

VARIATIONS IN POST-STORM ASSESSMENT METHODOLOGIES WITH A LOOK FORWARD TO CONCEPTS FOR THE FUTURE

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Acknowledgment

Ralph Clark, P.E., Office of Resilience and Coastal Protection, FDEP, Tallahassee, FL
(consulted on storm assessment approaches and historical information)



FLORIDA SHORE & BEACH
PRESERVATION ASSOCIATION
A League of Cities and Counties on Beach and Coastal Issues

35th Annual National Conference on Beach Preservation Technology
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STORM IMPACTS



LONG BEACH, NY: POST HURRICANE SANDY (2012)



POST-STORM EFFORTS

- Health and safety
- Damage assessments
- Recovery and repair
- Scope and cost



"YOU CAN FLUSH TOILETS"

STORM RESPONSE TEAMS

- **Local Governments**

- Rapid response, coordination, press reporting, costs

- **State (FDEP)**

- Windshield inspections, qualitative assessments, storm reports, costs

- **Federal (USACE)**

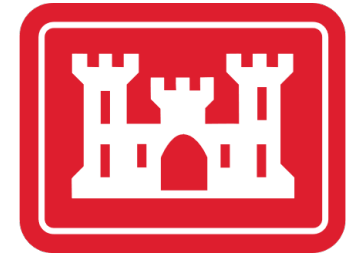
- Field teams, quantitative assessments, storm reports, costs

- **Federal (FEMA)**

- Emergency response, assisted by USACE, PDA, costs

- **Coastal Consultants**

- Assist all levels of government, perform field assessments, qualitative observations & quantitative assessments, and ... costs!



