



Herbert Wertheim
College of Engineering
UNIVERSITY of FLORIDA

Interim Report

Survey and Investigation of Buildings Damaged by Category III, IV and V Hurricanes in FY 2022-2023

Hurricane Idalia - 28 August 2023

Investigators:

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Sponsor: Florida Building Codes and Standards (Florida DBPR)

Project Manager: Mo Madani

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Acknowledgements



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Sean A. Robinson, Civil Engineering Student, Univ. of Florida

Giorgio Carmagnani, Civil Engineering Student, Univ. of Florida

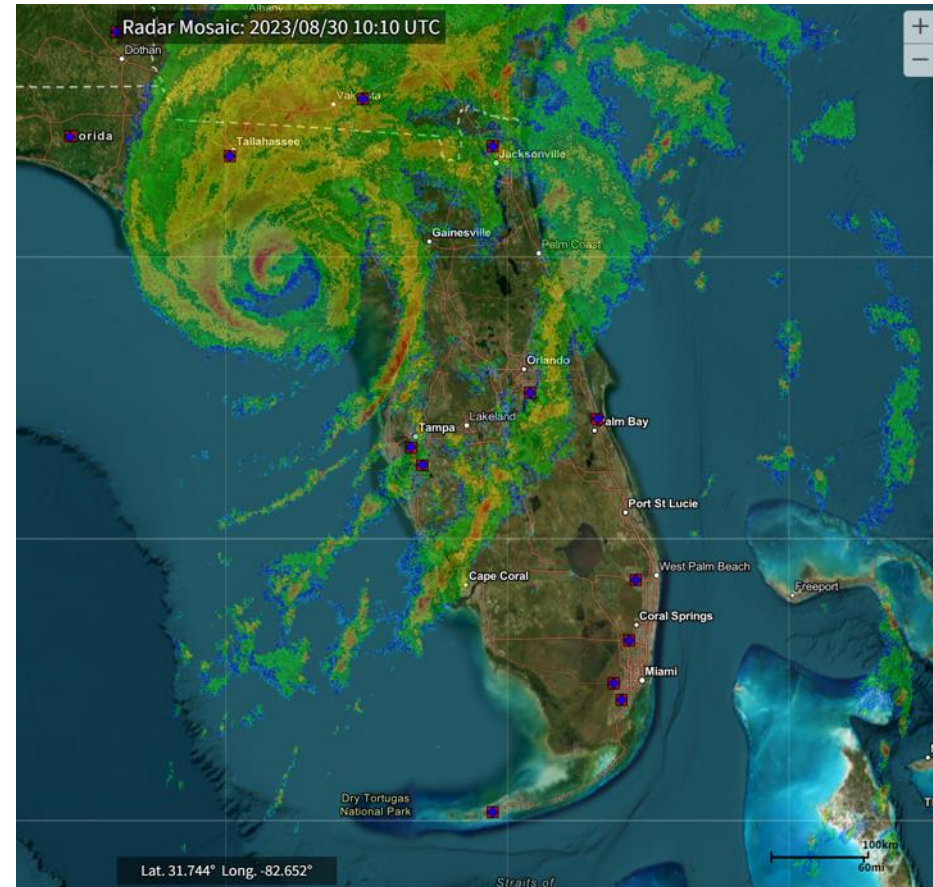
Johnathon Santo Micali, Civil Engineering Student, Univ. of Florida

Agenda:

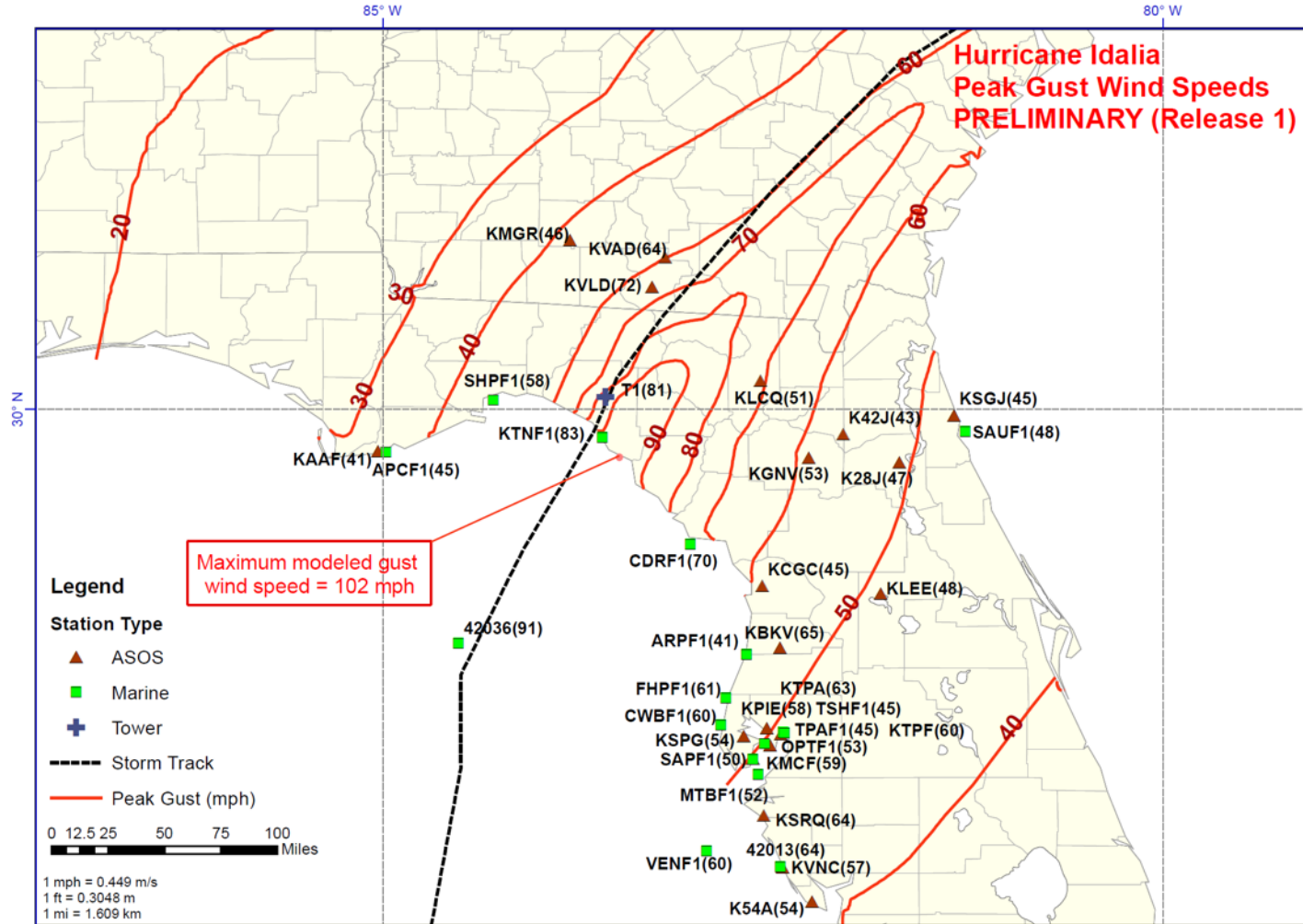
- Hurricane Idalia Summary (wind, surge, rainfall, tornadoes)
- Florida Building Code Modifications
 - Design Wind Speed
 - CCCL Lines
- Triage Building Performance Assessment by UF
 - Deployment
 - Initial Triage Assessment of Building Performance
 - Formal Surveys (with StEER and others)
- Enrichment of Reconnaissance Data
- Summary
- Questions and Comments?

