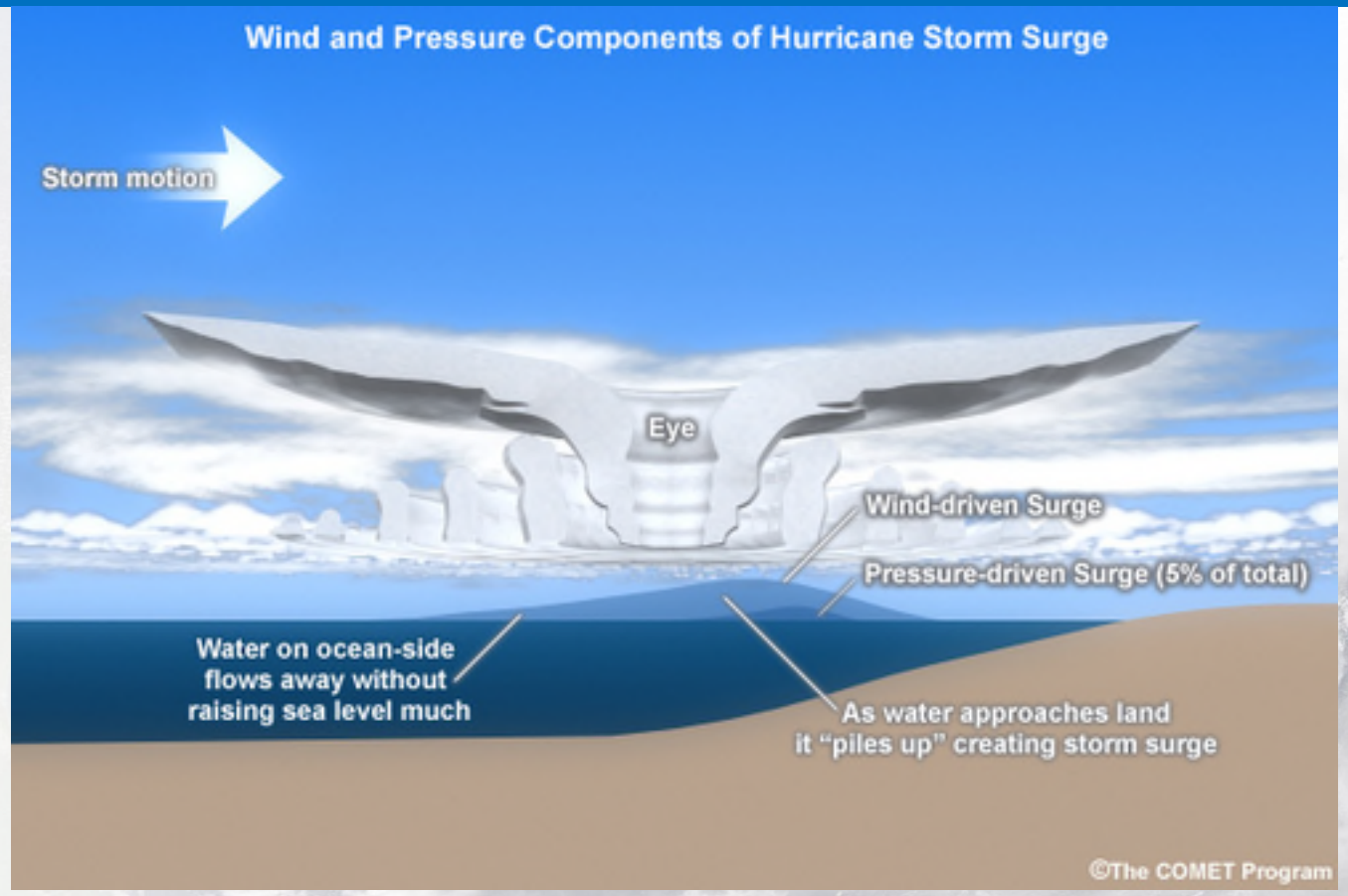
Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tides.

The combination of storm surge plus the astronomical tide is called the storm tide.

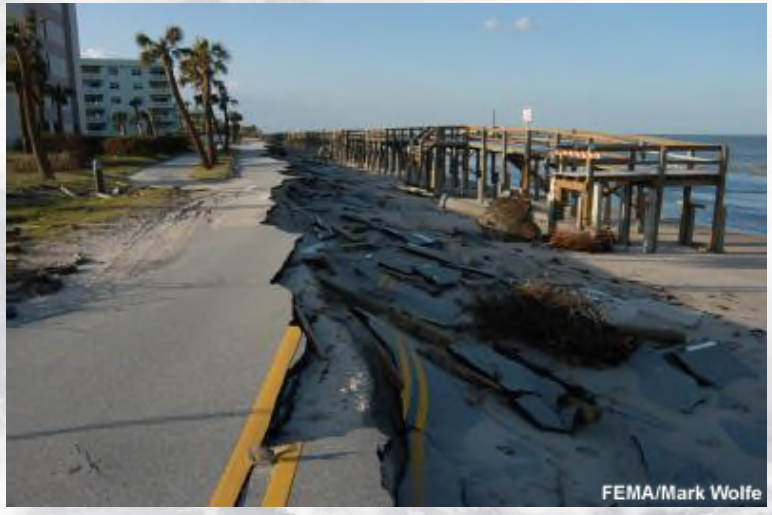
This rise in water level can cause extreme flooding in coastal areas particularly when storm surge coincides with normal high tide, resulting in storm tides reaching up to 10 feet or more in some cases.



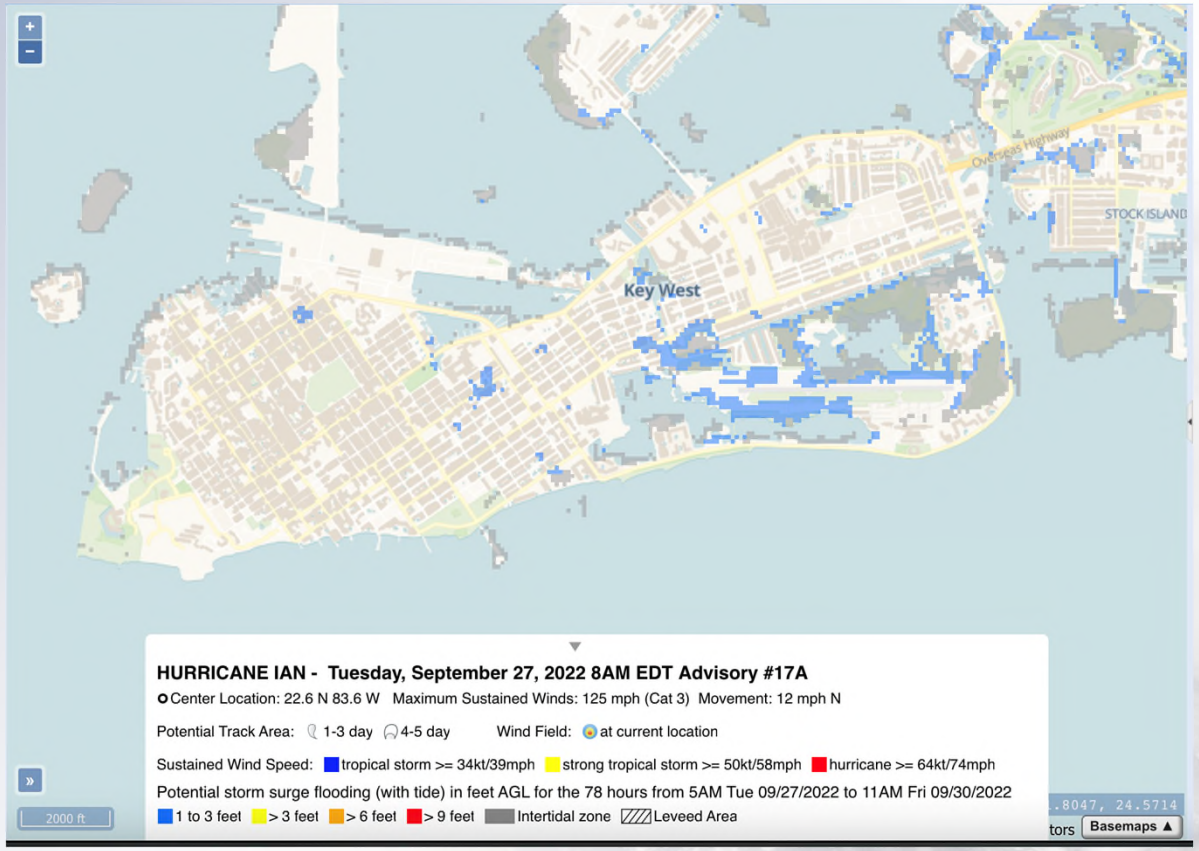
Storm surge forms from the water pushed towards shore by the force of the winds moving cyclonically around the storm. The rising force from the low pressure of the center of the storm is minimal compared with the rise in water due to the winds pushing water towards shore. Therefore – "peak wind" and "lowest pressure" are not nearly all the factors that go into how high the water gets at YOUR location.



Storm surge is a very complex phenomenon because it is sensitive to the slightest changes in storm intensity, forward speed, size (the radius of maximum winds), angle of approach to the coast, central pressure (minimal contribution in comparison to the wind), and the shape and characteristics of coastal features such as bays and estuaries.



Limitations of Potential Storm Surge Maps over Complex Terrain



Potential Storm Surge Flood Map (Top 10% probability of forecast water level height)

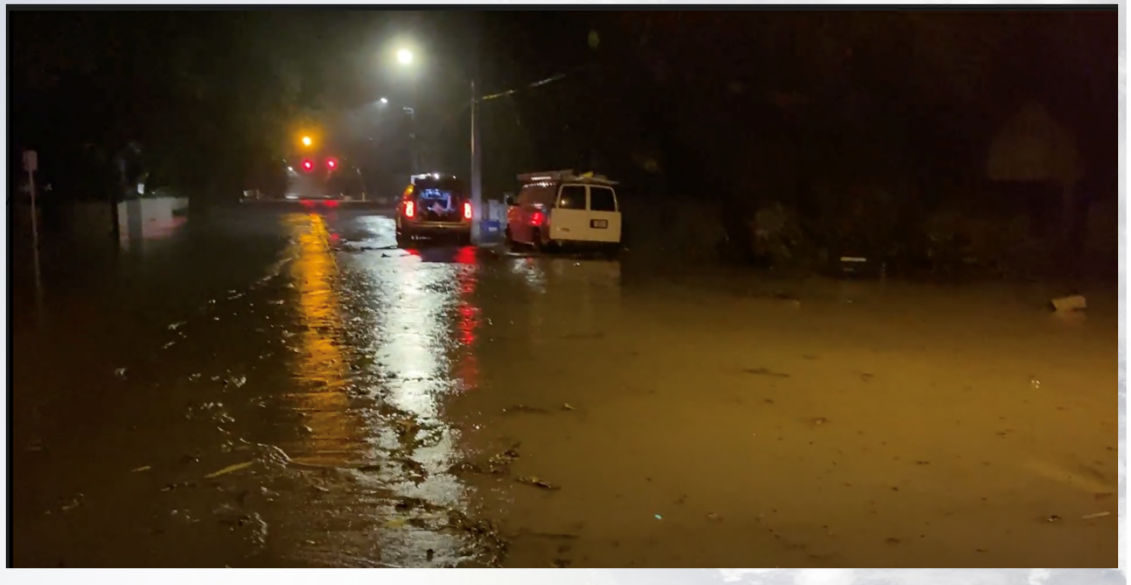
1 to 3 feet was indicated – but did not indicate much flooding much of the south central / southwest part of Key West

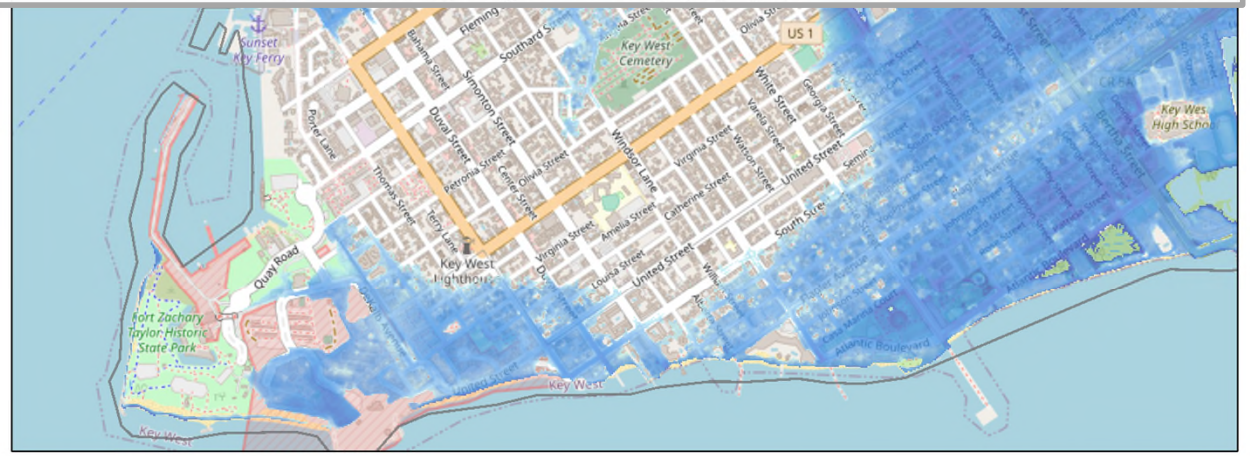
Representing the Surge via “Out-of-the-Box” Means

NOT AN ACTUAL IAN SURGE OBSERVATION MAP!!