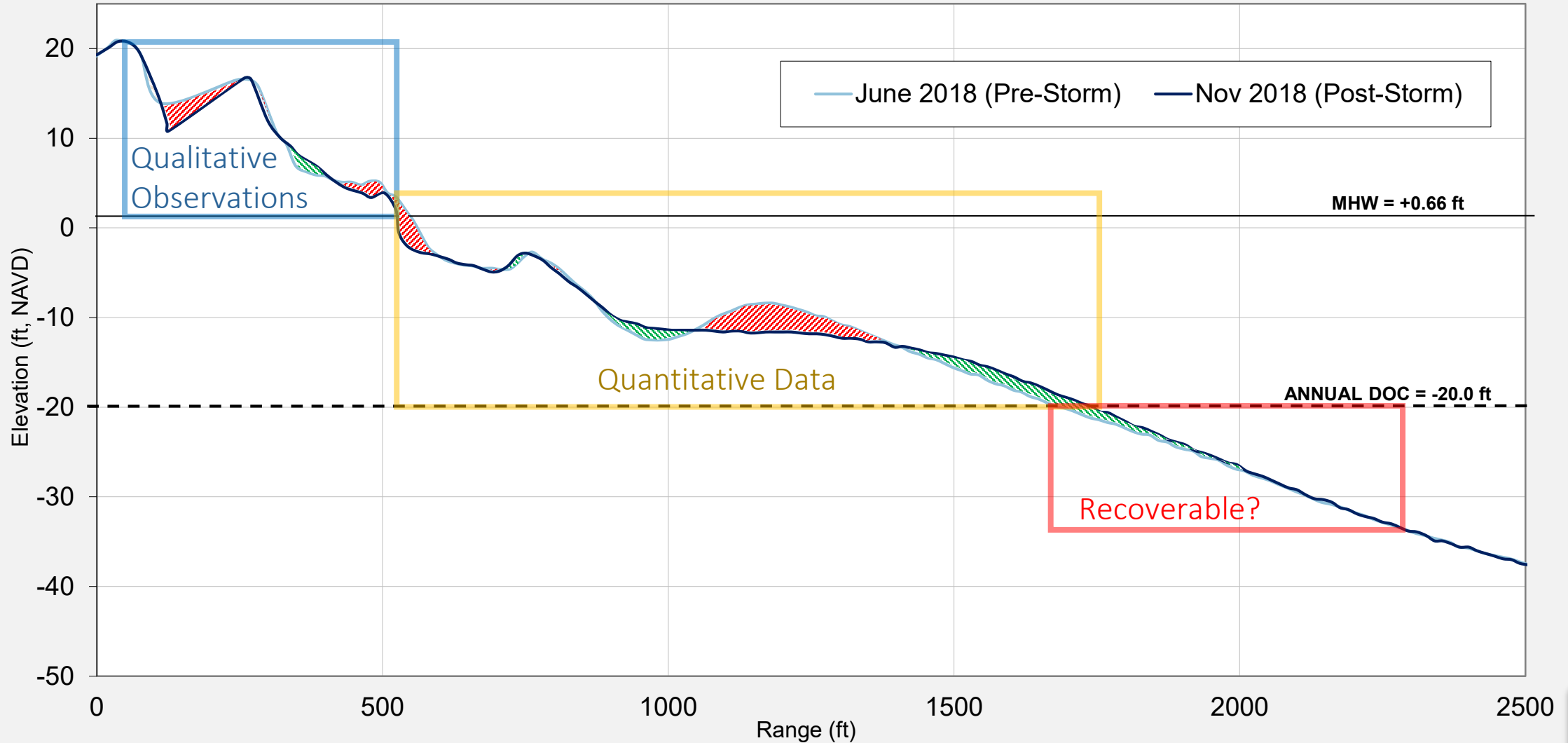
FEMA

INDIAN RIVER COUNTY – HURRICANE DORIAN

- Post-Storm site visit conducted September 5, 2019
- Visual assessment of dune/beach impacts for Sector 5
- Provided justification for Post-Dorian profile survey
- 50,000 cy estimate vs. 61,100 cy by post-storm survey