Hurricane Idalia (2023) Summary

Landfall Date	30-August 2023
Landfall Location	Kenton Beach, FL
Landfall Intensity	Category 3
Max Sustained Winds at Landfall (NHC)	125 mph
Peak Surge Inundation	~ 8 ft above ground level
Economic Losses	\$2.5 – 4 billion (Verisk)
Fatalities	9 total / 5 direct in FL and GA



Hurricane Idalia – Wind Hazard Observations



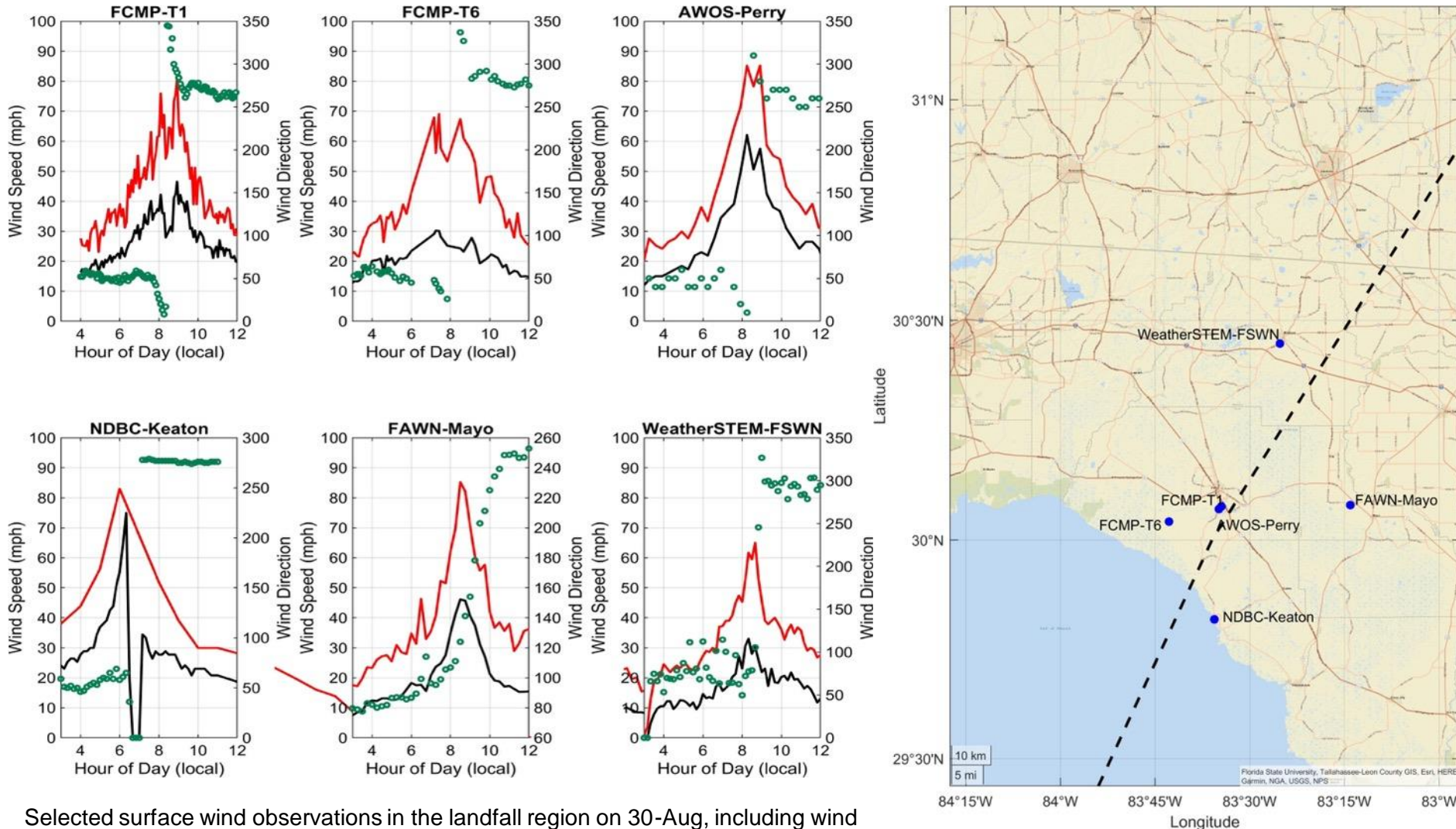
Hurricane Idalia (2023): Preliminary Peak Wind Gust (mph)

Estimated 3-second gust wind speeds (mph) at 33 ft above ground over flat open terrain from ARA model fit to surface level observations using storm track and central pressure data from NHC through Intermediate Advisory Number 19A and observations through 1200 UTC on 8/31/2023. The values of peak gust winds in mph are shown after station names; Values have been adjusted for anemometer height and terrain; "-" means station failed before the arrival of the peak wind; "a" indicates a potentially anomalous value. The maps have been produced for the National Institute of Standards and Technology under Contract 1333ND22PNB730388. Maps are subject to change.