“Kludge” from Sea Level Rise Scenario for 4.3 feet above Mean Higher High Water

Photo Below: David Ross, NWS Florida Keys



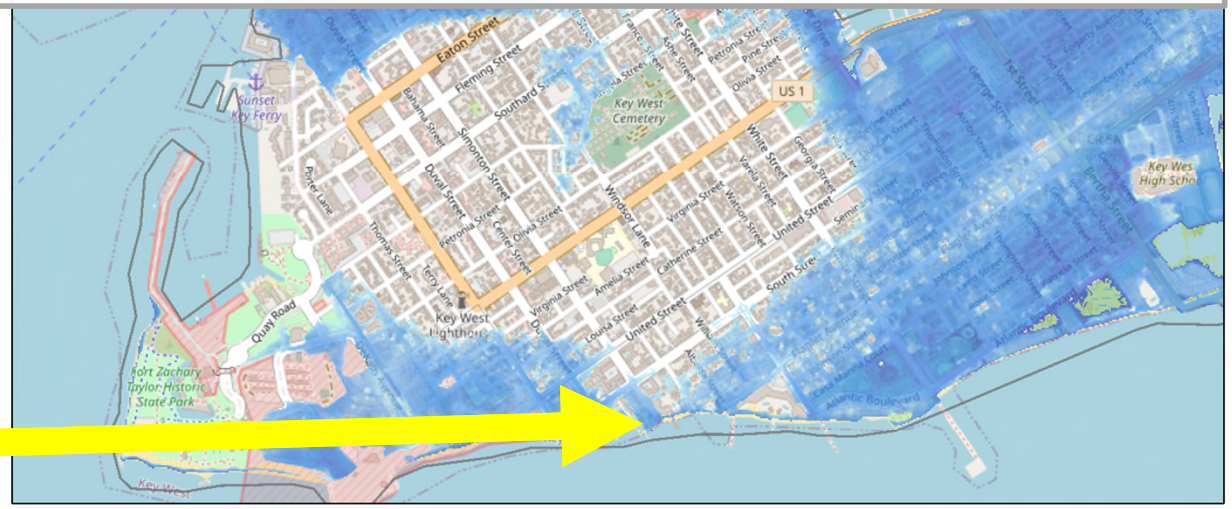


Representing the Surge via “Out-of-the-Box” Means

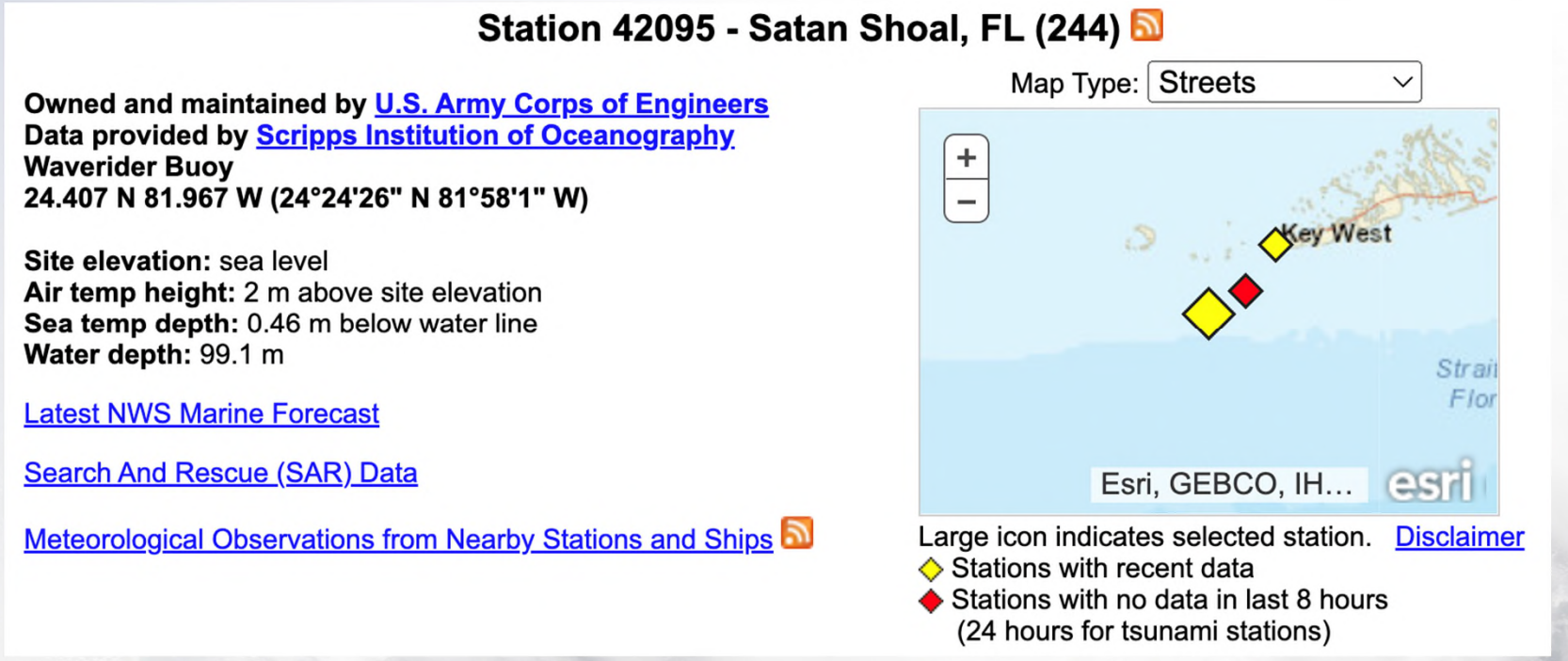
USGS Rapid Deployment Gauges

Can provide near-realtime data, but are NOT tide gauges.
They activate when water hits the base of the collector tube

The Simonton Street Rapid Deployment Gauge (RDG)
activates at a water level of 3.1 NAVD88

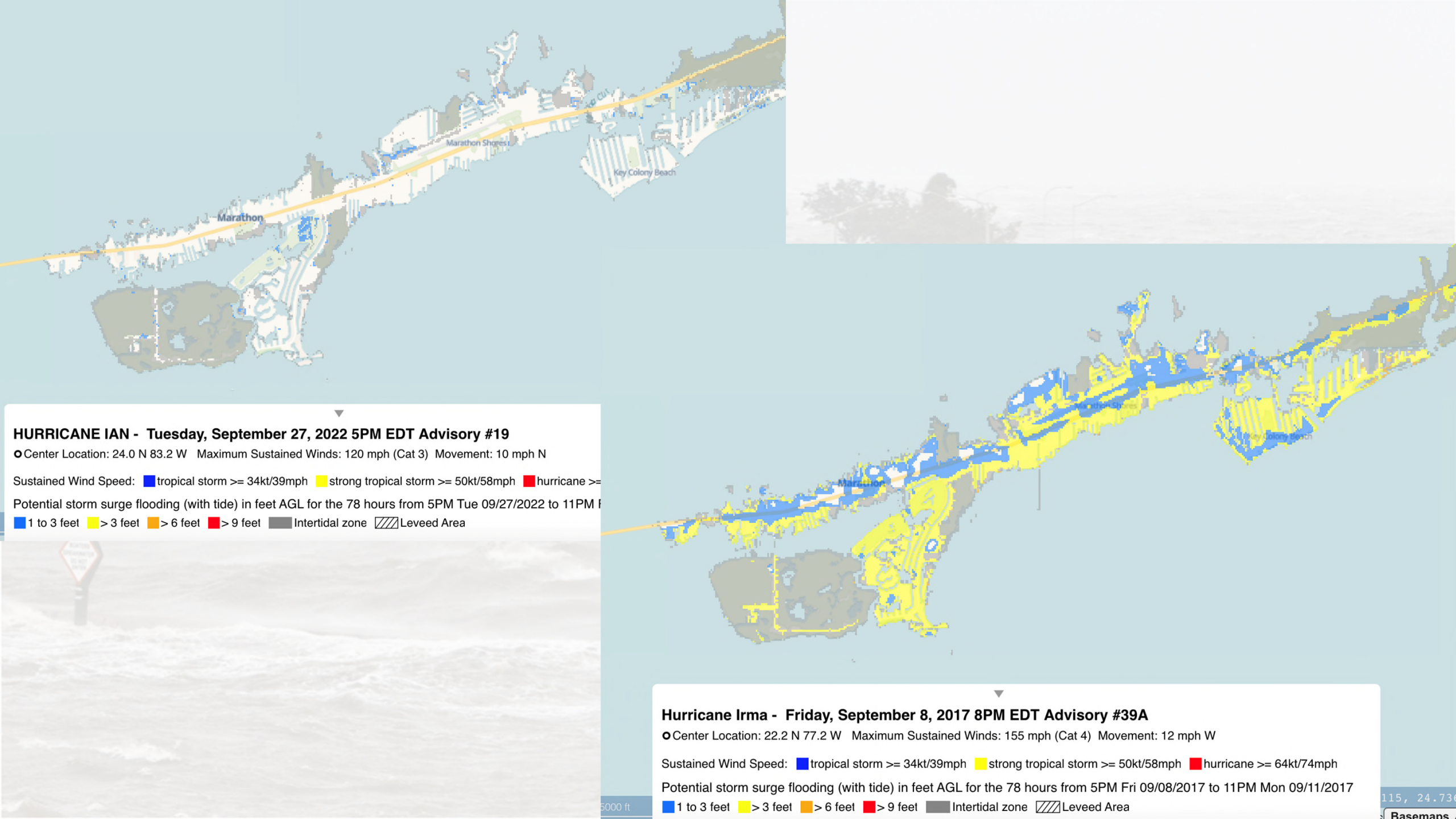


Learning from Offshore Measured Sea Heights



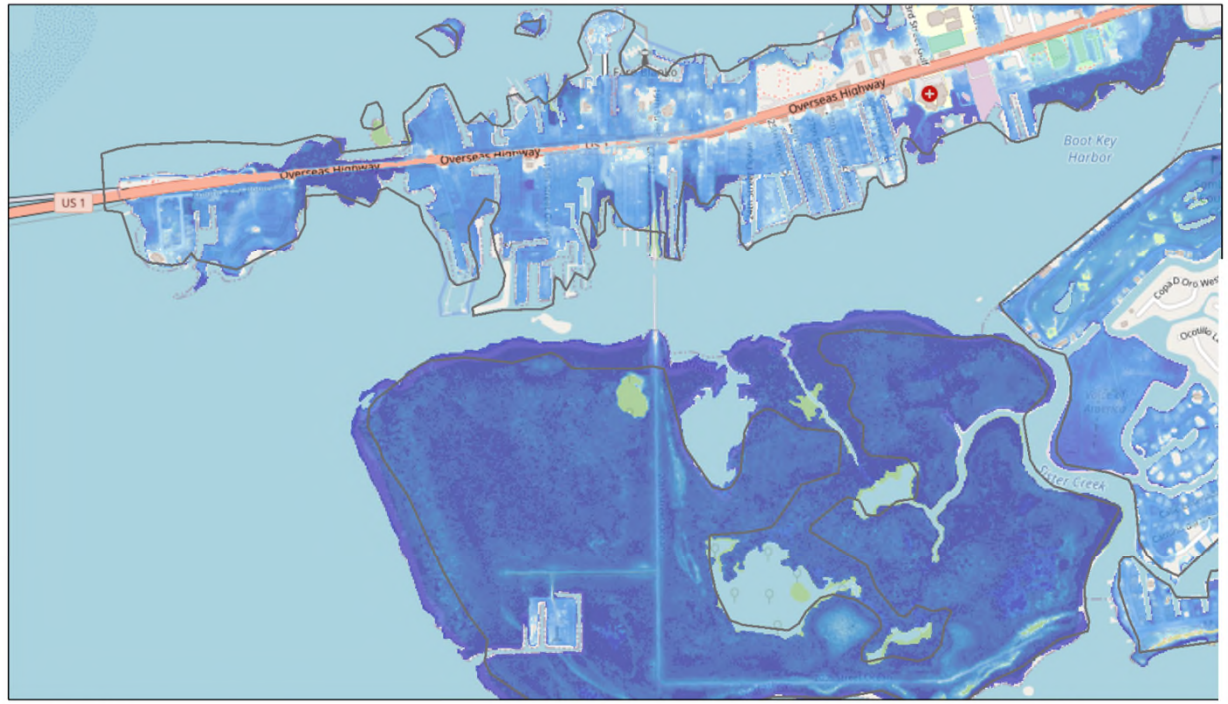
Peak significant wave height (highest 1/3 of waves) of 26 feet with a dominant period of 10 seconds from 187 degrees (just west of due south)
at 10:00 pm EDT Tuesday Sep. 27th

This was within one hour of the day's higher high tide – 2 days past the new moon phase (spring tide) – a "perfect storm" to maximize water level

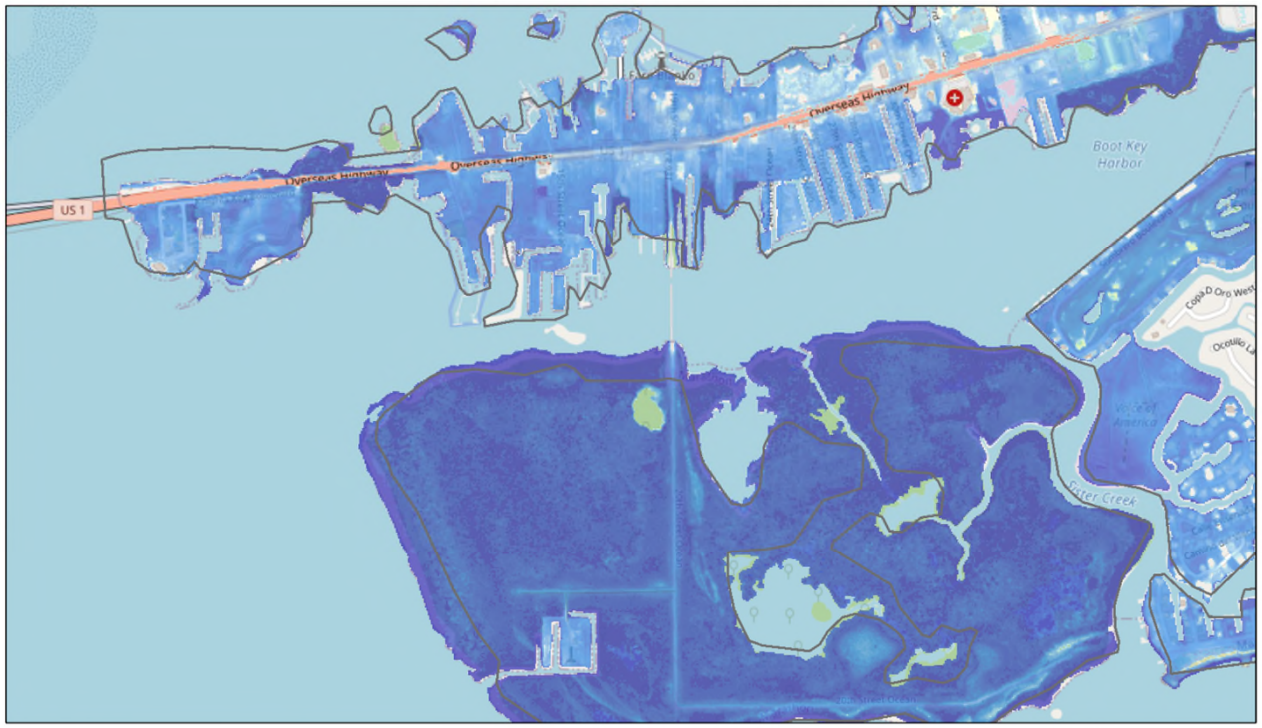

Marathon
Marathon Shores
Key Colony Beach
HURRICANE IAN - Tuesday, September 27, 2022 5PM EDT Advisory #19
Center Location: 24.0 N 83.2 W Maximum Sustained Winds: 120 mph (Cat 3) Movement: 10 mph N
Sustained Wind Speed: tropical storm >= 34kt/39mph strong tropical storm >= 50kt/58mph hurricane >=
Potential storm surge flooding (with tide) in feet AGL for the 78 hours from 5PM Tue 09/27/2022 to 11PM
1 to 3 feet > 3 feet > 6 feet > 9 feet Intertidal zone Leveed Area
Hurricane Irma - Friday, September 8, 2017 8PM EDT Advisory #39A
Center Location: 22.2 N 77.2 W Maximum Sustained Winds: 155 mph (Cat 4) Movement: 12 mph W
Sustained Wind Speed: tropical storm >= 34kt/39mph strong tropical storm >= 50kt/58mph hurricane >= 64kt/74mph
Potential storm surge flooding (with tide) in feet AGL for the 78 hours from 5PM Fri 09/08/2017 to 11PM Mon 09/11/2017
1 to 3 feet > 3 feet > 6 feet > 9 feet Intertidal zone Leveed Area
Basemaps

Tactical Storm Surge Reference

Marathon West - Boot - 4.3 MHHW



Marathon West - Boot - 5.2 MHHW



Tropical Storms – Wide Variation of Potential Impacts

Category	Sustained Winds
1	74-95 mph 64-82 kt 119-153 km/h
2	96-110 mph 83-95 kt 154-177 km/h
3 (major)	111-129 mph 96-112 kt 178-208 km/h
4 (major)	130-156 mph 113-136 kt 209-251 km/h
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher

The Tropical Storm classification with sustained winds of 39 to 73 mph (a range of 34 mph) makes it one of the largest wind categories outside open-ended Category 5.

Strong tropical storm force winds of 50 knots or greater essentially have hurricane-force wind gusts

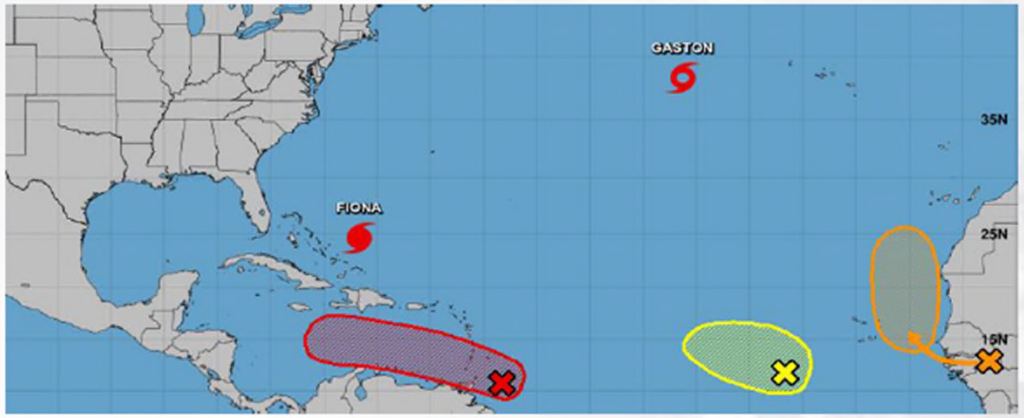
Extended duration, such as being outside the eyewall of a major hurricane moving slowly past, will eventually duplicate the damage of a Category 1 hurricane.