PANAMA CITY BEACH - HURRICANE MICHAEL



MANATEE COUNTY – HURRICANE ETA

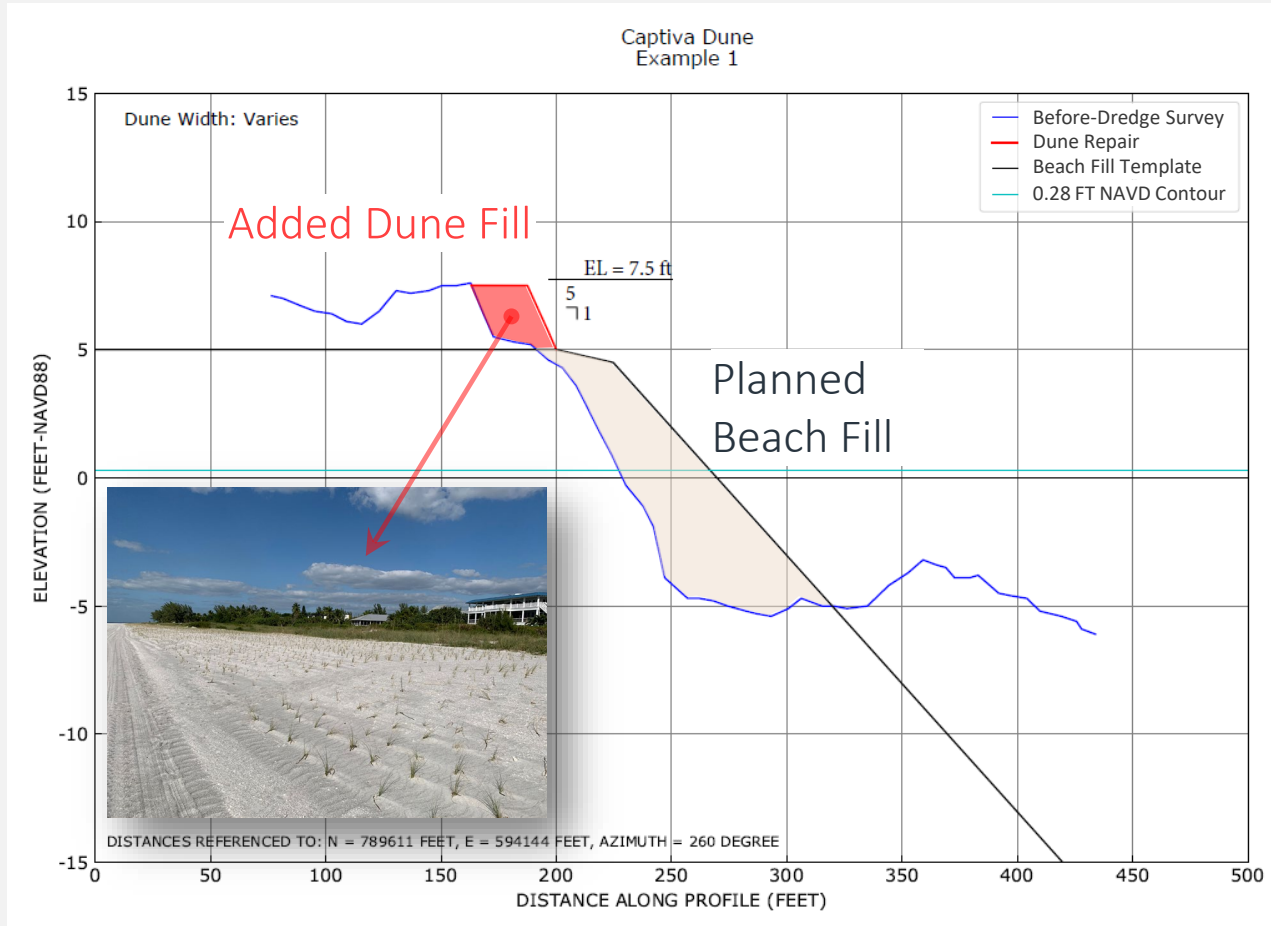


Post-Eta Photograph by Erica Carr-Betts, APTIM

- November 2020
- Relatively quick passage
- Observable return bar
- FEMA eligibility uncertain
- Active/upcoming projects
- No formal assessment

CAPTIVA ISLAND - HURRICANE ETA

- Widespread dune impacts post-award addressed by direct refilling



HOW TO ESTIMATE DAMAGES?



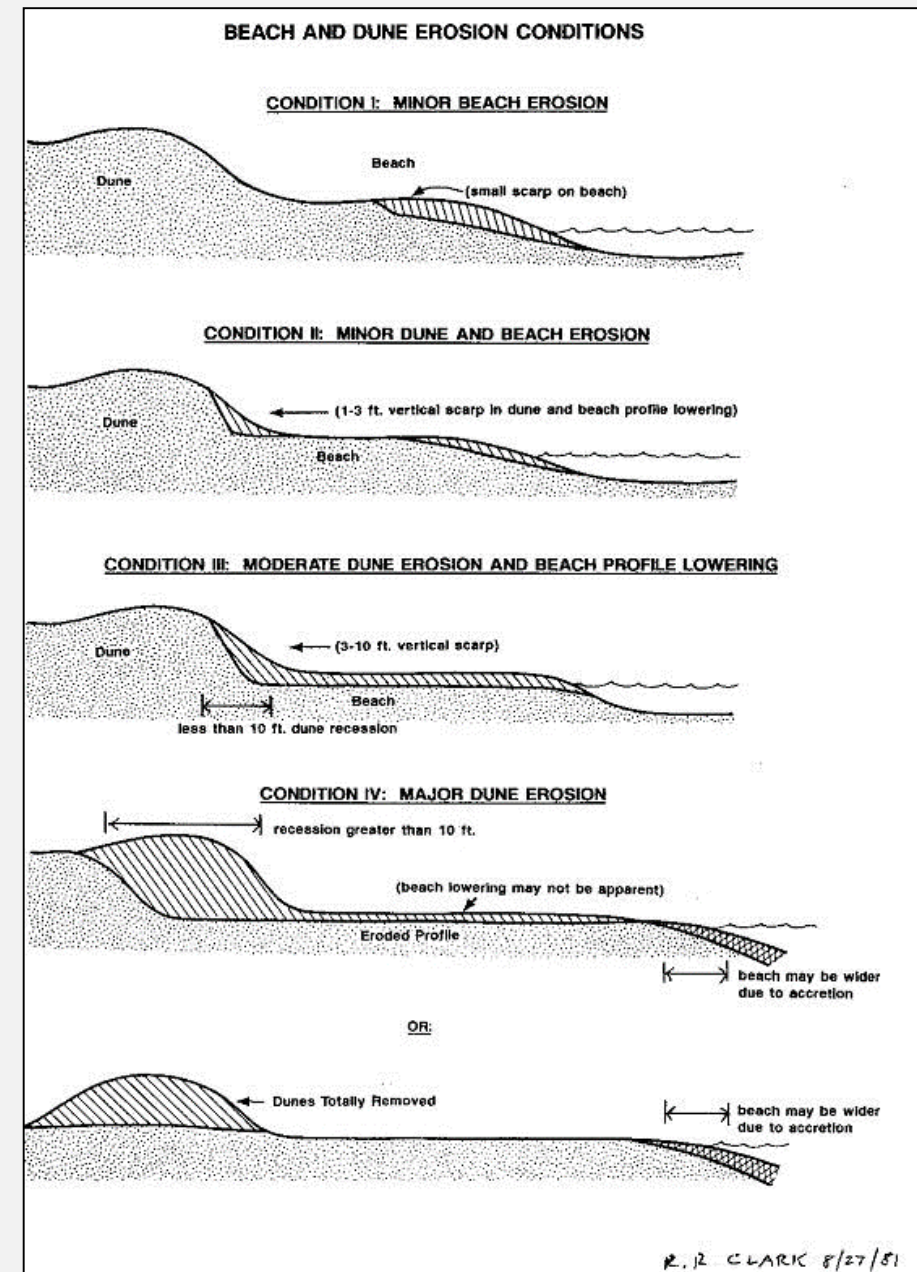
*What we learned in the 70's responding to storm events was that there was **no consistent or standard language for field inspectors and engineers to report post-storm beach conditions.** What was minor to one was major to another. And new staff people and staff that didn't have real "beach" experience were clueless. Also, locals looking for funding assistance as well as reporters looking for a "sky is falling" story tended to exaggerate the conditions. Others who didn't see the conditions before the storm, tended to minimize the effects. And then there were those in agreement that had different ways of describing the same conditions – major erosion, heavy erosion, etc. **Dean O'Brien used to tell me to make it simple.** So, this all gave birth to the*