Created on: 8/31/2023

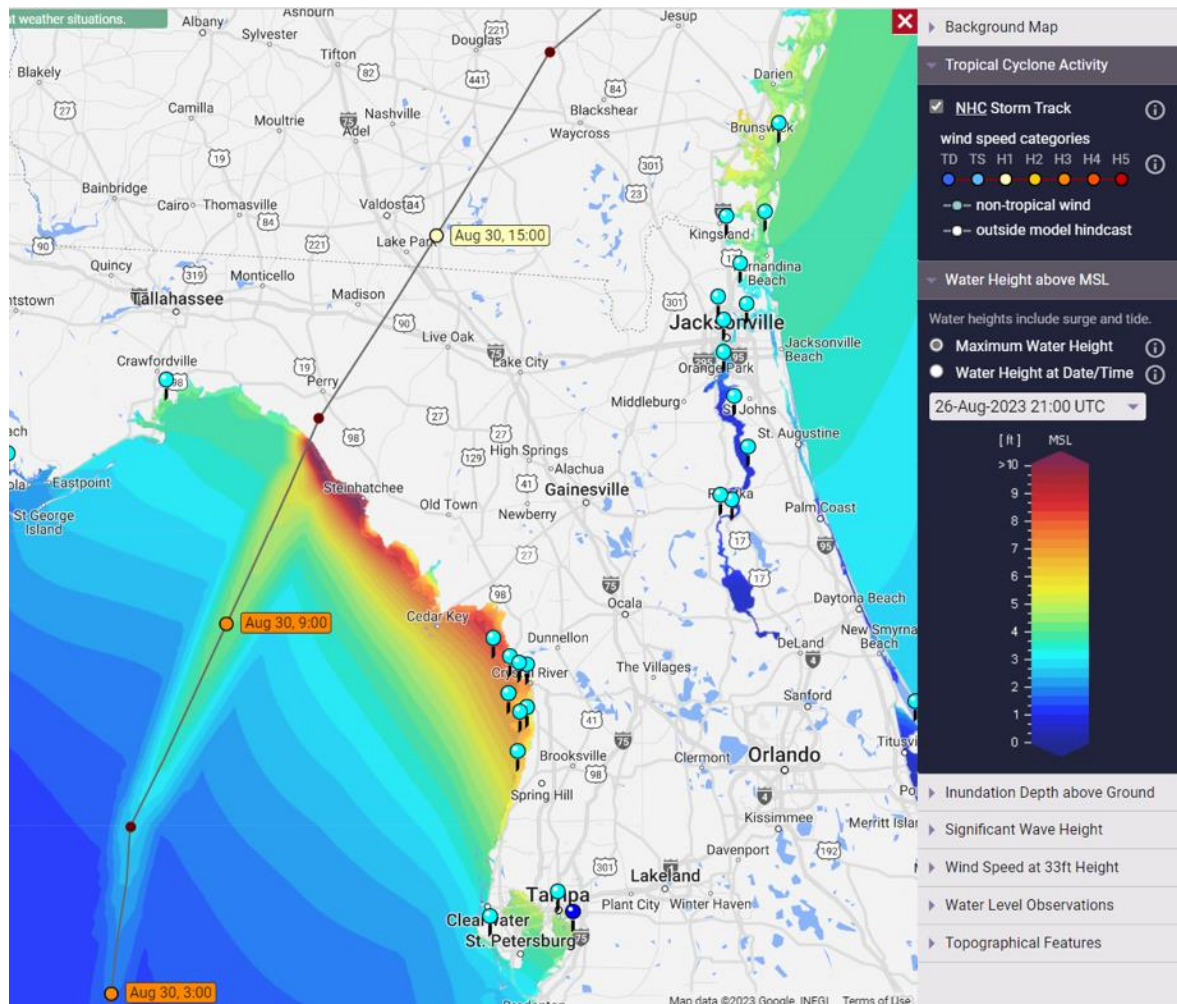


Hurricane Idalia – Surface Wind Observations

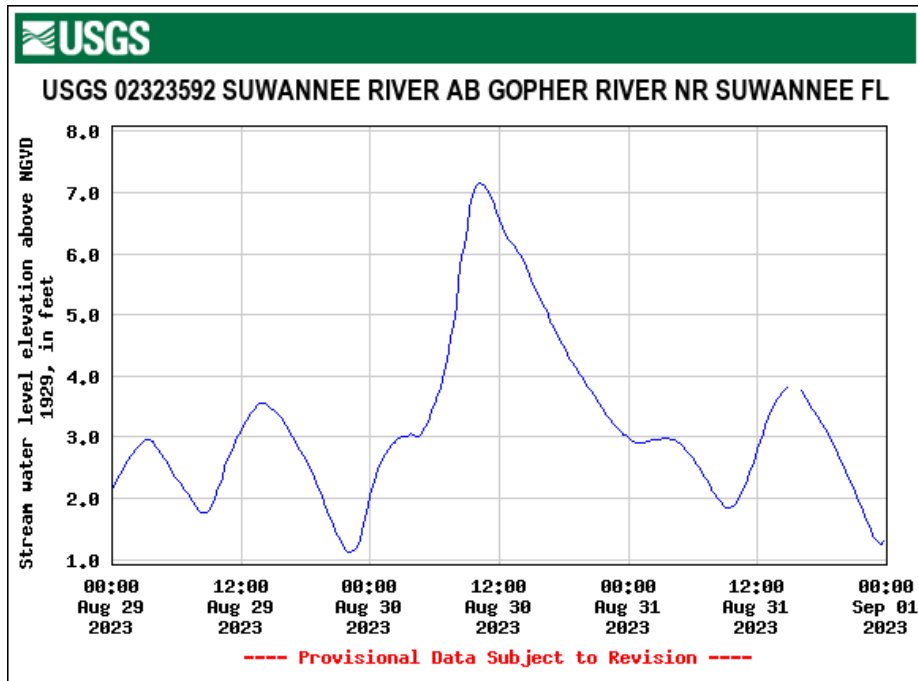
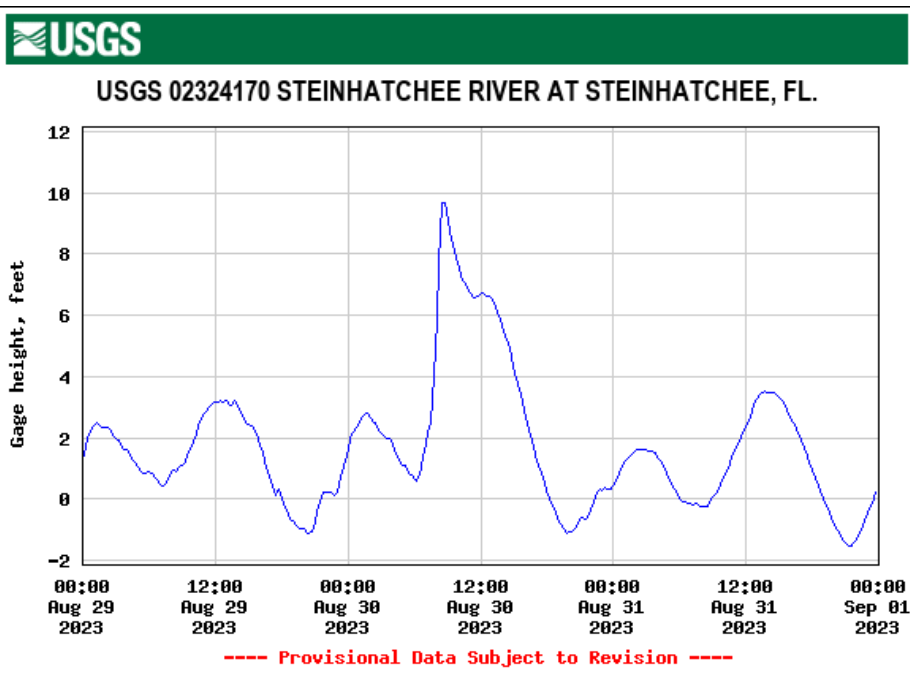
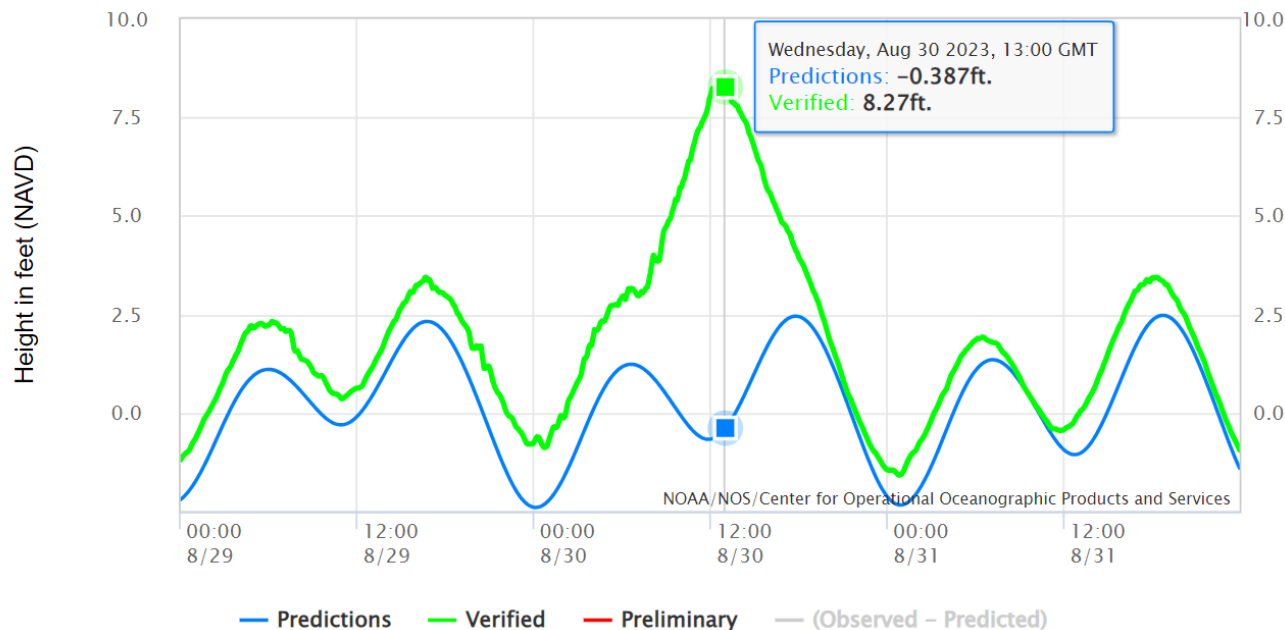


Selected surface wind observations in the landfall region on 30-Aug, including wind gusts (red), sustained wind speeds (black), and wind directions (green). Note: Precise averaging times for gusts and sustained winds vary slightly between stations.