It also can move ***a lot*** of seawater!

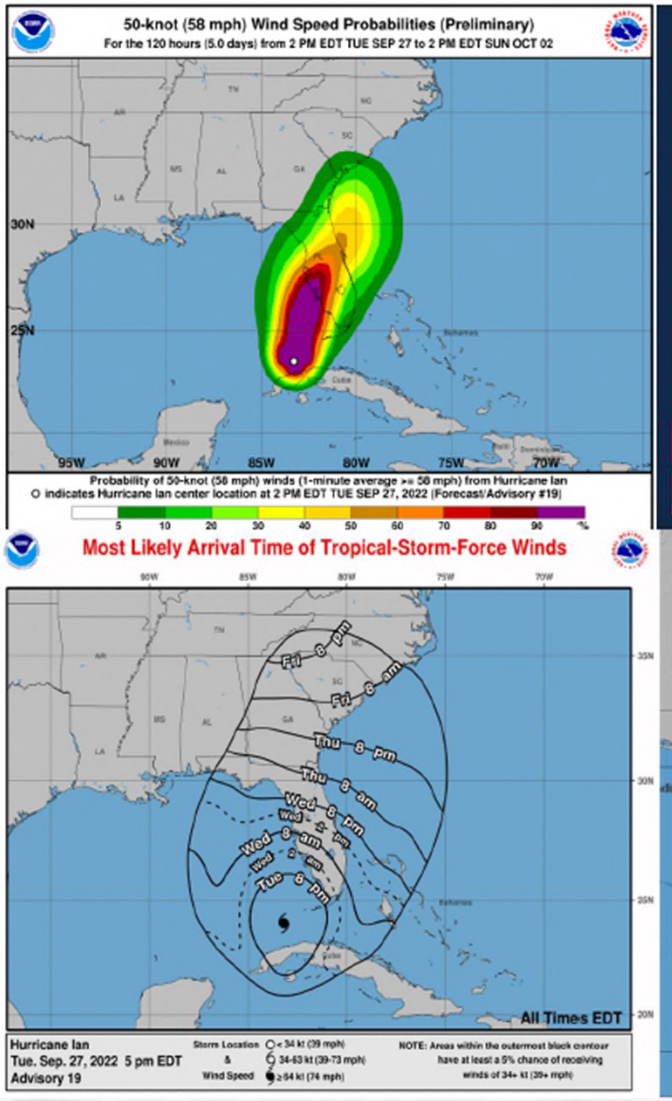
20 Years of Progress

Improvements

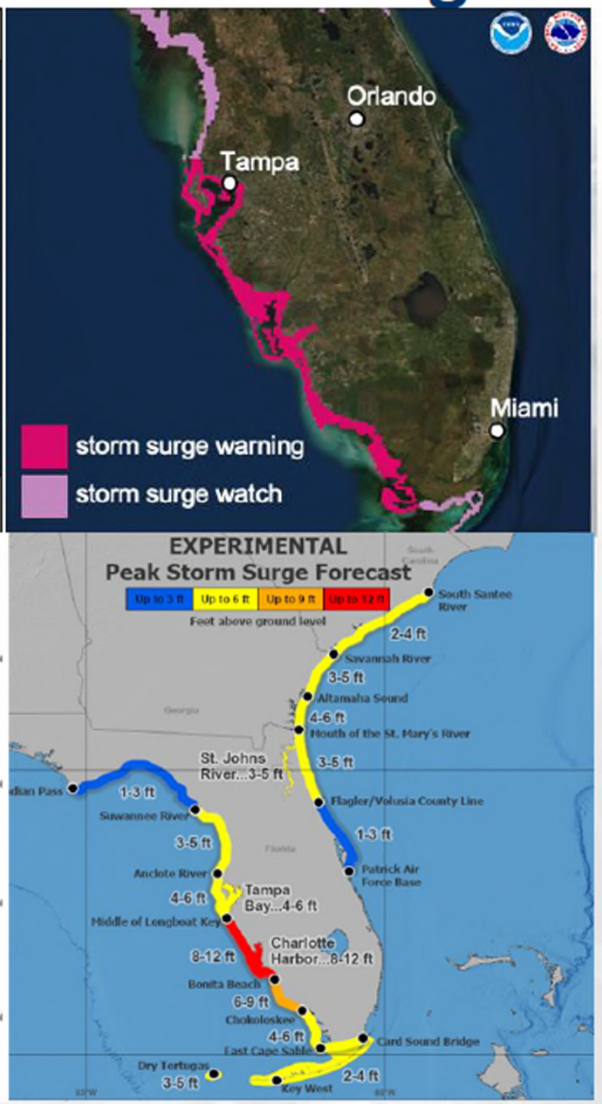
- Track errors: 30–45% lower
- Intensity errors: 20–40% lower
- 3-day to 5-day forecasts
- Increased lead time (12 h) for hurricane watches/warnings
- Probabilistic hazard information and forecast framework



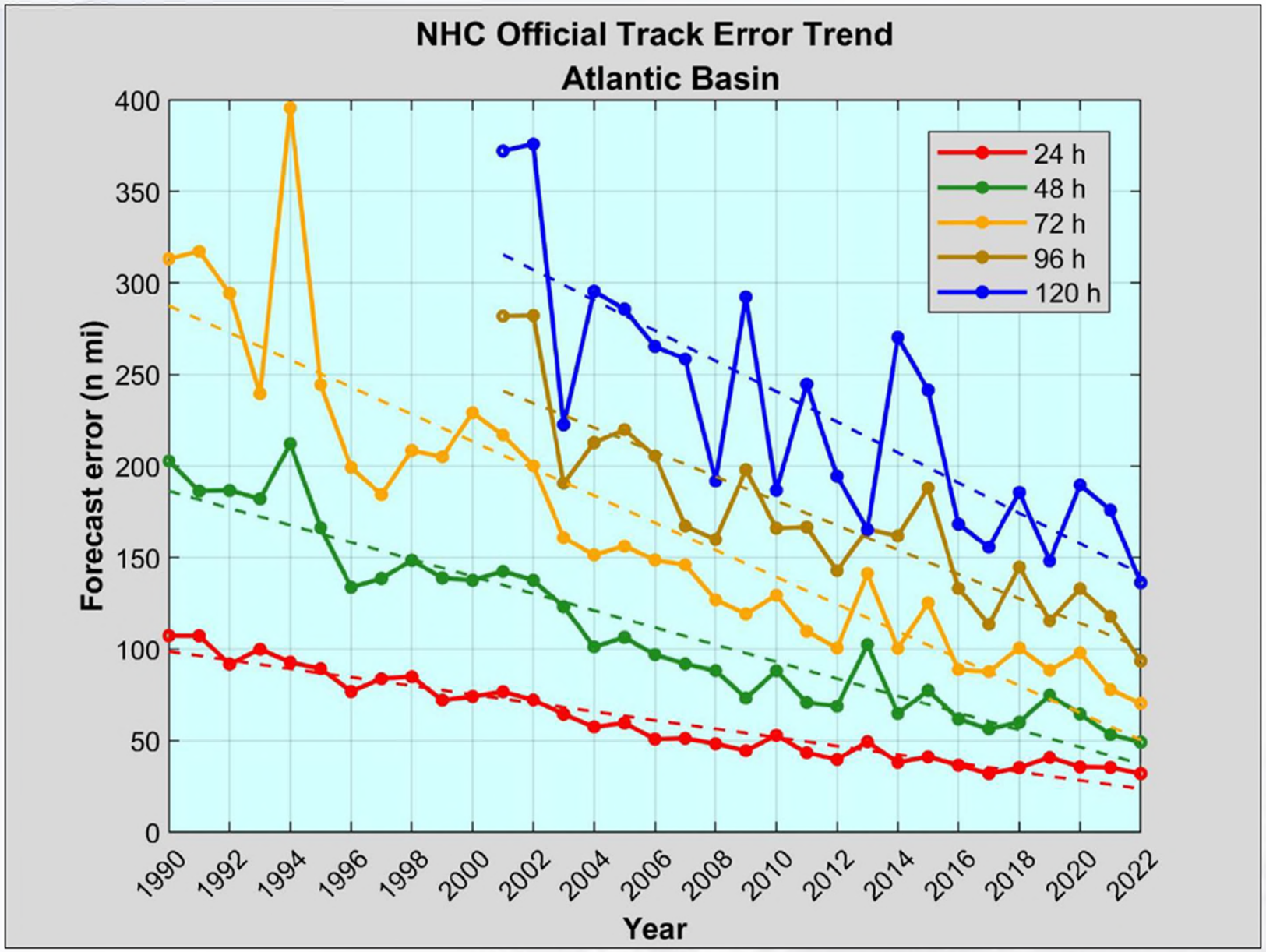
wind



storm surge



Atlantic Track Error Trends



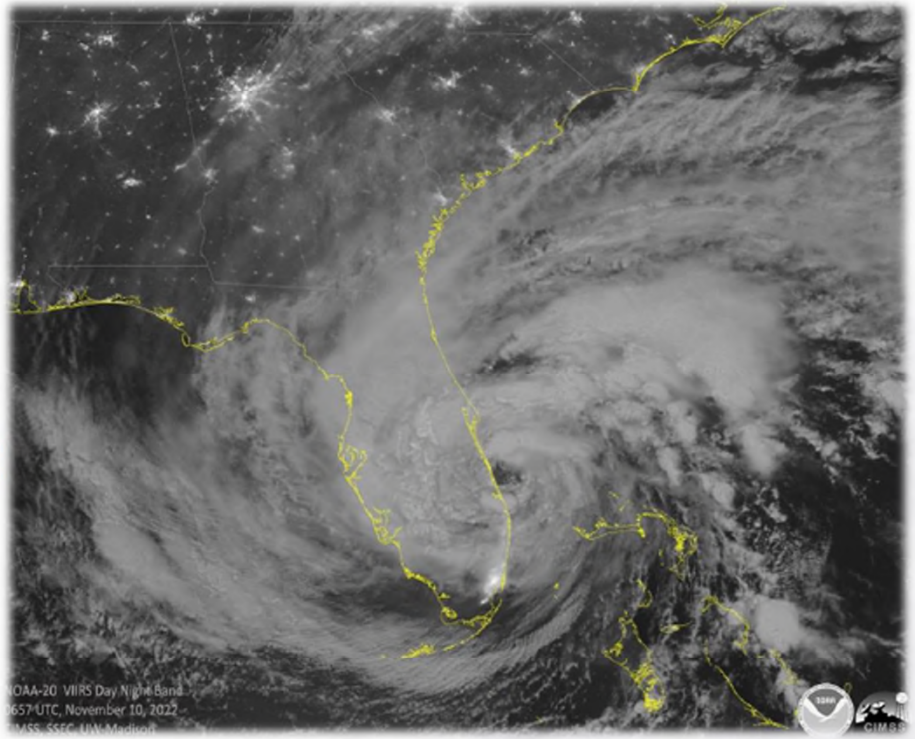
Errors nudged down again in 2022; pronounced long-term improvement trends

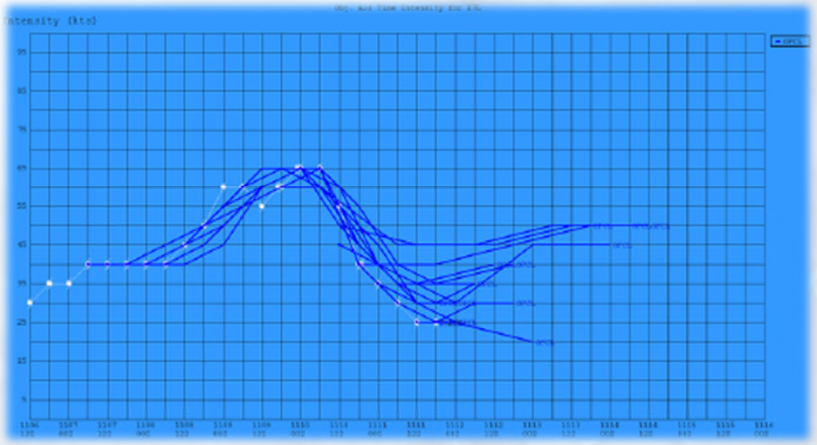
Preliminary Track records broken in 2022

Time	N	Track
000	256	4.5
012	227	22.0
024	196	31.2
036	169	41.5
048	147	51.0
060	127	62.6
072	109	74.3
096	77	99.2
120	53	137.4