"Clark Post-Storm Erosion Scale"

- RALPH CLARK, P.E., FDEP

CLARK POST-STORM EROSION SCALE

- No attempt to quantify the erosion
- Observe the conditions qualitatively
- Developed for FDEP (Clark, 1981)
- *“40 years later we’re still using it to qualitatively describe the post-storm beach conditions” - R. Clark*



EROSION SCALE CONDITIONS



Photo 3: Major Beach and Dune Erosion, New Smyrna Beach

- **Condition I - Minor Beach Erosion**
 - Small scarp on beach
- **Condition II - Minor Dune and Beach Erosion**
 - 1-3 ft. vertical scarp in dune and beach profile lowering
- **Condition III – Moderate Dune and Beach Profile Lowering**
 - 3-10 ft. vertical scarp (less than 10 ft. of dune recession)
- **Condition IV – Major Dune Erosion**
 - Dune recession > 10 ft. or dunes totally removed
 - Beach may be wider and lowering may not be apparent

Image source: HURRICANE FRANCES & HURRICANE JEANNE Post-storm Beach Conditions and Coastal Impact Report with Recommendations for Recovery and Modifications of Beach Management Strategies (FDEP, October 2004)

QUALITATIVE SCALE - ADVANTAGES

- Utility oriented toward program management and cost decisions
- Consistency in communicating the storm's impact
- Rapid response in advance of more expensive operations
- Provides focus for where quantitative data may be needed
- Allows for post-storm surveys to be reserved for high priority areas with qualitative assessments elsewhere

QUALITATIVE SCALE - DRAWBACKS

- Descriptive –
 - Good for natural beaches
 - Difficult to describe project erosion
- Subjective –
 - Storm tides that don't reach the dune line: *Condition I - Minor Beach Erosion*
 - Later post-storm surveys may show major beach erosion (measured)
- Extreme Events –
 - When a particular coastal area is assessed as *Condition IV*, an adjacent project area is likely to be assessed *Condition IV* as well; impacts may differ