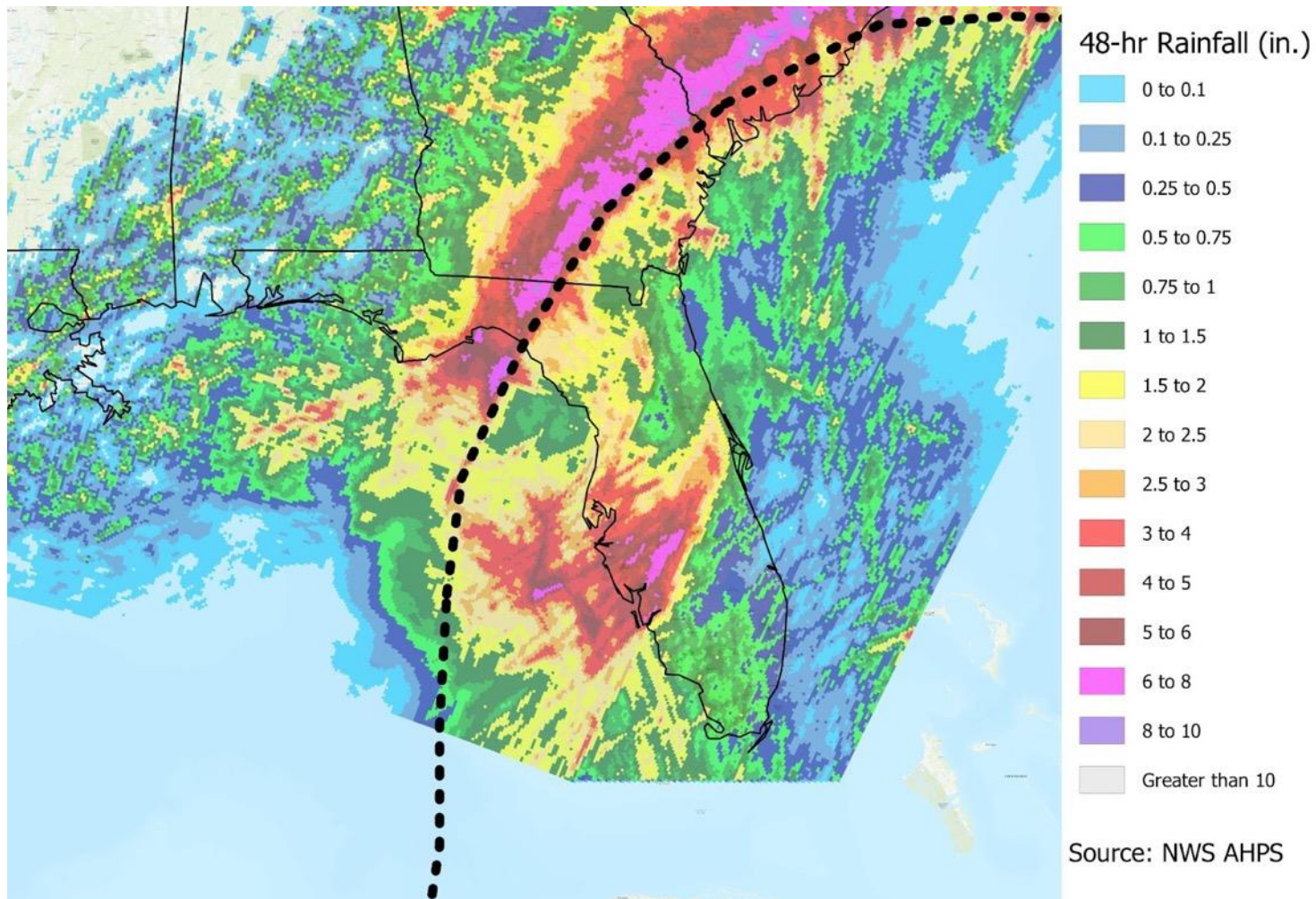
Storm Surge relative to Mean Sea Level



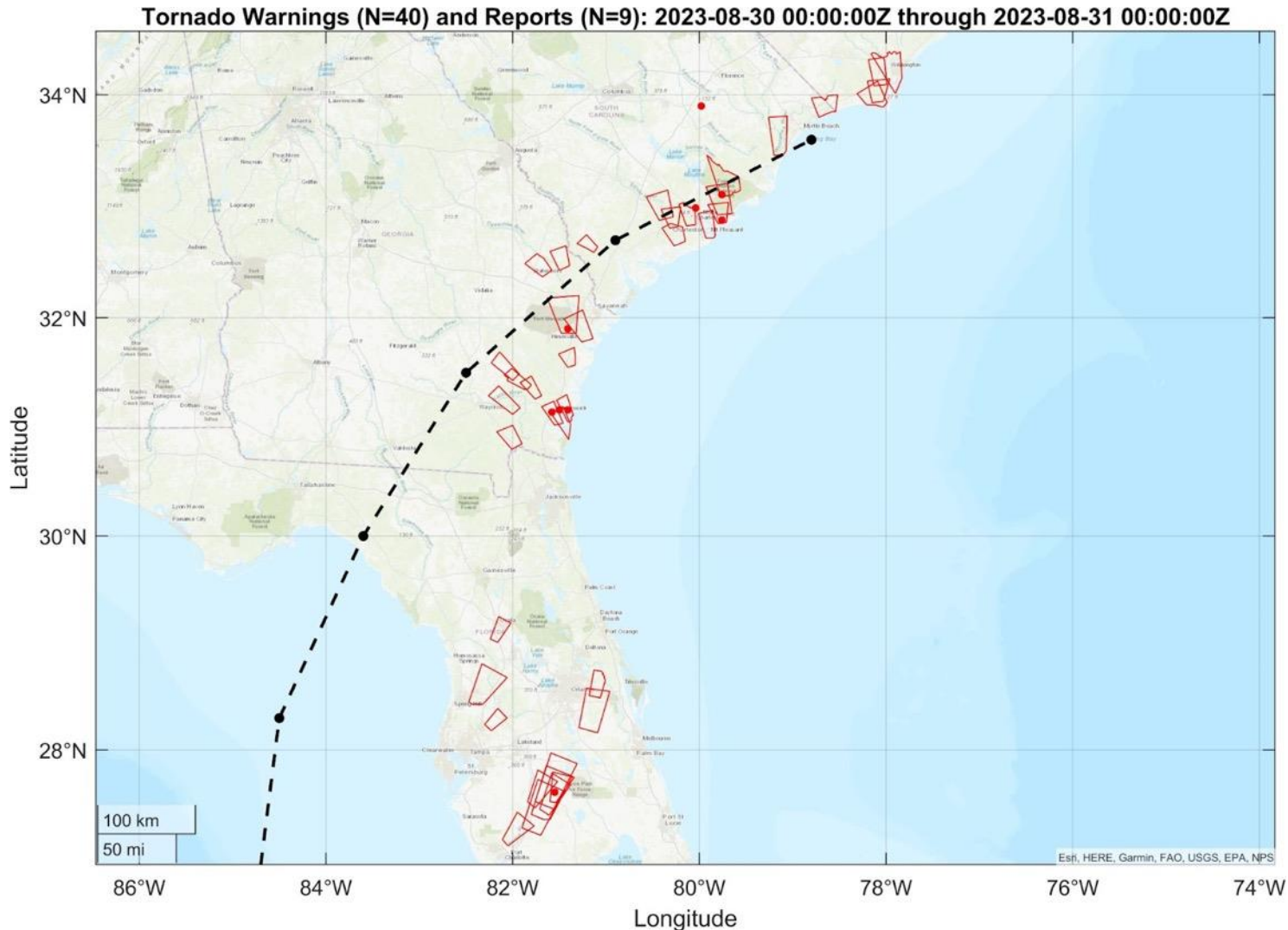
NOAA/NOS/CO-OPS
Observed Water Levels at 8727520, Cedar Key FL
From 2023/08/29 00:00 GMT to 2023/08/31 23:59 GMT



Idalia's Rainfall Intensity



Tornado Warnings and Sightings



Local Building Codes Provisions - History

Table 3.1. History of building codes and wind design standards for Keaton Beach, FL