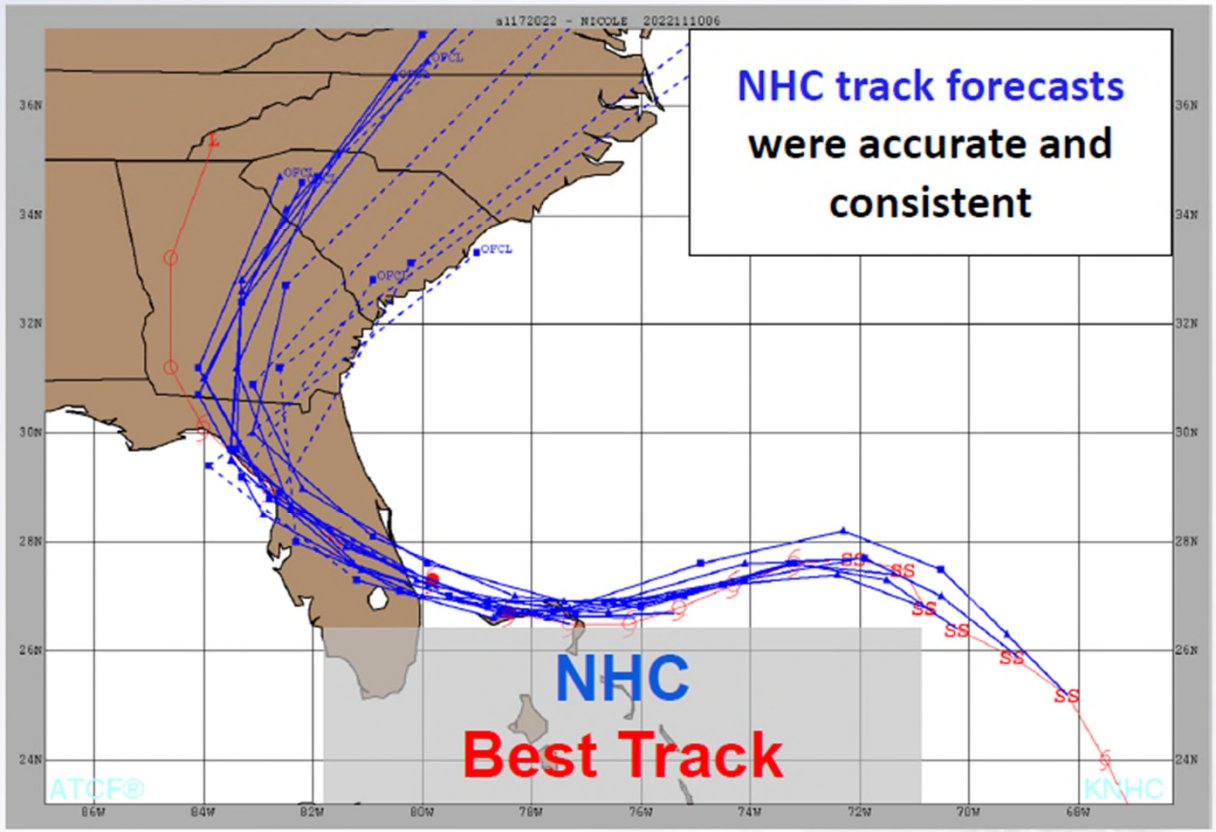
Hurricane Nicole

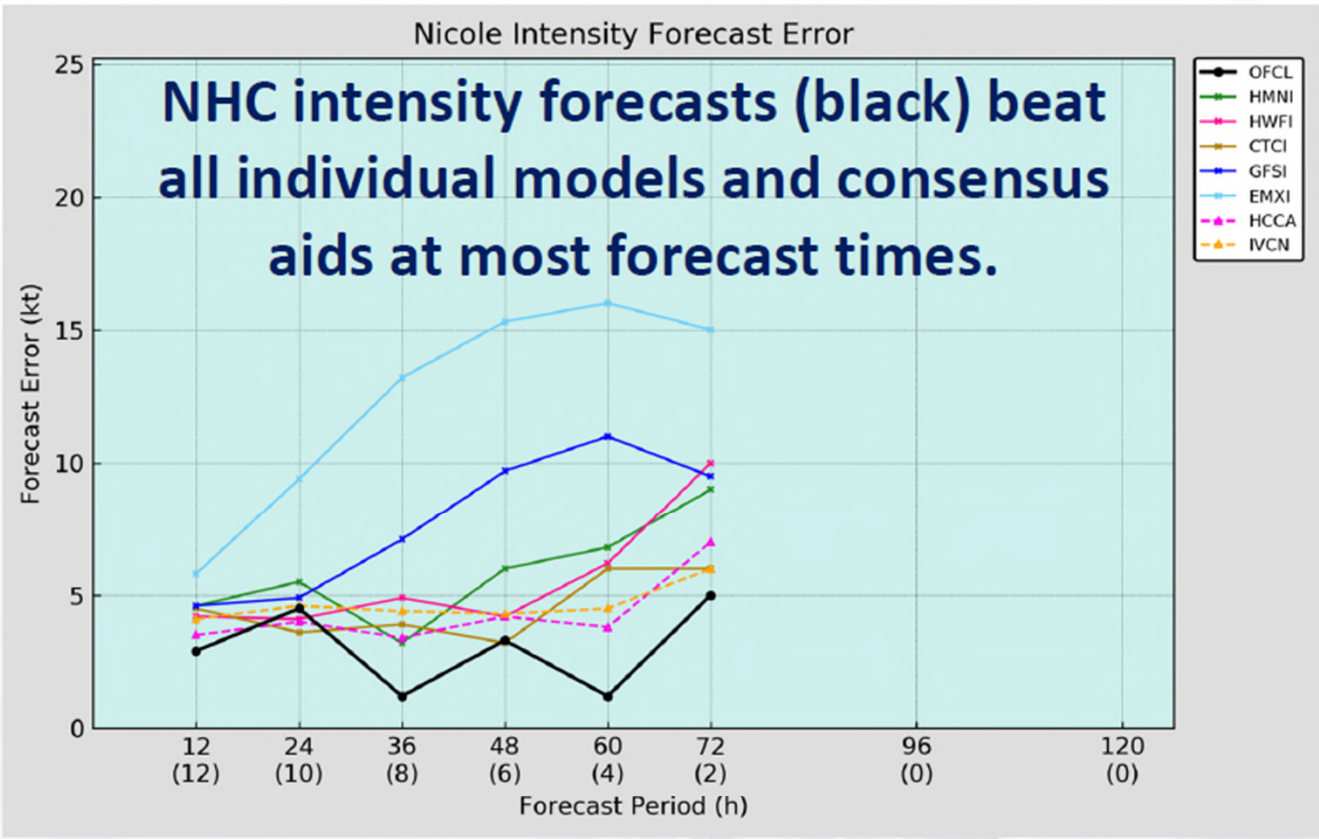
- Unusually late-season hurricane landfall in Florida – only the 3rd on record
  - 1935 “Yankee” Hurricane, 1985 – Kate
- Very large wind field caused significant wave action & beach erosion along Florida’s east coast
- No direct fatalities, but 5 indirect deaths in Florida
- U.S. damage $1 billion
- Track and intensity forecasts were quite good
- NHC began messaging threat of coastal impacts nearly a week before landfall in briefings





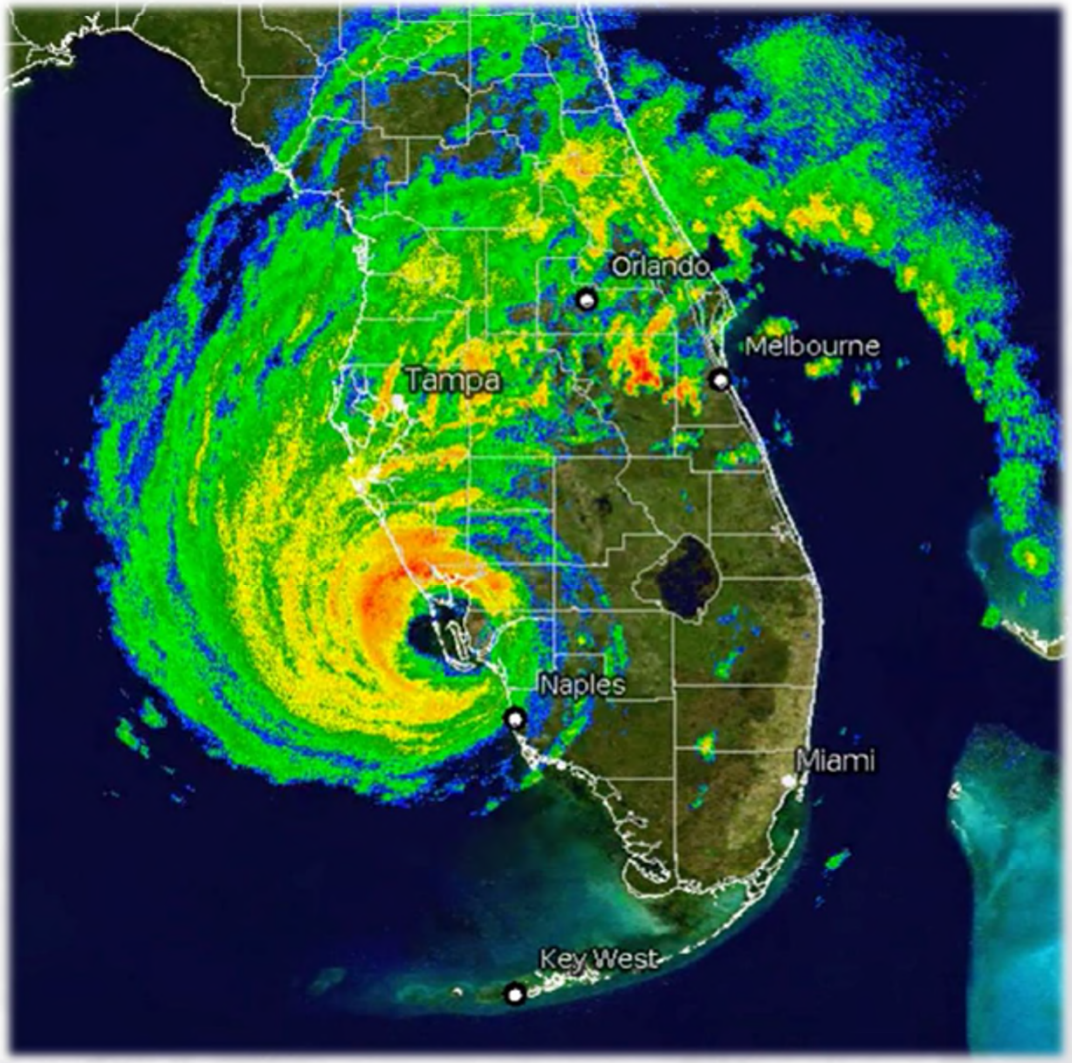
Hurricane Nicole – Track and Intensity



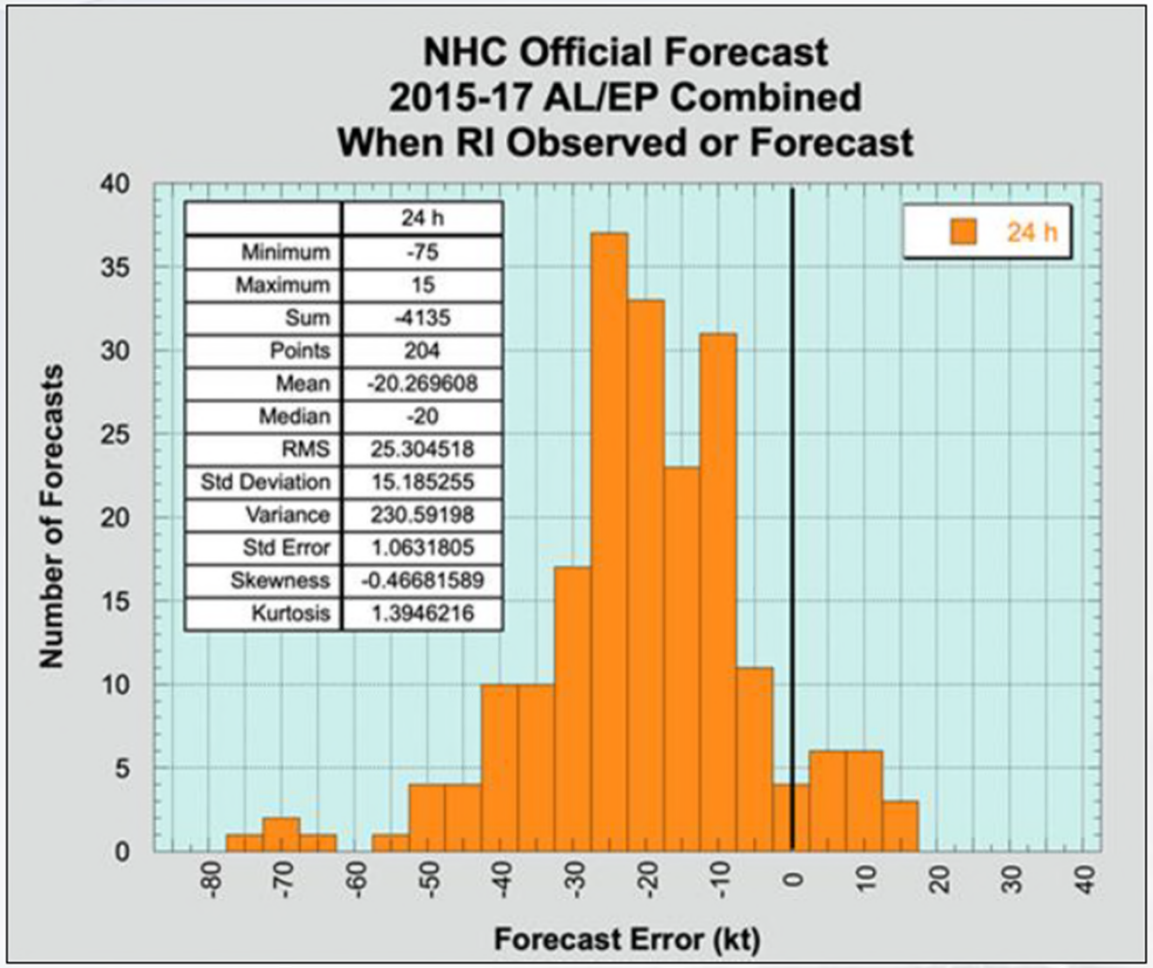


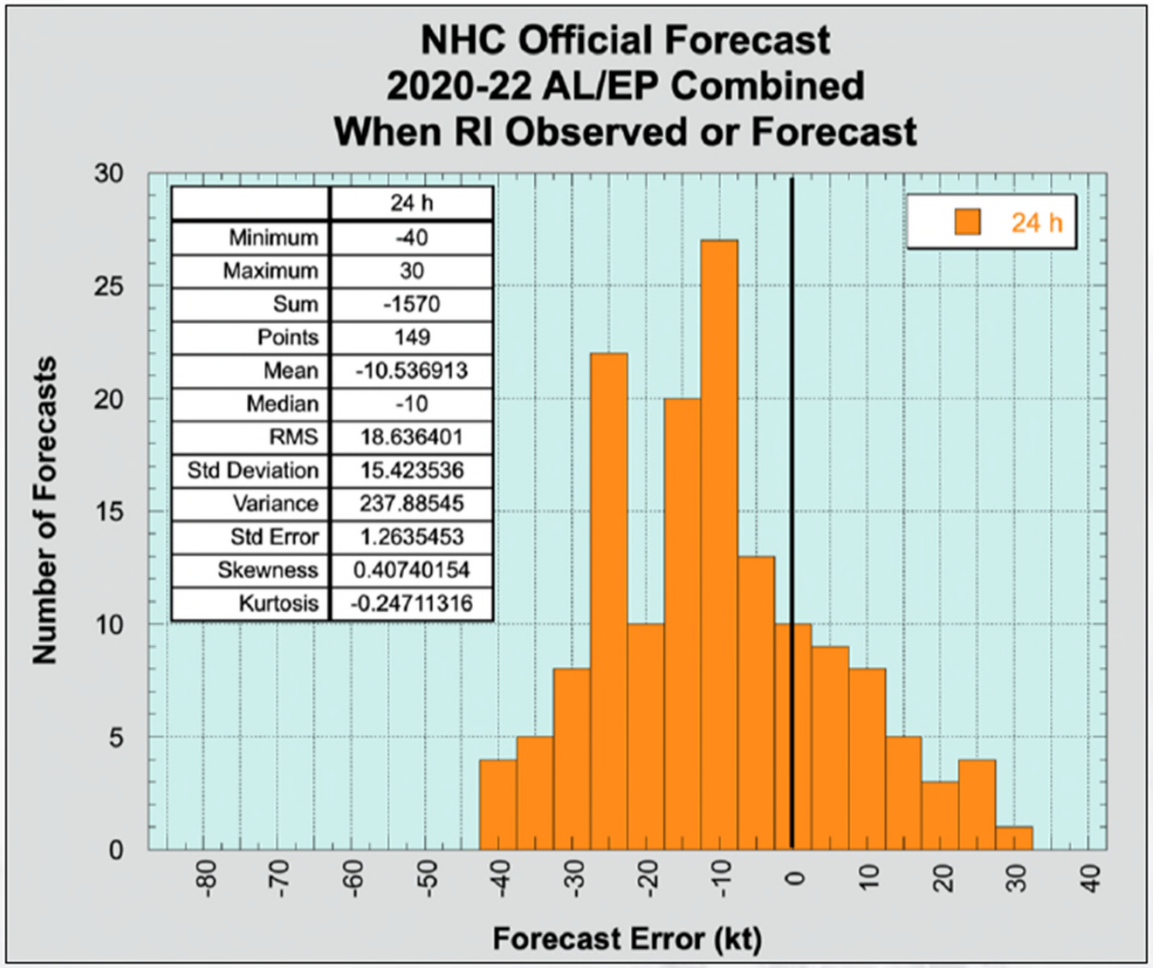
Hurricane Ian

- Category 5 hurricane offshore the morning before landfall
- Landfall as a category 4 hurricane near Cayo Costa, Florida on September 28
  - Maximum winds 150 mph (130 kt)
  - Minimum pressure 941 mb
- Landfall occurred about 61 h after Ian became a hurricane
- Tied for 5th strongest U.S. hurricane landfall on record (behind the 4 cat 5s)
- U.S. damage $112.9 billion
  - Costliest hurricane to ever hit Florida