Not intended as a substitute
for quantitative data

STORM DAMAGE ASSESSMENT CONSIDERATIONS FOR THE FUTURE

- Storm timing, intensity, scope/swath of impact
- Requirements for declared emergencies at the State and Federal levels
- Pre-storm conditions, visual observations, ground photographs, basic data collection
- Cost, timing, and location of traditional surveys
- Advanced remote sensing approaches

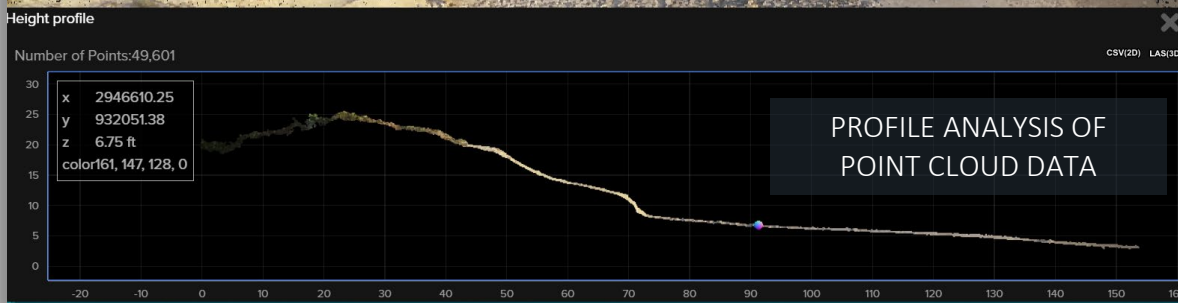
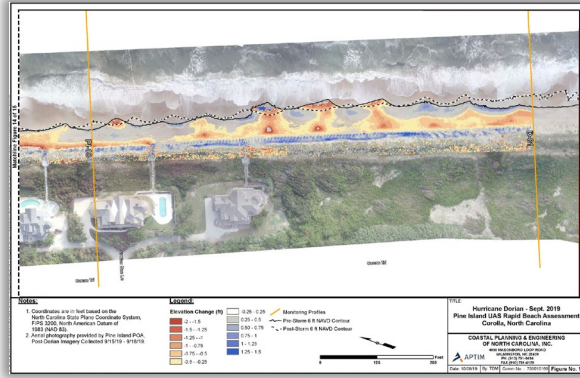
TRADITIONAL ASSESSMENT METHODS

- Rapid assessment by direct observation
- Comparable pre- and post-storm photos
- Basic measurements from landmarks and visual cues
- Topographic surveys of the dry beach to wading depth
- Hydrographic surveys of the submerged profile
- Quantification for cost estimates and funding requests