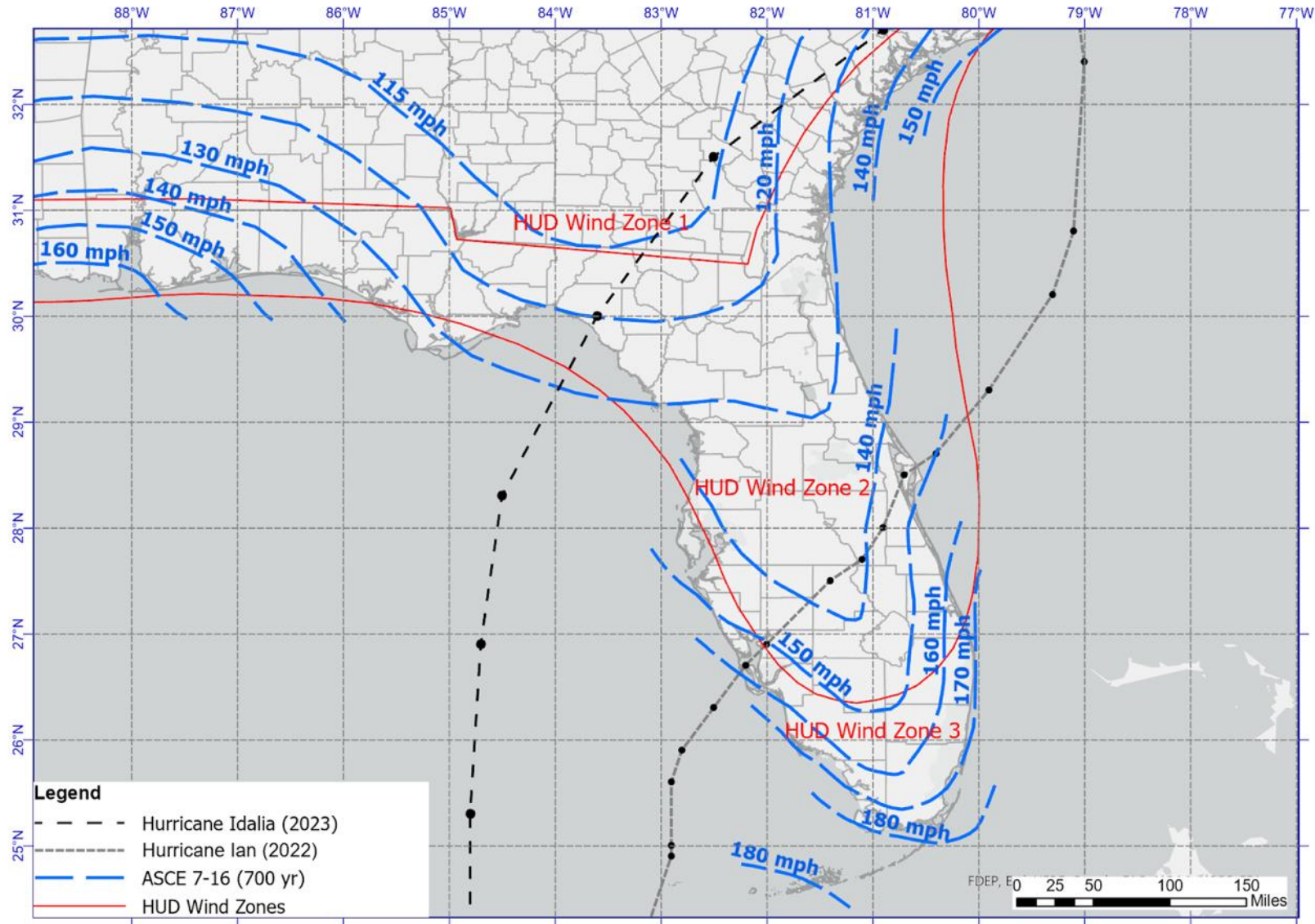
Code Edition	Effective Date	ASCE Reference	Design Wind Speed (mph) ^a	ASD Wind Load Factor	Lateral Design Pressure (psf) ^b
1997 SBC	Pre-2002	ASCE 7-98	120	1	36.8
2001 FBC	Mar-02	ASCE 7-98	120	1	36.8
2004 FBC	Oct-05	ASCE 7-02	120	1	36.8
2007 FBC	Mar-09	ASCE 7-05	120	1	36.8
2010 FBC	Mar-12	ASCE 7-10	122	0.6	22.9
2014 FBC	Jun-15	ASCE 7-10	122	0.6	22.9
2017 FBC	Dec-2017	ASCE 7-10	122	0.6	22.9
2020 FBC	Jan-2021	ASCE 7-16	117	0.6	21
2023 FBC	July-2023	ASCE 7-22	122	0.6	22

^a Design wind speeds are 3-second gusts in open terrain at 10 m height above ground level, but correspond to a 50 yr MRI in ASCE 7-98/02/05 and a 700 year MRI in ASCE 7-10.