Progress in Forecasting Rapid Intensification



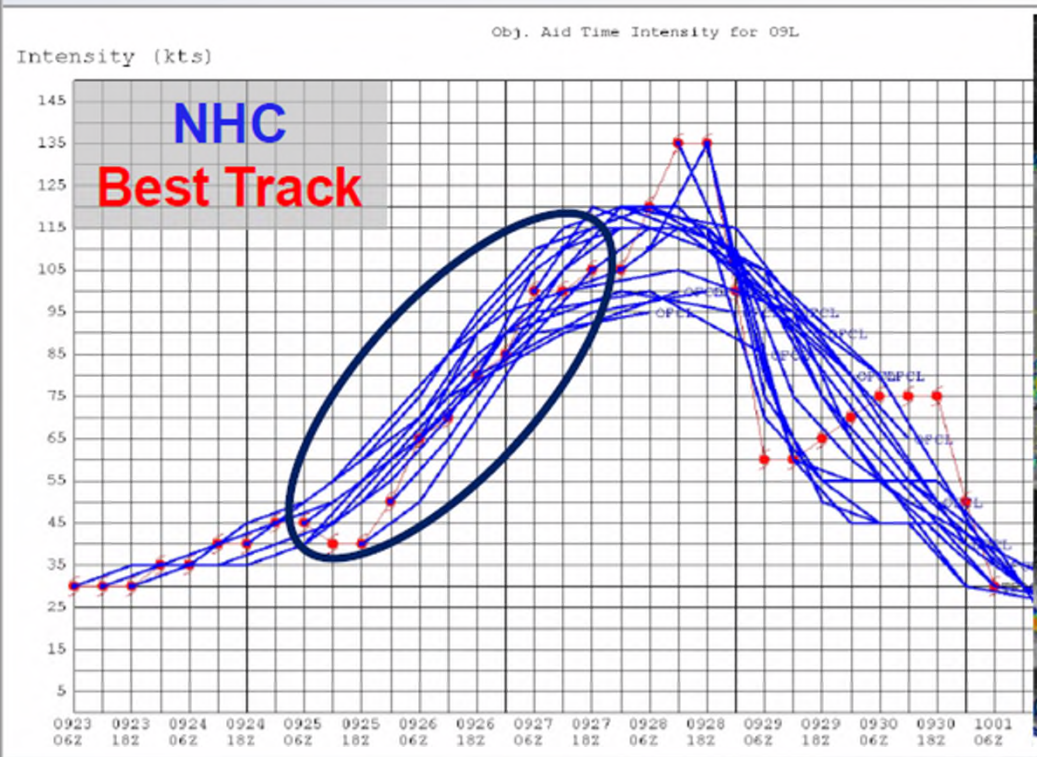


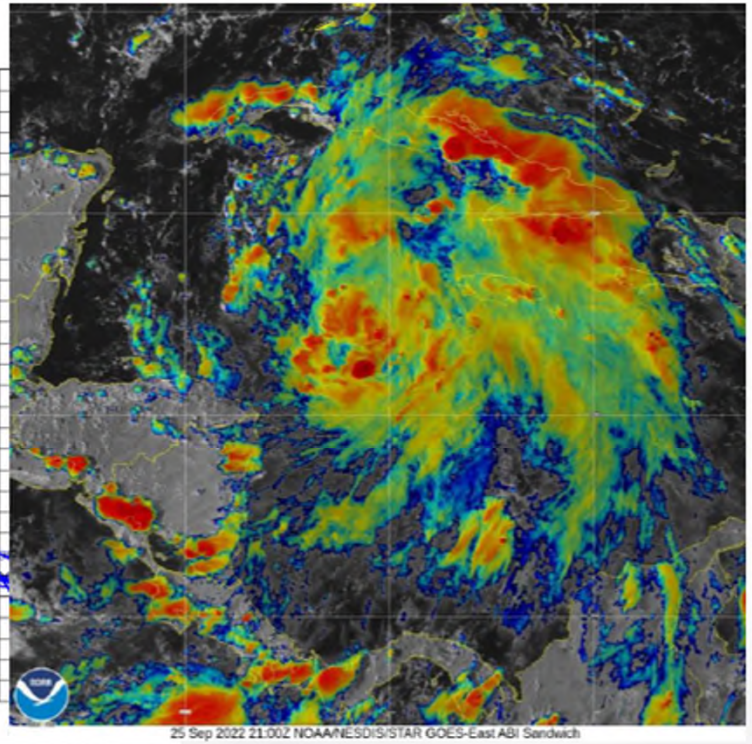
NHC's 24-h intensity error during rapid intensification events has been cut in half since 2017 – 10 kt compared to 20 kt

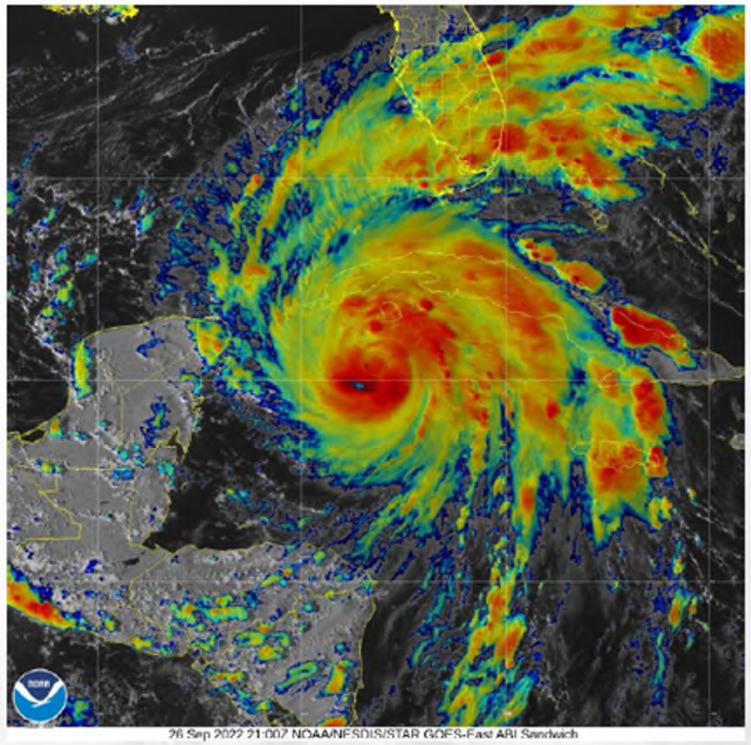
Largest under-forecast error reduced by 46% (40 kt compared to 75 kt)

Hurricane Ian – Rapid Intensification

NHC explicitly forecast Ian's rapid intensification







50 mph in 24 hr

NHC's average intensity forecast errors were 10-25% lower than the intensity consensus from 12 through 48 h, and more than 30% lower than consensus at 72 h

Hurricane Ian

- U.S. damage: $112.9B
- U.S. Fatalities: Total 156
  - Direct: 66
    - 41 Storm Surge
    - 12 Freshwater Flooding
    - 4 Wind
    - 8 Marine-Related
    - 1 Rough Surf
  - Indirect: 90
    - 18 Lack of Access to Timely Medical Care
    - 16 Accidents (such as trip & fall during power outages)
    - 16 Cardiac Events
    - Other causes: vehicular accidents, accidents related to storm prep or clean up, carbon monoxide poisoning, suicide, and homicide

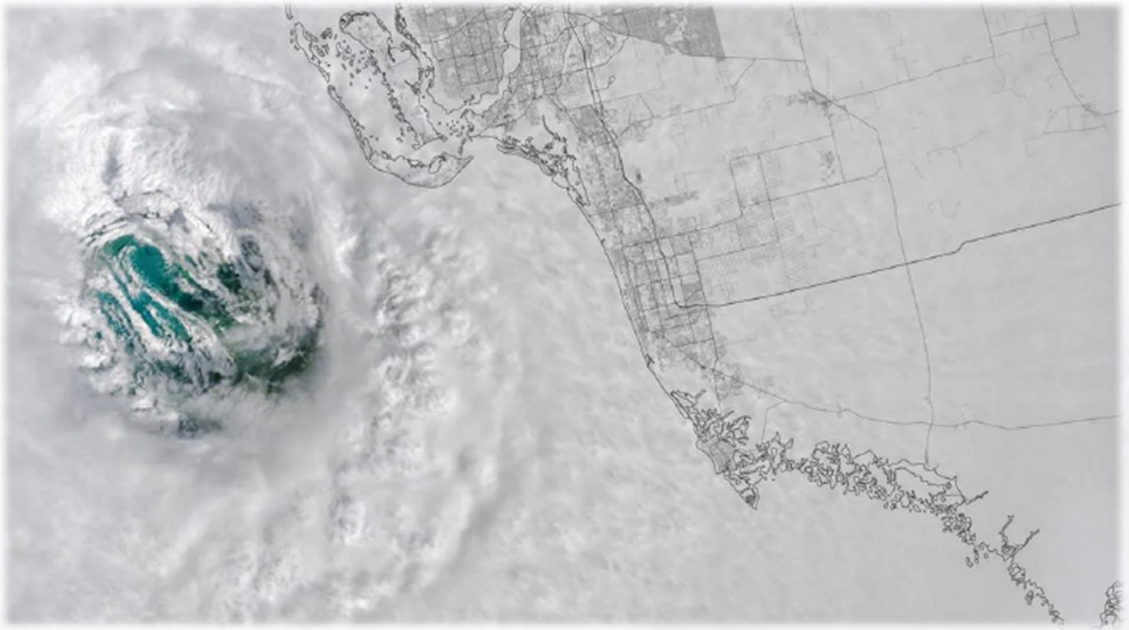


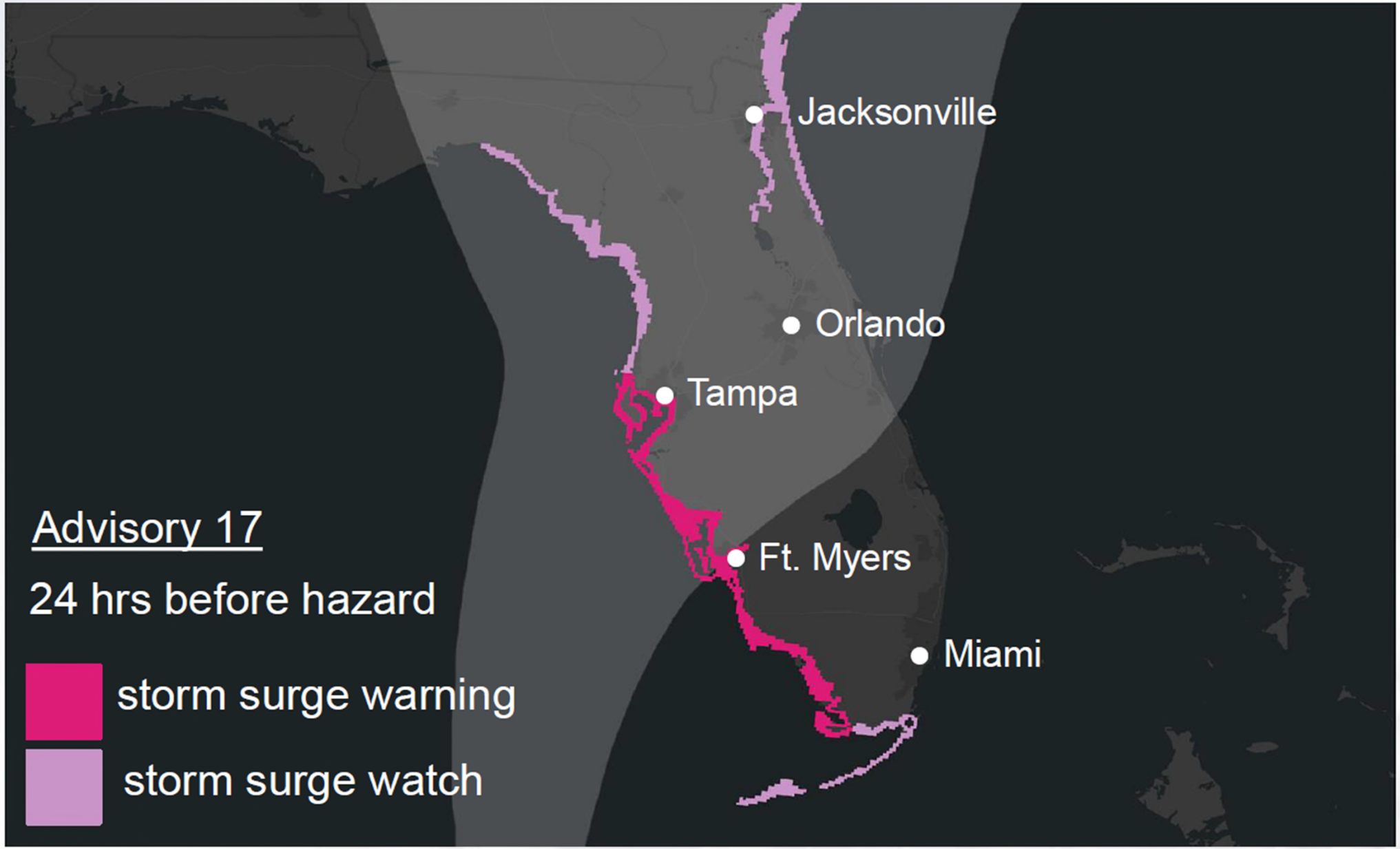
Image courtesy: Max Olsen

Ian Storm Surge Damage at Fort Myers Beach

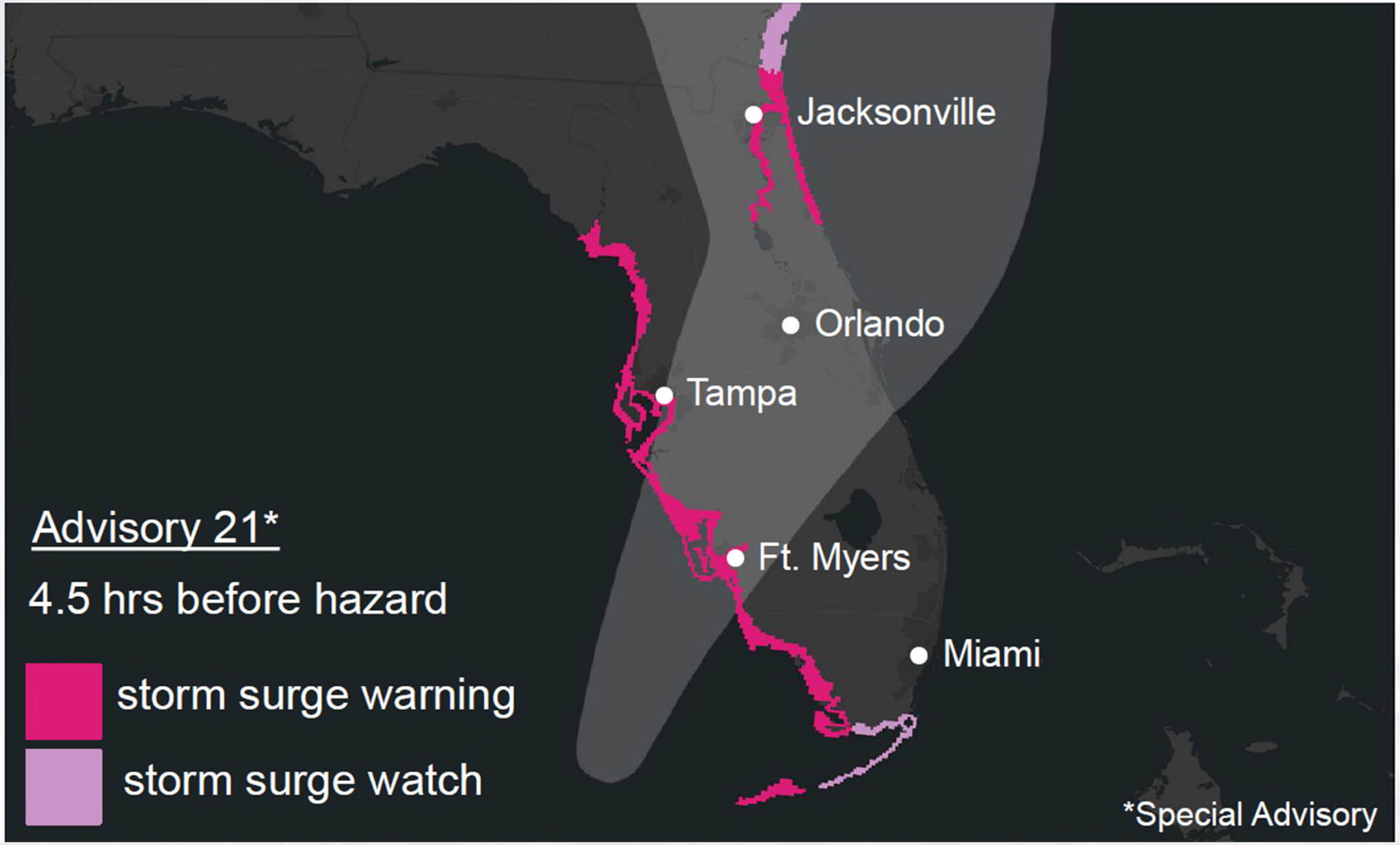
Ian Storm Surge Damage at Fort Myers Beach