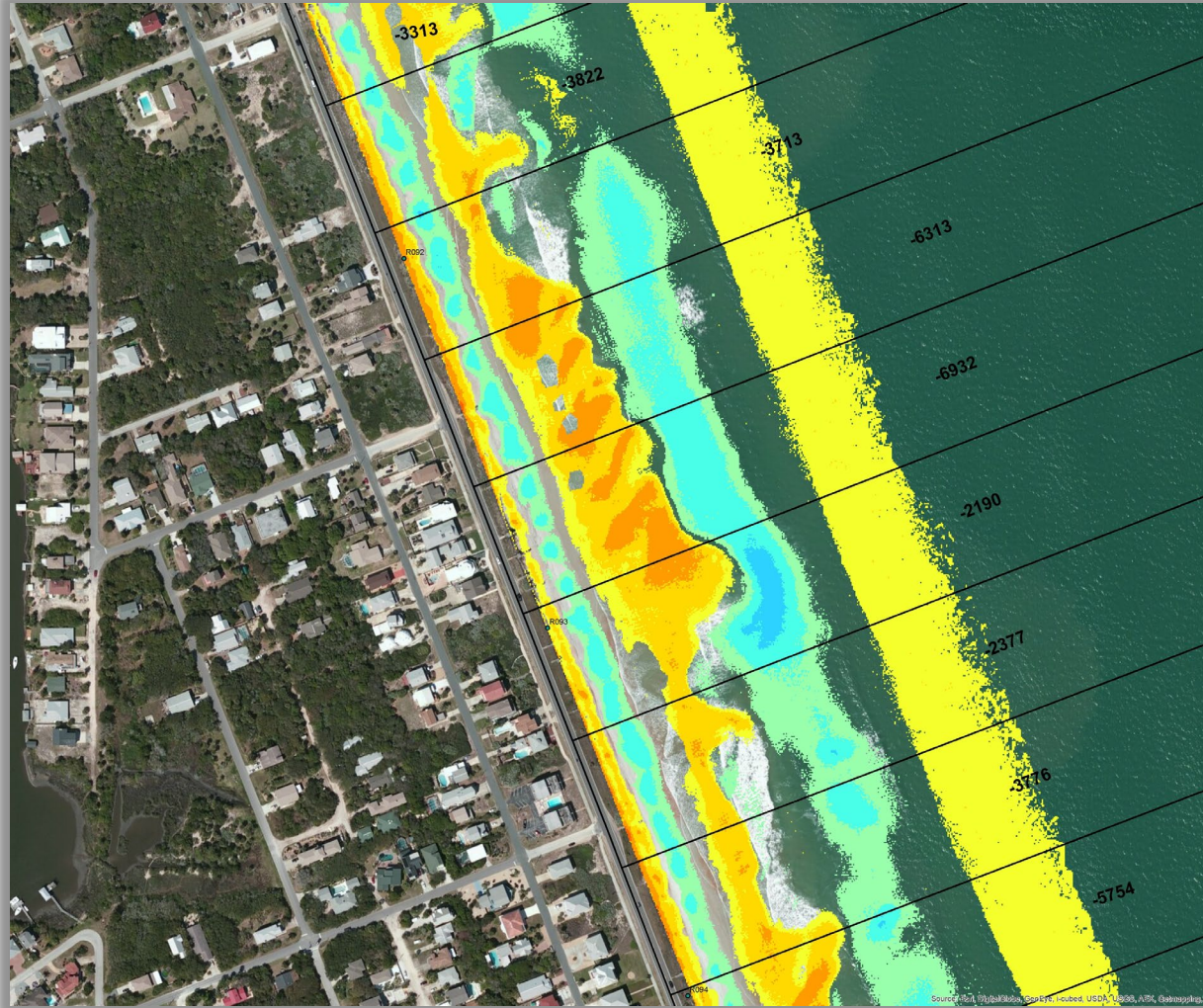
While pre- and post-storm observations can be used for rapid reconnaissance to supplement damage assessments, quantification can only be achieved through data collection and analysis.

UNMANNED AIRCRAFT SYSTEMS (UAS)



- Drone imaging by certified UAS pilot
- Beach and dune assessment surveys prior to and following storm events
- Rapidly deployed, high-resolution, low-cost, time-efficient, repeatable
- Limited to dry beach and line of sight
- Requires ground control or survey grade (RTK) drone for georeferencing
- Processing systems produce a wide variety of products and results

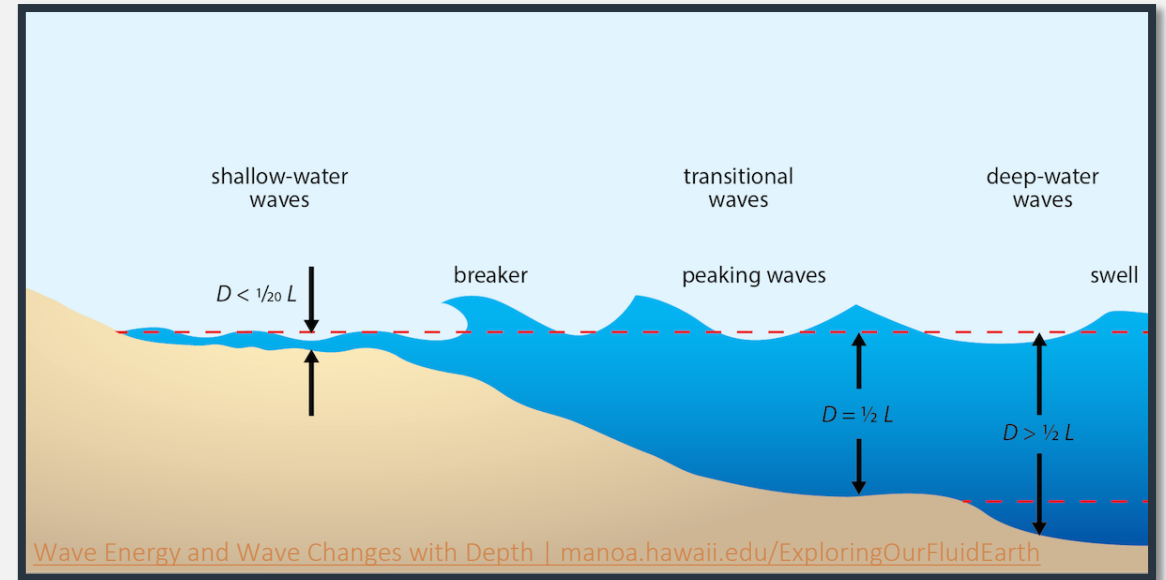
LIGHT DETECTION AND RANGING (LIDAR)