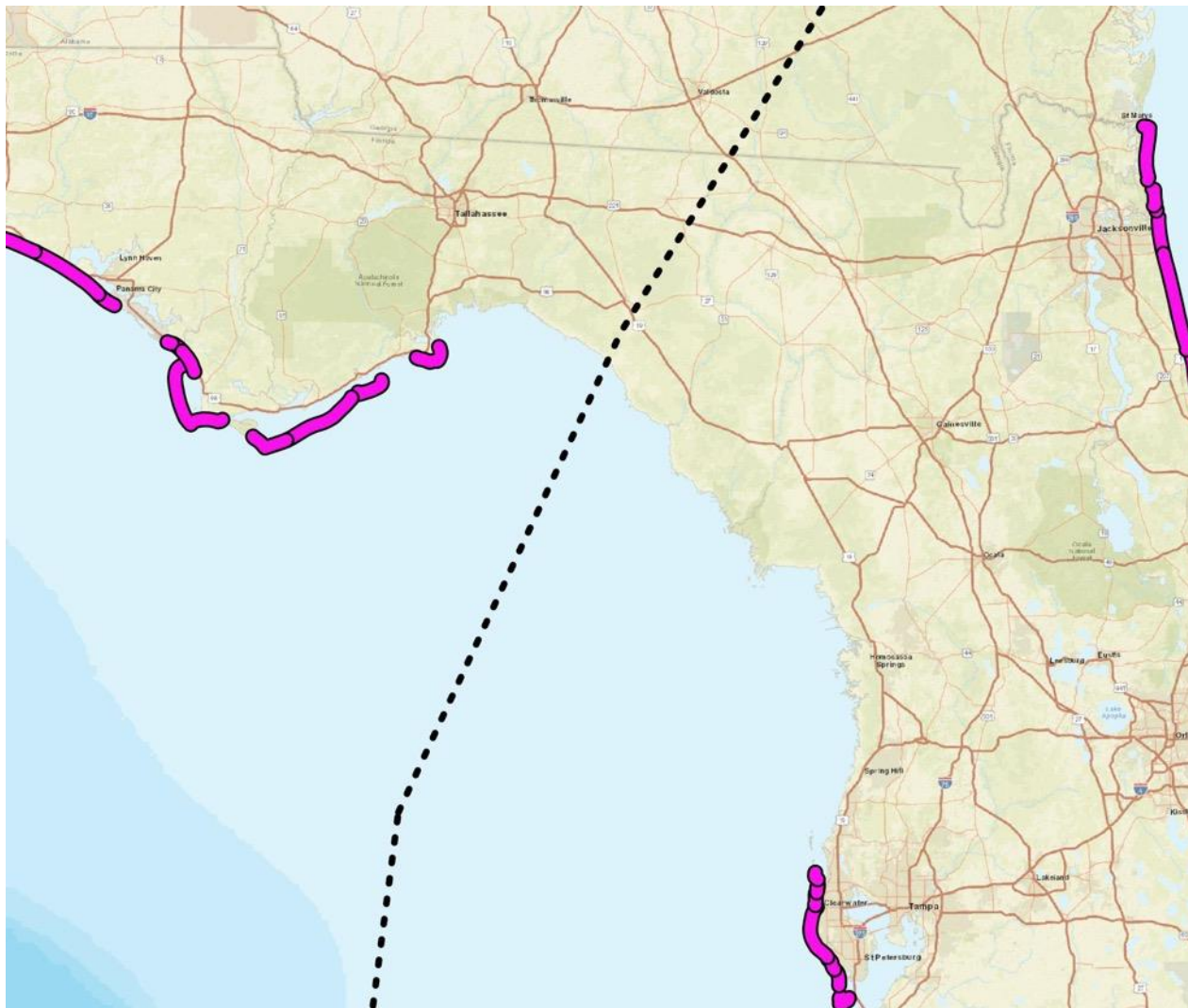
^b Lateral design pressure is defined as $P = 0.00256 \cdot (V_{\text{design}})^2 \cdot \text{LF}$, where V_{design} is the design wind speed, and LF is the ASD wind load factor.

FBC Changes after Hurricane Charley (2004)

- Improved wood to masonry wall interfaces
- Improved roof tile attachment
- Adoption of wind-rated resistance of asphalt shingles
- Required roof deck re-nailing when reroofing
- Adoption of wind pressure criteria for soffits
- Adoption of wind pressure labels for windows, garage doors, and shutters.



Florida Coastal Construction Control Line



Idalia best track with respect to the Florida Coastal Construction Control Line (2022). The CCCL is absent in the landfall region.

--- NHC Best Track
FL CCCL (2022)

0 25 50 mi



Post-Idalia Assessments

- Two triage assessments performed

Date	September 1, 2023	September 8, 2023
Personnel	(2) UF personnel, led by co-PI Gurley	(4) UF personnel, led by PI Prevatt
Locations Assessed	Steinhatchee, Dark Island, Keaton Beach, Dekle Beach, Ezell Airstrip neighborhood	W of Jasper, SW of Live Oak

Dr. Gurley and Dr. Ferraro Survey

1 September 2023

Wind-only damage

Steinhatchee
Dark Island
Keaton Beach
Dekle Beach
Ezell Airstrip

- Primarily loss of roof cover (shingles or old metal roofs)
 - Most structures had little to no observable roof cover loss
 - Roof cover loss was almost exclusively to older buildings
 - All elevations of subject buildings typically not available, so unseen damage is very likely
- Debris impact damage evident
- Window damage was observed. Pressure vs debris not assessed
- Roof decking damage was observed but infrequent, and only older construction

Overall observation is that coastal wind damage is consistent with that expected for a Cat 1-2 event, but it is much less frequent or severe than Cat 3 expectations. (This is independent of any storm surge damage)

Keaton Beach



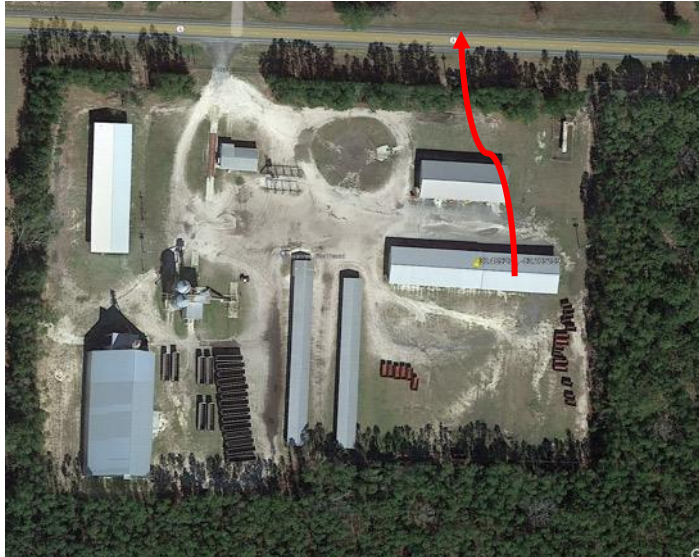
Dark Island



Ezell Airstrip Neighborhood



Suwannee R. Peanut Co.



Polo Hay LLC



Case Study - #1



(before)



(after)

Complete destruction of single-story, concrete masonry home constructed in 1970.
(Horseshoe Beach, FL)

Case Study - #2



Complete loss of a building (a) in Horseshoe Beach, FL. Failed (broken and withdrawn) foundation members (piles) can be seen. Home was built in 1937 and was elevated ~6 ft above grade. Building (b) was constructed in 1994 and elevated ~10 ft above grade.

Case Study - #3



Wall and window damage likely due to surge (Horseshoe Beach, FL)

Case Study - #4

Before ([Google Maps](#))



After



Structural roof damage to a wood-frame home constructed in 1982, elevated approximately 7 ft above grade. An adjacent home, constructed in 1994, only suffered minor wall cladding loss. (Keaton, Beach, FL)

Multi-family Dwellings



Extensive facade (brick) damage, limited sheathing damage exposing insulation, and loss of balcony end wall on an apartment building in Perry, FL.