Ian Storm Surge Damage at Fort Myers Beach

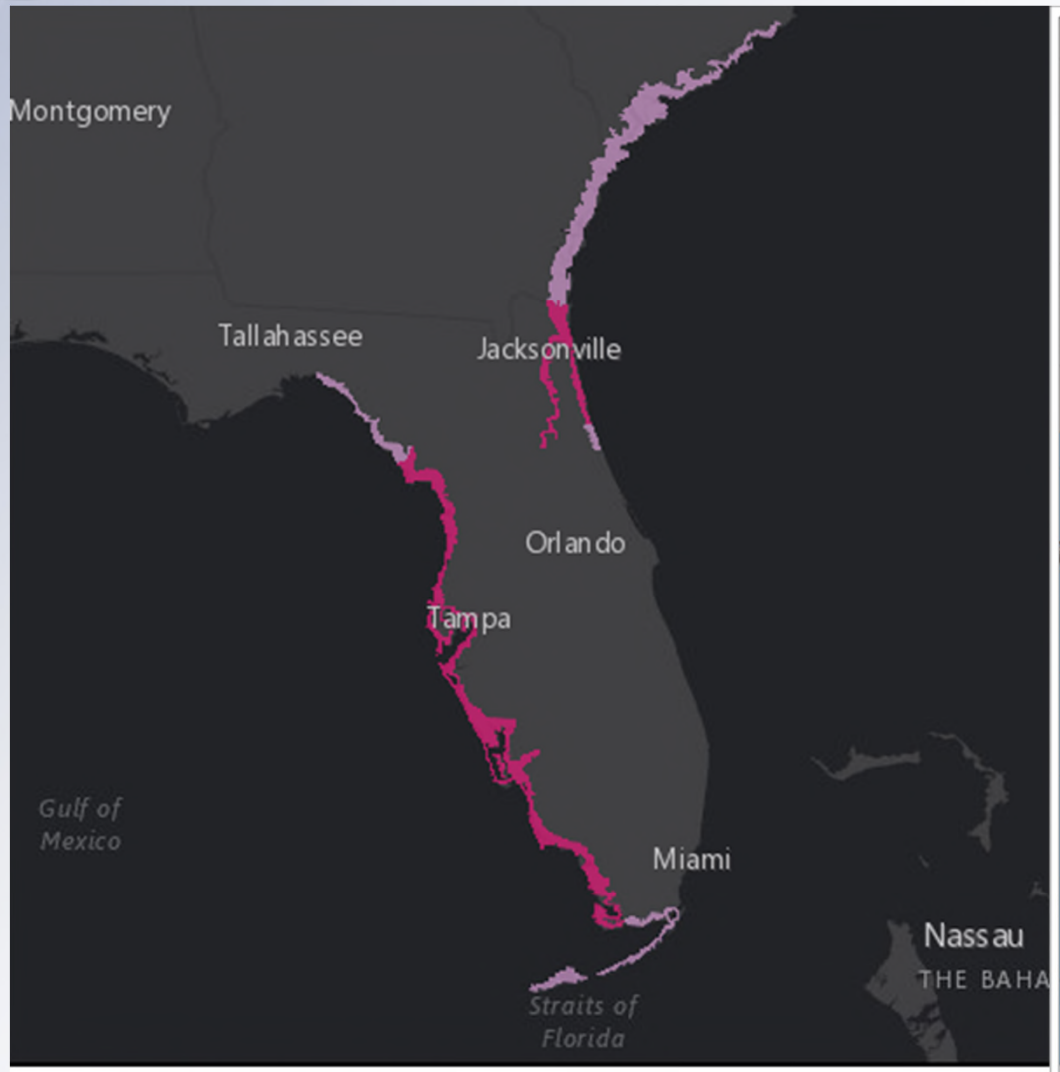
Hurricane Ian – Storm Surge

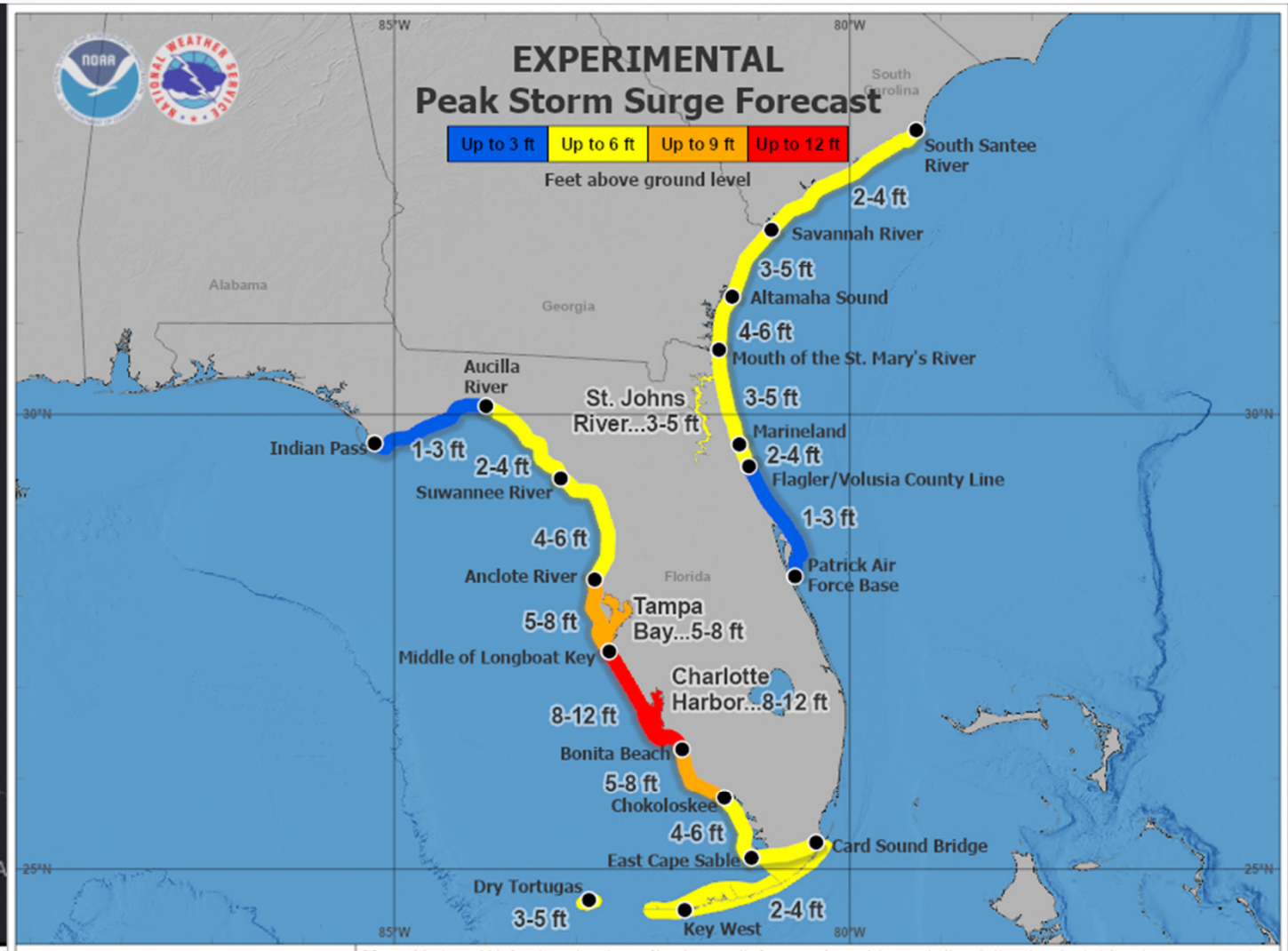


Hurricane Ian – Storm Surge



The most powerful storm surge messaging





Communicating Risk Challenge

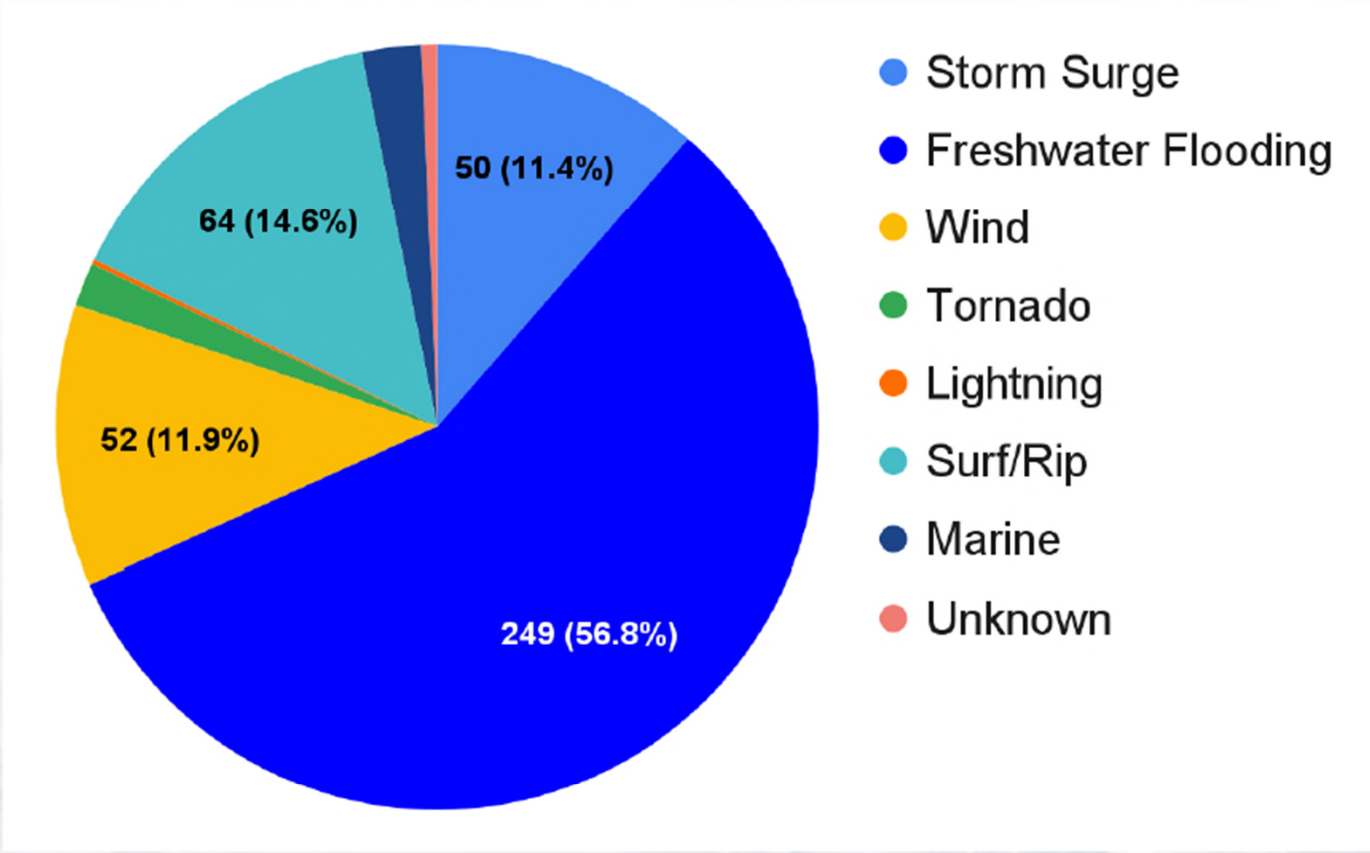
First Out 21%	Anxious and eager to leave if a hurricane is in the forecast
Constrained 14%	Aware of risks & willing to evacuate but face barriers
Optimists 16%	Doubt that a hurricane will occur but willing to evacuate
Reluctant 27%	Reluctant to evacuate but will leave if ordered to
Diehards 22%	Confident they can safely ride out hurricanes at home

Sandy study by Jennifer Marlon, Yale University

Slide from Ken Graham, Dir., NHC, FL GHC & Monroe TDC Workshop

Direct TC Fatalities – 2013-2022

- 57% (249) due to freshwater flooding
- 15% (64) due to surf/rip currents, many from storms well away from the U.S.
- 12% (52) due to wind – many tree related scattered across multiple storms
- 11% (50) due to storm surge



Landing an airplane

Source: The Washington Post

Landing an airplane

- 1 in 3 Americans, including nearly half of men, are confident they can land an airplane.

Source: The Washington Post

Landing an airplane

- 1 in 3 Americans, including nearly half of men, are confident they can land an airplane.
- “There is a zero percent chance of somebody pulling that off” – Patrick Smith (commercial air pilot)

Source: The Washington Post

Stop Obsessing about Models

NHC's track forecasts have lower average errors and are more consistent than individual models overall

2022:

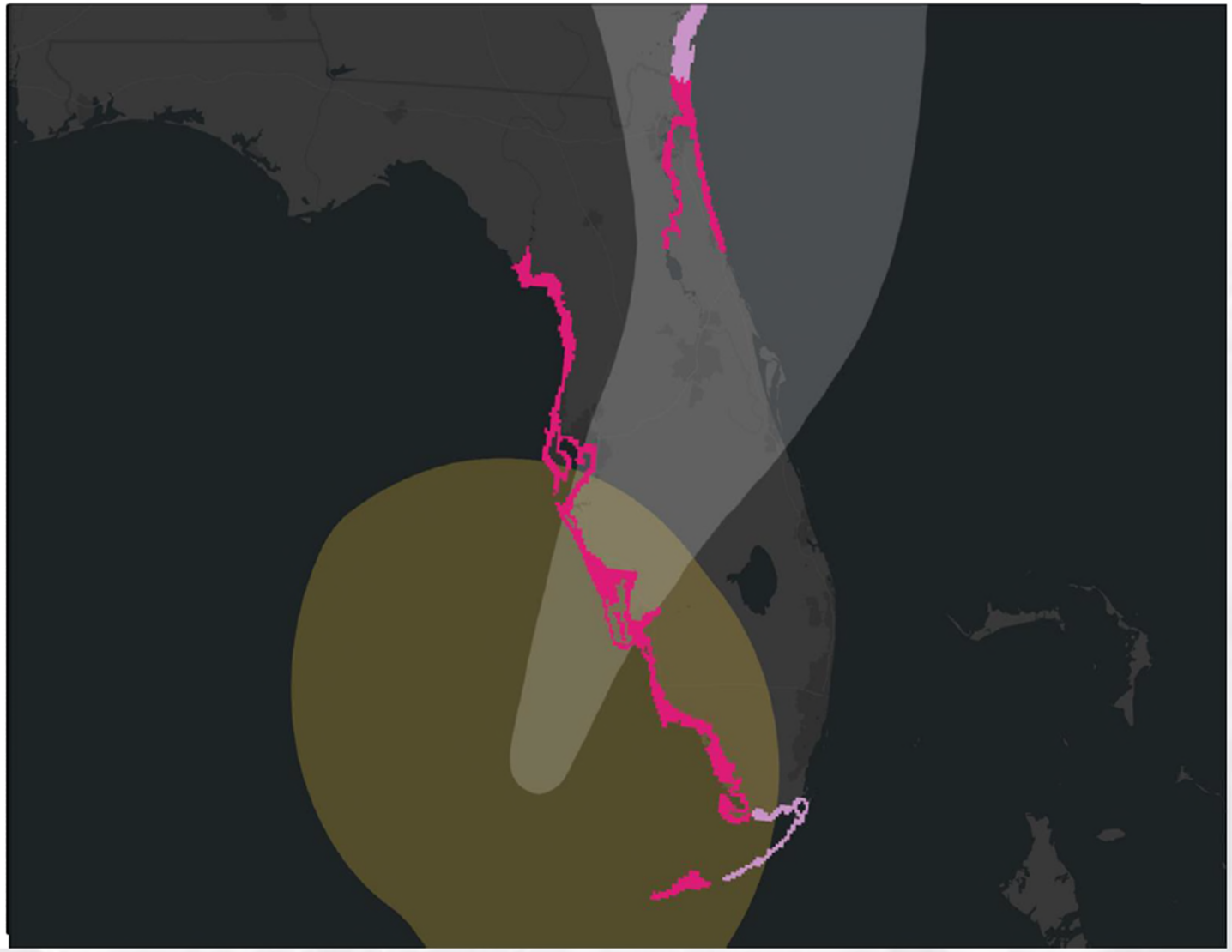
- **Record low track errors from 24–120 h**
- **Record low intensity errors from 12–60 h**

Don’t Rely Solely on the Cone

Hazards can and do extend outside the cone!