- Deployment with plane, drone, or vehicle mounted equipment
- Beach and dune assessment prior to and following storms
- High-resolution over large swaths
- Limited by system and water clarity
- Uses RTK GPS for georeferencing data
- Processing systems produce a wide variety of products and results

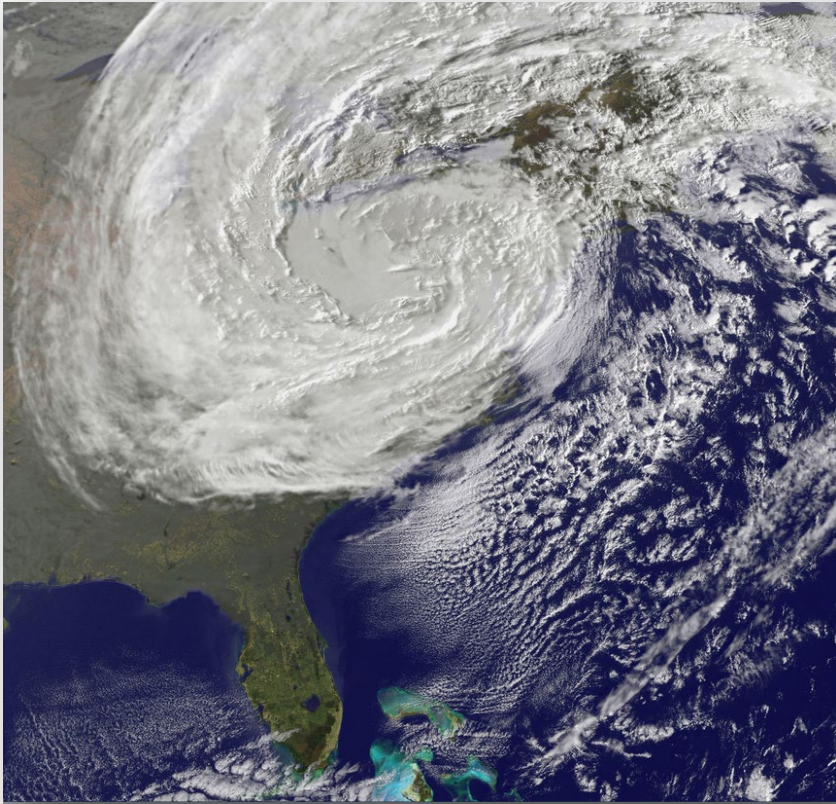
SATELLITE AND AERIAL DERIVED BATHYMETRY

- Wave kinematics, signal attenuation, image recognition, space-based laser
- Being studied worldwide
- Pros –
 - Continuous and readily available
 - Large scale regional assessments
 - Locates storm bar and other features
- Cons –
 - Satellite imagery can be expensive
 - Pixel limitations, resolution and accuracy
 - Continued development for improved quantification (shallow water, surf zone)



Remote imaging of waves to estimate the depth of the seafloor using specialized techniques and algorithms

SUMMARY



GOES Project Image Hurricane Sandy Oct 2012

- Storms are impactful in many ways
- Answers are often needed quickly
- Impacts are hard to quantify
- Need to “see” underwater
- No substitute for data collection
- Consistency is paramount
- Technology is helping get us there

THANK YOU!



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