Category	Damage Observed
Single-Family Residential Buildings	Pre-1994 houses predominantly damaged, at or near grade. Roof cover and wall cladding losses
Multi-Family Residential Buildings	Brick building cladding failures, roof cover failures
Commercial Buildings	MBMA building total collapse, gas station canopies, storm surge damage to coastal structures,
Farm Buildings	A few total collapse of wood, steel framed buildings
Healthcare/Medical Facilities	No damage observed
Schools	Failures of metal roofing, & asphalt shingle roofing
Government Facilities	No damage observed
Mobile/Manufactured Homes	Few damage reports – including homes floated off foundation by storm surge
Critical Facilities	Fire Station, Cedar Key – Accessory structure
Historical Buildings	No damage observed
Religious Institutions	1 flooded church in Horseshoe Bend, 2 roofing failures from churches (Perry and Jasper, FL)

Farm Buildings

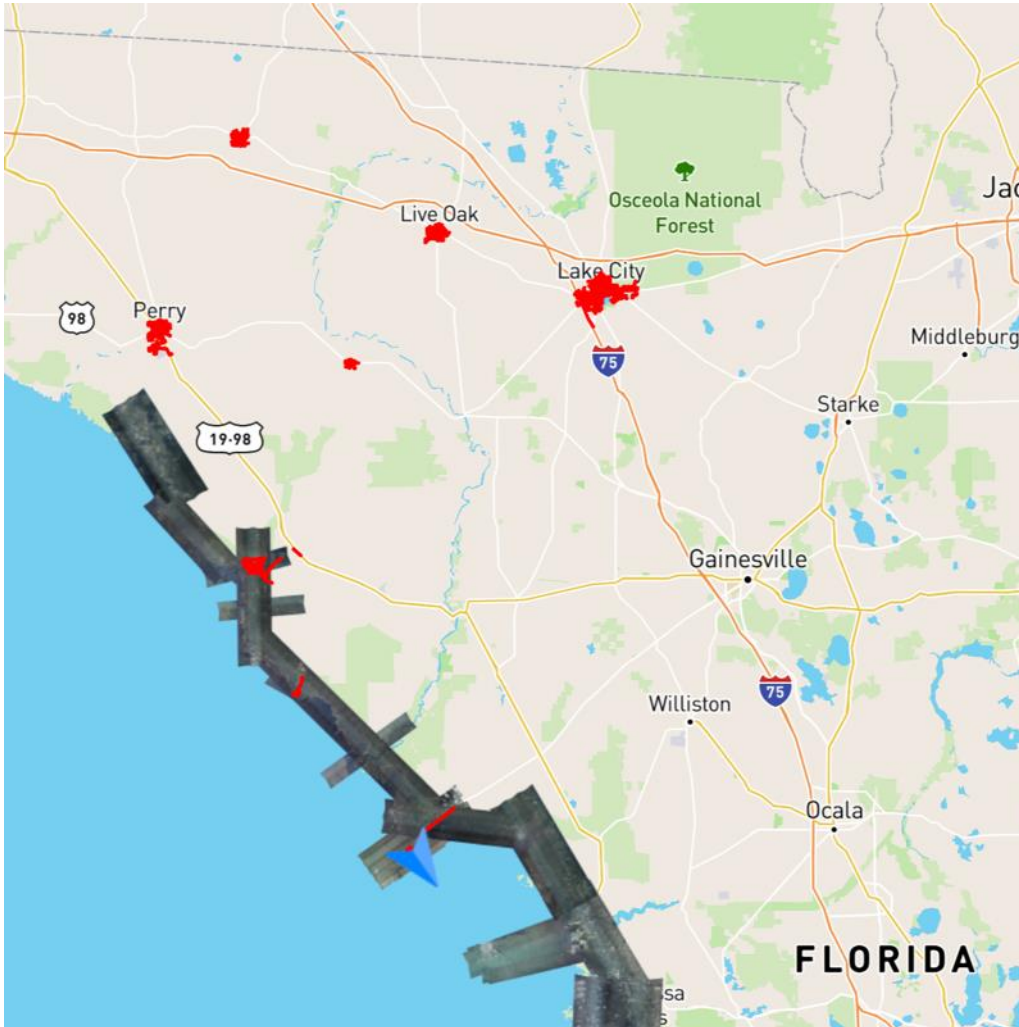


Column-foundation pull-out capacity failure.(Source: UF Triage Assessment).

Additional Visual Data Available



Before/After Imagery by SiteTour360



Approximately 450 miles of data

Cedar Key

Steinhatchee

Horseshoe Beach

Mayo

Perry

Lake City

Live Oak

Madison

Summary

- Hurricane Idalia was one of the lowest-impact major hurricanes to landfall in the state of Florida in recent years – due to rural location
- Moderate peak wind speeds (70 to 90 mph), caused damage to structures well inland from coast, as far as Jasper, FL near to the Georgia border.
- We do not recommend further investigation given small numbers of damaged buildings - anticipate limited opportunity to derive new knowledge
- Opportunities for bolstering community resilience:
 - Risk perception and behavioral response to risk information (wind speeds 90 mph)
- Policy advocacy
 - Coastal Building Elevations/ Blue Sky Study
 - Reconsider: Code Exemptions for Buildings on Agricultural Property
 - Vulnerability of Manufactured and Mobile Homes (especially in coastal locations)

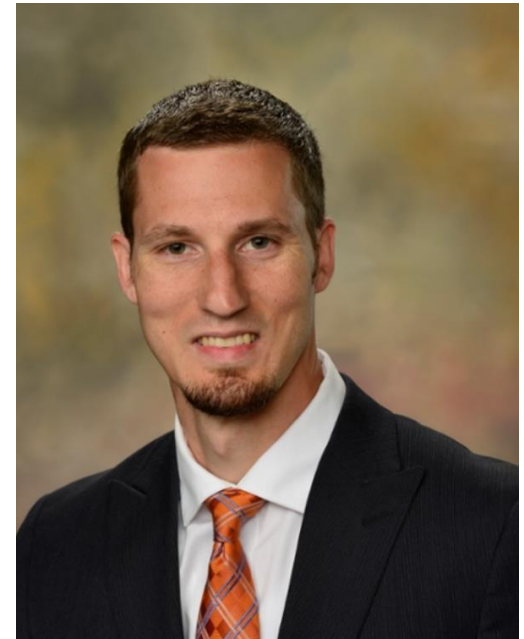
Thank you for your Time!



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