Augment the cone with hazard products:

- Watches/Warnings
- Time of Arrival
- Wind Speed Probabilities
- Experimental Peak Surge
- Inundation mapping
- Excessive Rainfall Outlook

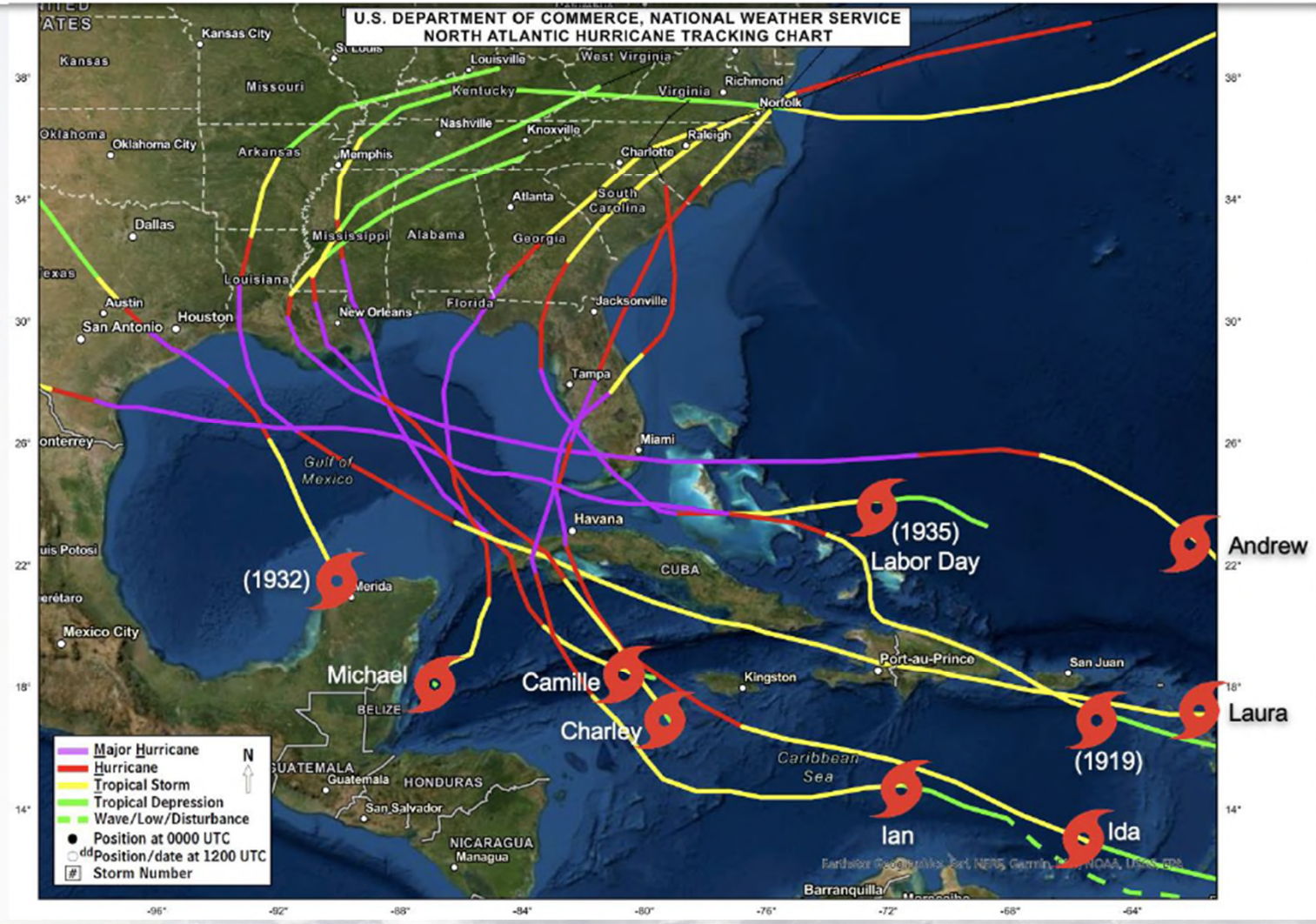


Shorten Lead Times

The Nation's Strongest – 150 MPH or Greater
All But 1 Were Tropical Storms 3 Days Before Landfall

U.S. 150 mph+

1919 – Storm 2
1932 – Storm 2
1935 – Labor Day
1969 – Camille
1992 – Andrew
2004 – Charley
2018 – Michael
2020 – Laura
2021 – Ida
2022 – Ian



Average time to become a hurricane is 50 h before landfall

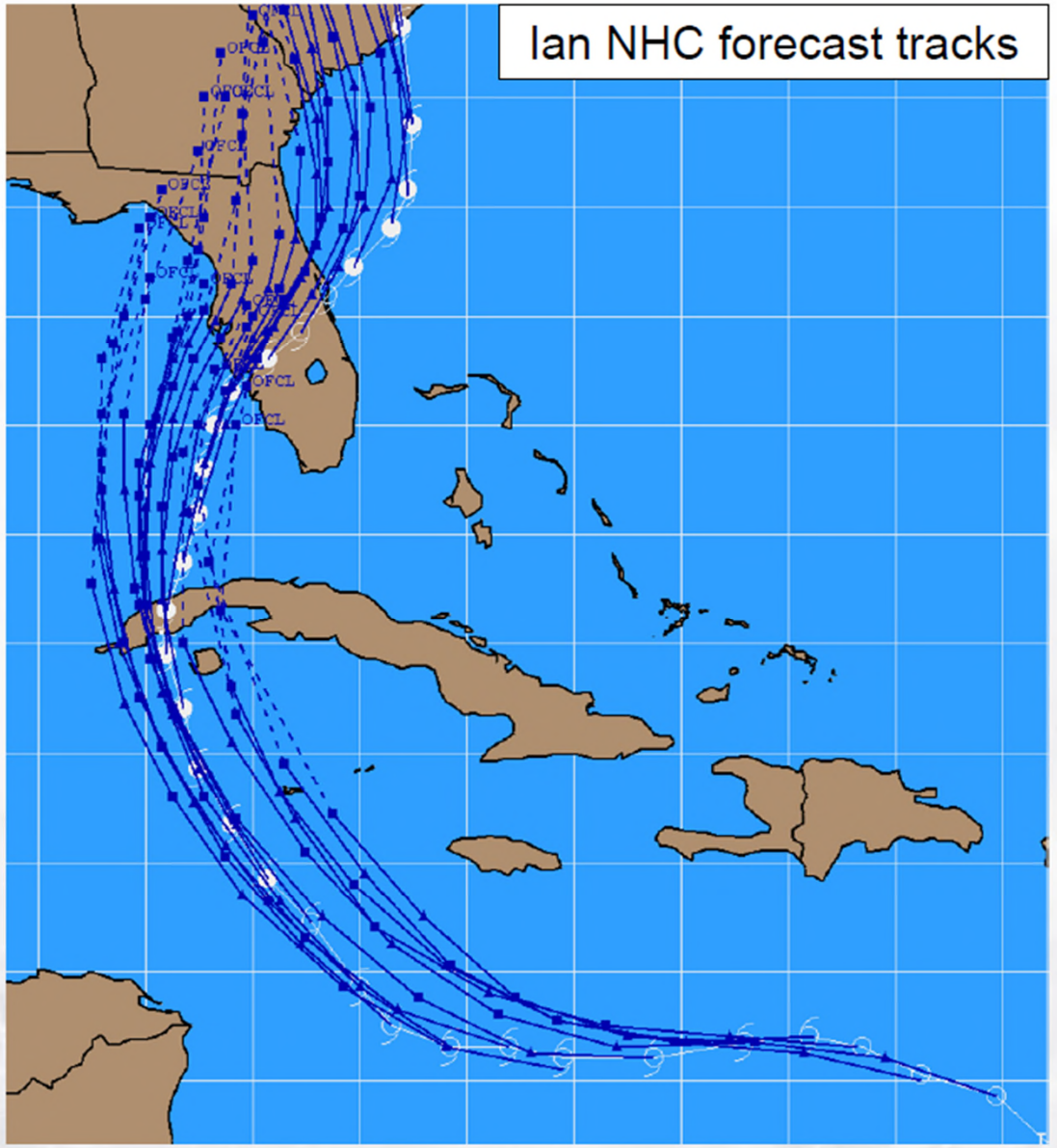
Avoid Anchoring

The track and intensity forecasts can and will change

Do not anchor to the first forecast you see!

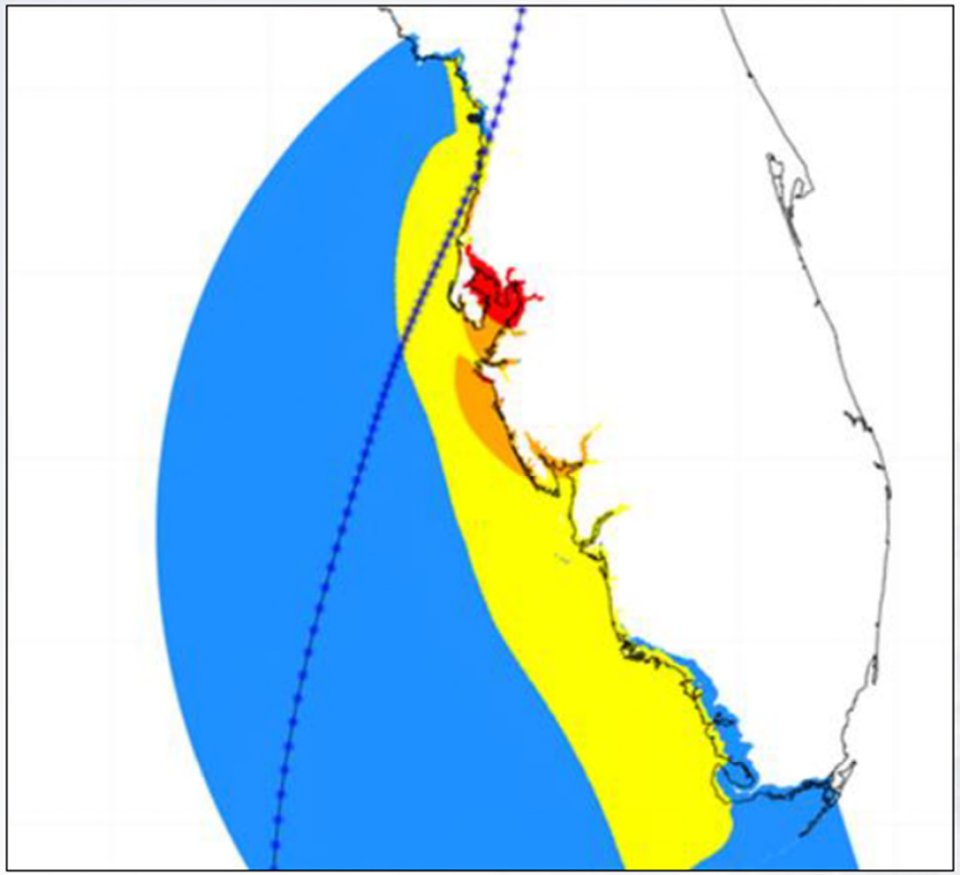
NHC issues a full package of forecast products every 6 hours

Watches and warnings communicate risk regardless of shifting details in forecast!

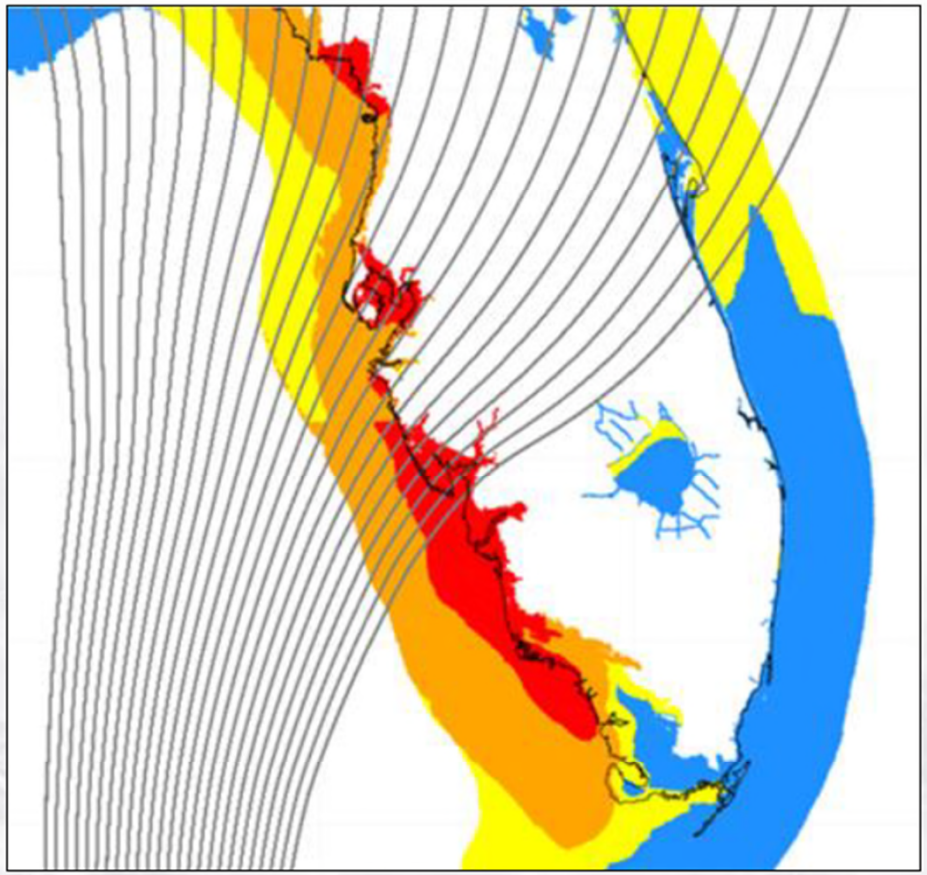


Adopt a Risk Mindset

One deterministic track



Ensemble of tracks



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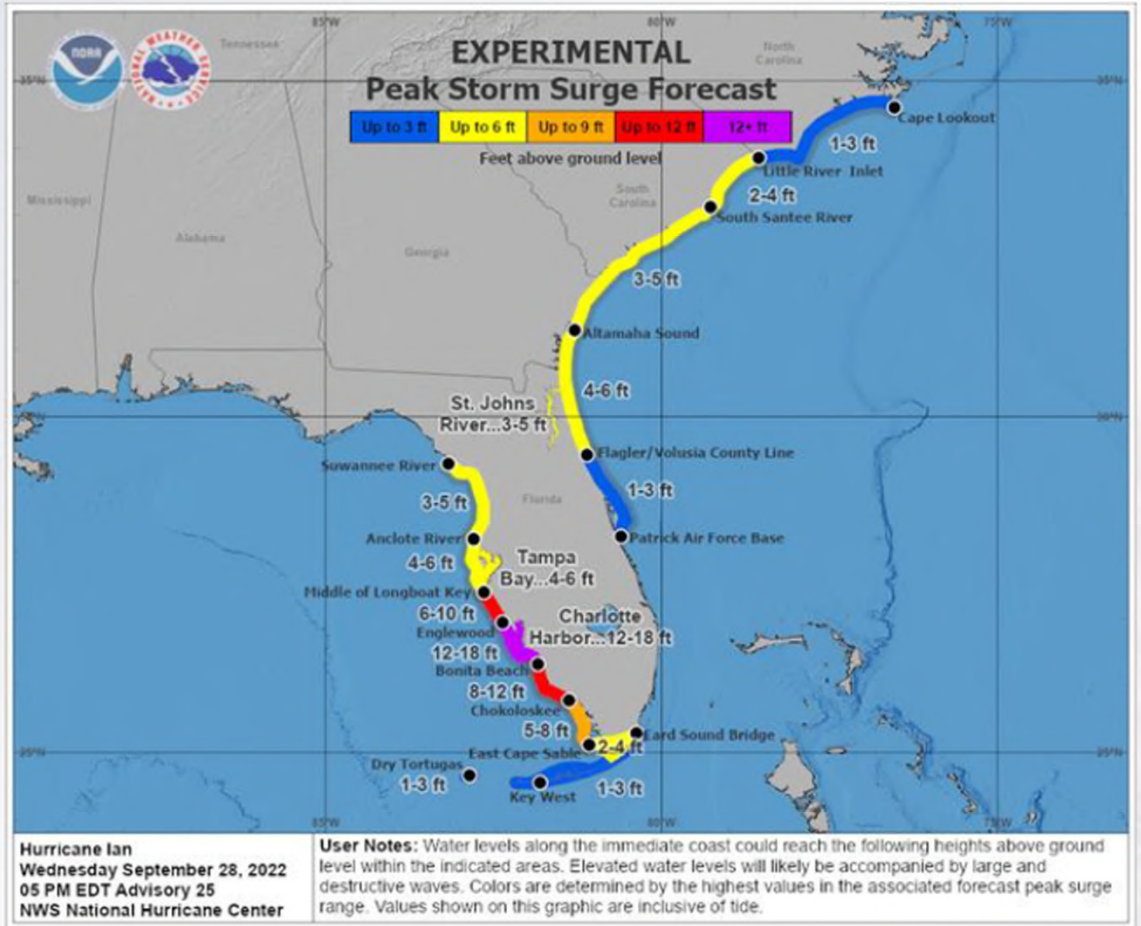
How does past experience shape public understanding?



“ **Why warnings went unheard**

One of the most common reasons people chose not to leave areas at high risk of storm surge was that they had survived hurricanes before unscathed.

It is human nature for people to measure their risk in a coming storm by comparing it to storms they've weathered in the past. But that calculation is wrong, experts say. Every hurricane is different, and slight changes to its path or strength can dramatically change the level of surging water.

As Ian made its approach toward Florida's southwest coast, many residents thought of the last major storm to come through: Irma, a Category 3 hurricane in 2017, for which nearly 7 million people statewide evacuated. Irma's forecasts had originally put Fort Myers and the rest of Lee County at risk of a direct hit, with storm surges of up to 15 feet. But the storm shifted east and weakened, and it arrived at low tide.

The $50 billion in damage statewide made Irma Florida's fifth-costliest hurricane at the time, but the storm still wasn't as destructive as forecasters had feared. The big surge didn't happen. Lee County suffered none of the state's 123 Irma deaths.

That experience influenced many people's decisions not to flee Hurricane Ian ”

- NBC NEWS

SOURCE: https://www.nbcnews.com/news/us-news/hurricane-ian-florida-death-toll-rcna54069

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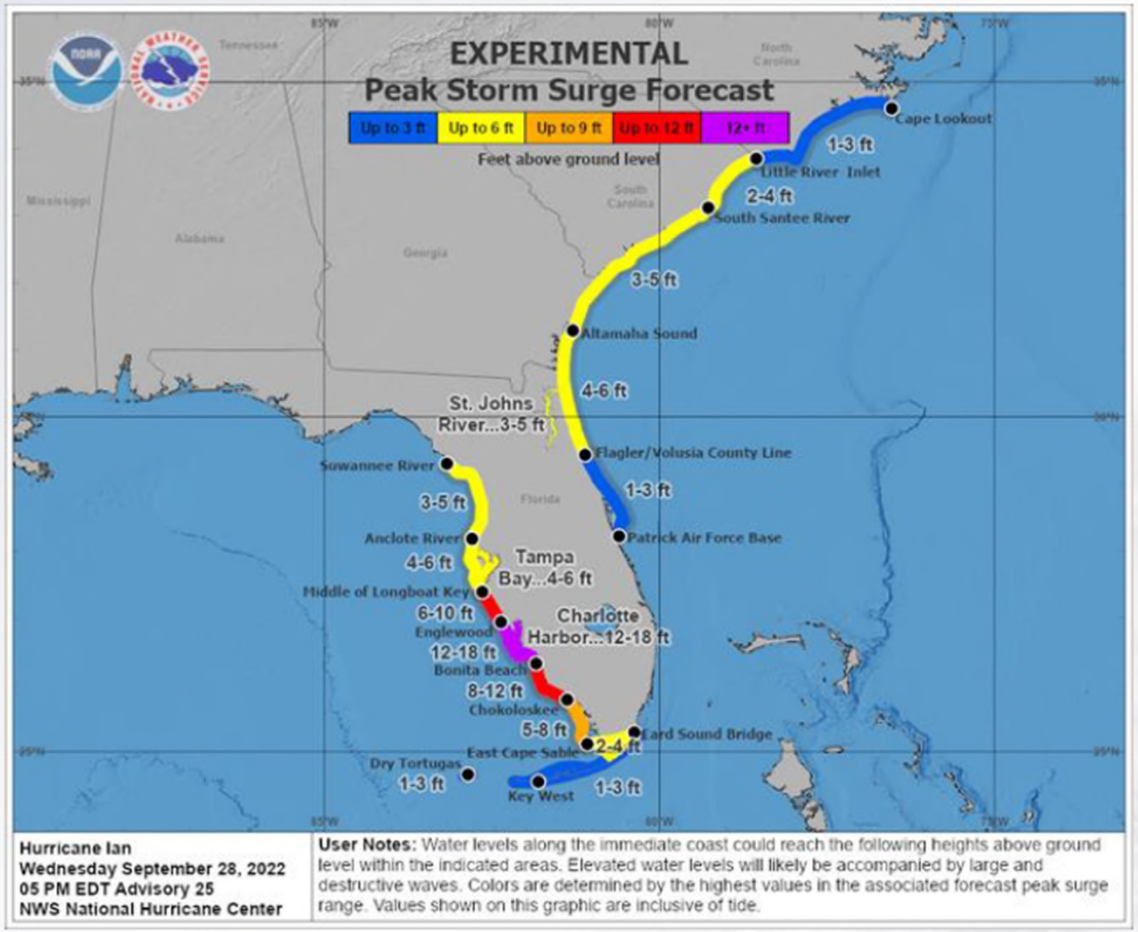

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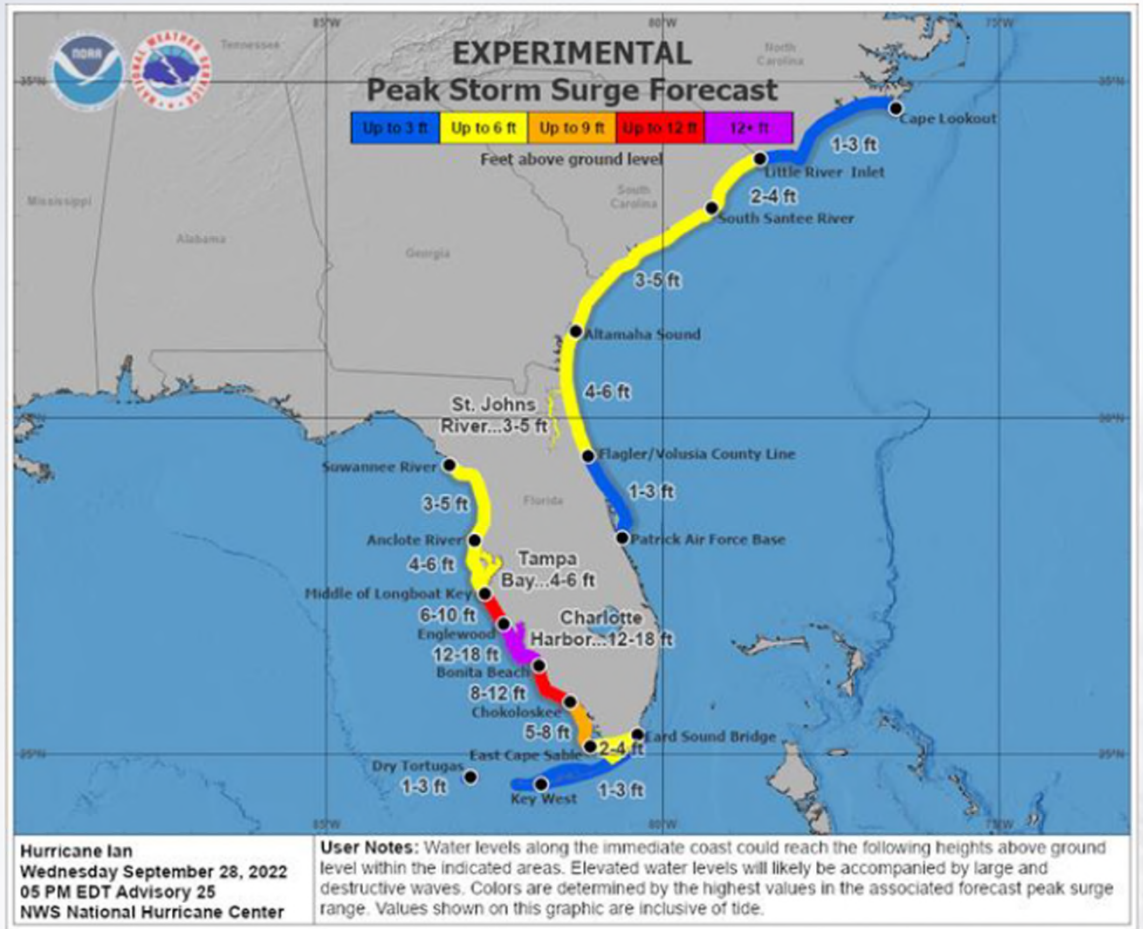

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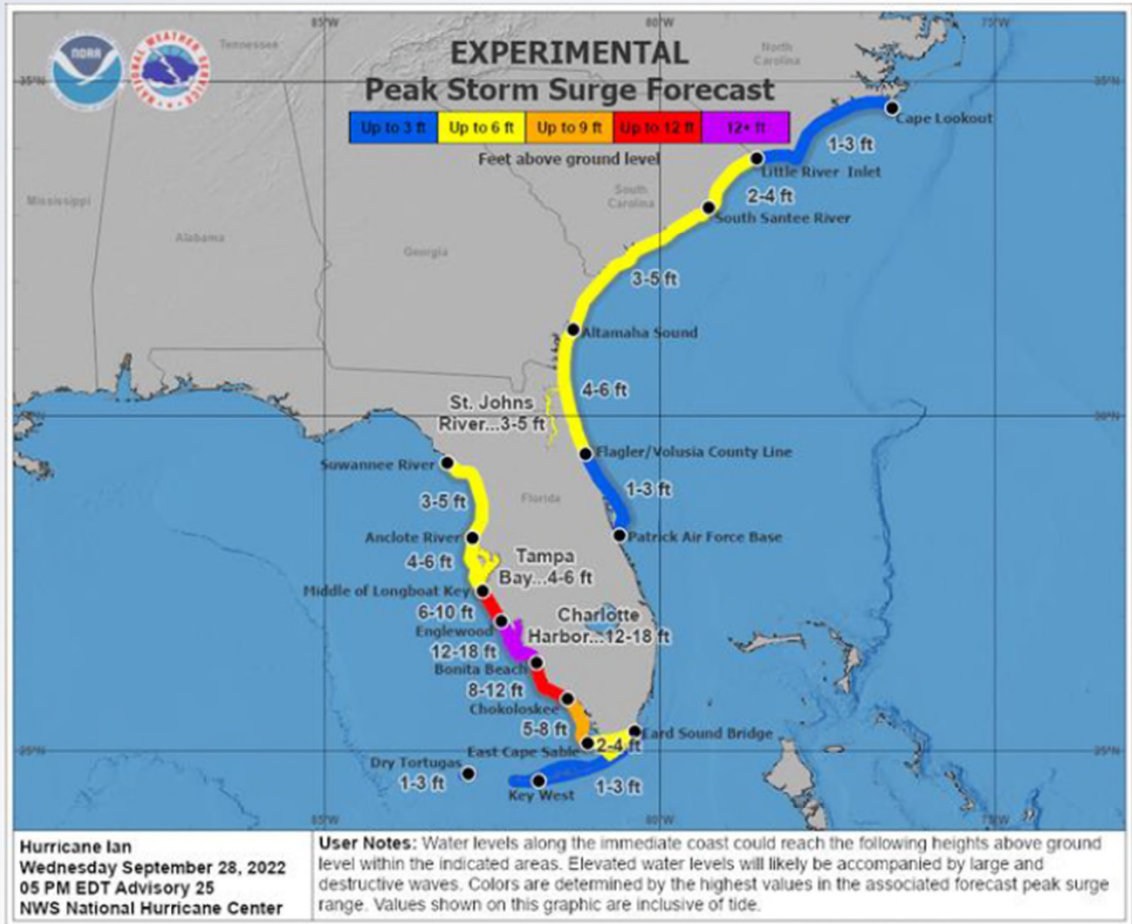

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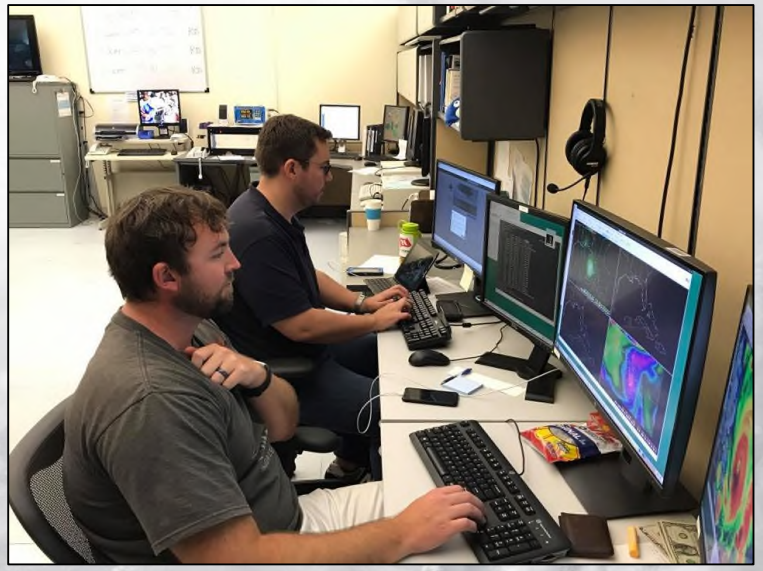
National Oceanic and Atmospheric Administration

Protect LIFE and property

All Hands on Deck



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THE FLORIDA KEYS NATIONAL WEATHER SERVICE:
Supporting Weather-Sensitive Decisions and Actions

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Hurricane Season 2023

Lessons Learned about Season Forecasts, Storm Surge & Rapid Intensification

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