



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

**National Conference on
Beach Preservation Technology**

**February 6-8, 2019
St. Augustine Beach, FL**



Broward County, FL Segment II Beach: Response to Hurricane Irma and Winter Storm Riley

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Broward County, FL





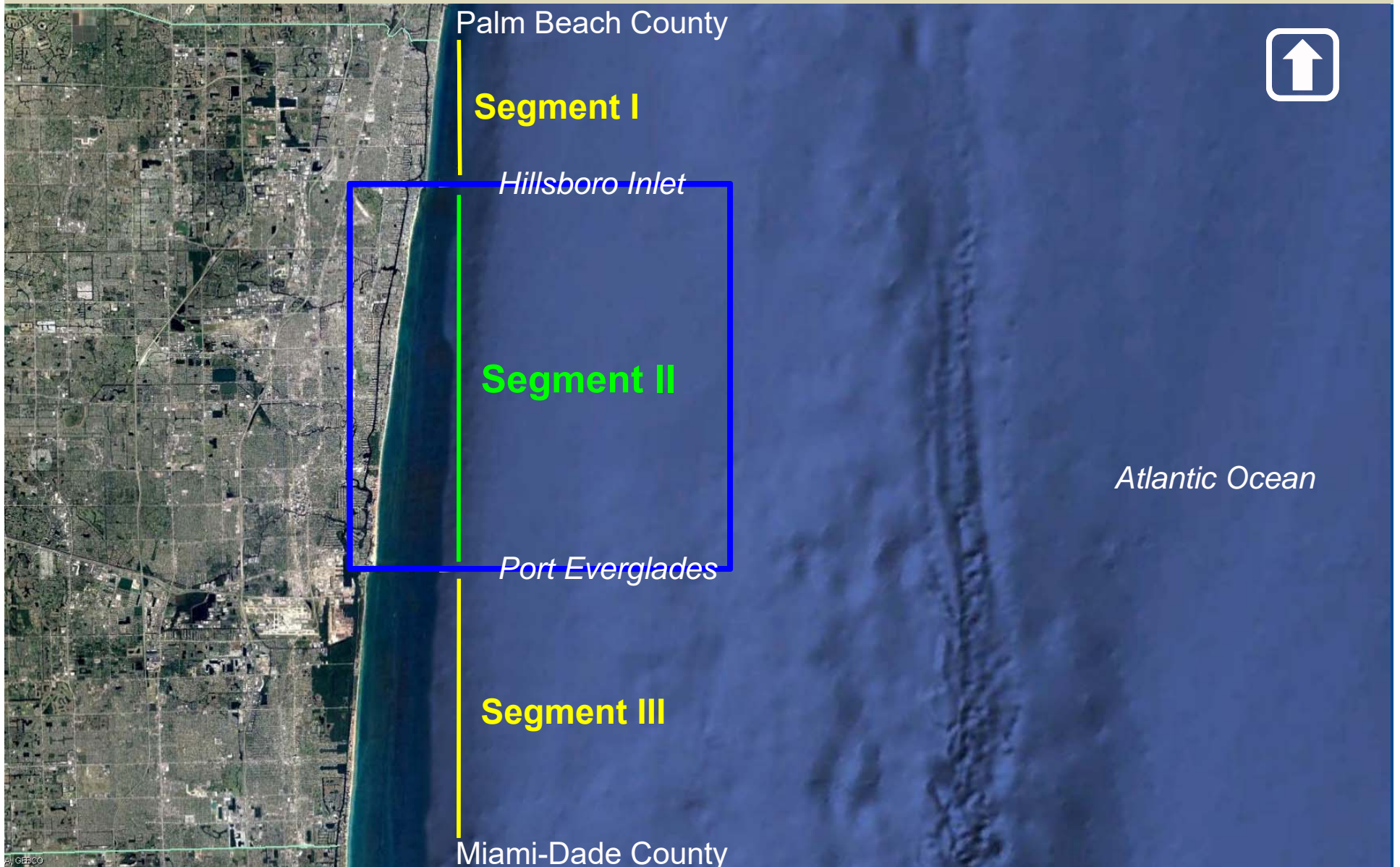
Gulf of Mexico

St. Augustine Beach

Atlantic Ocean

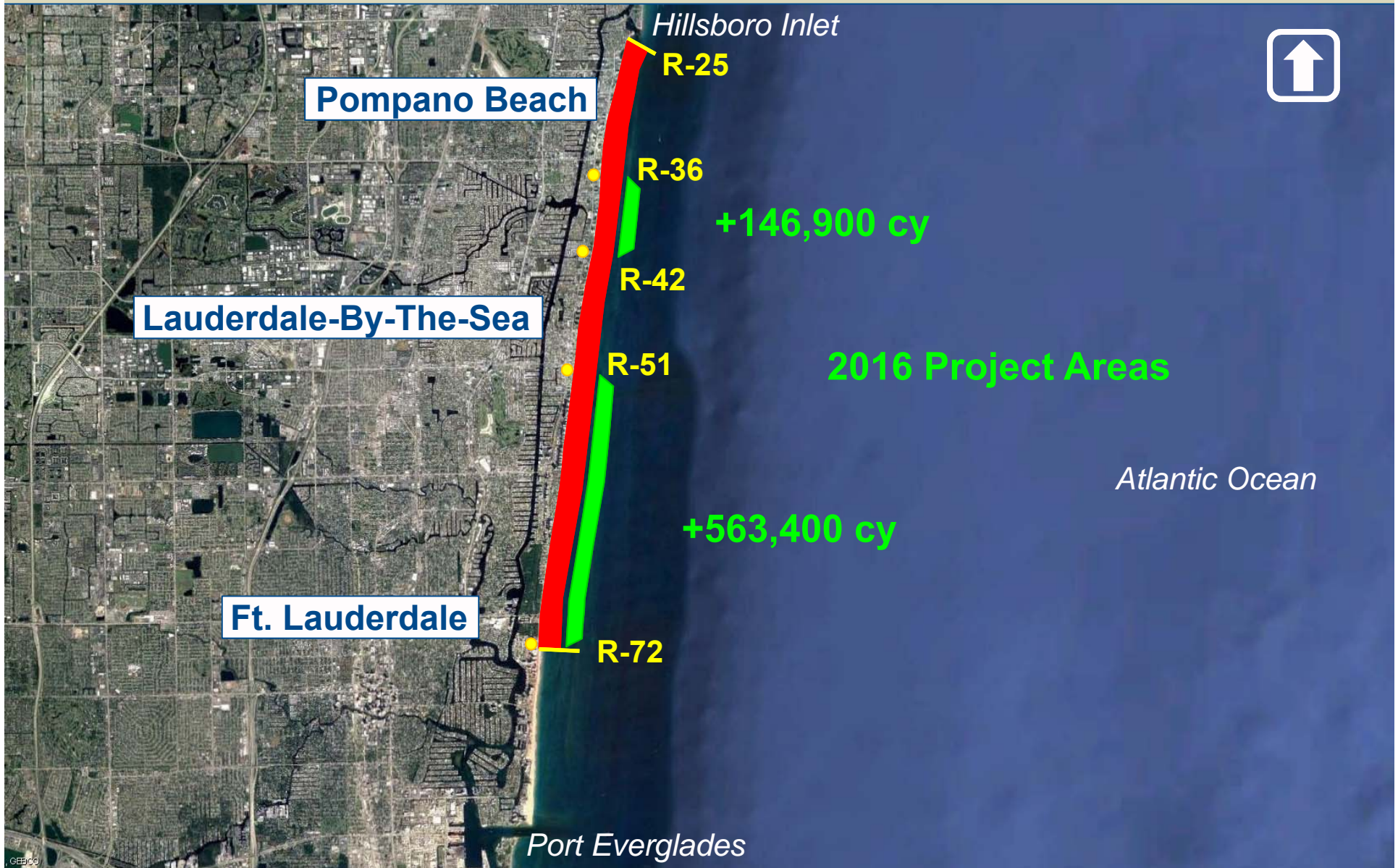
Broward County

BROWARD COUNTY SHORE PROTECTION PROJECT



AJ/GEP/CO

BROWARD COUNTY SHORE PROTECTION PROJECT – SEGMENT II



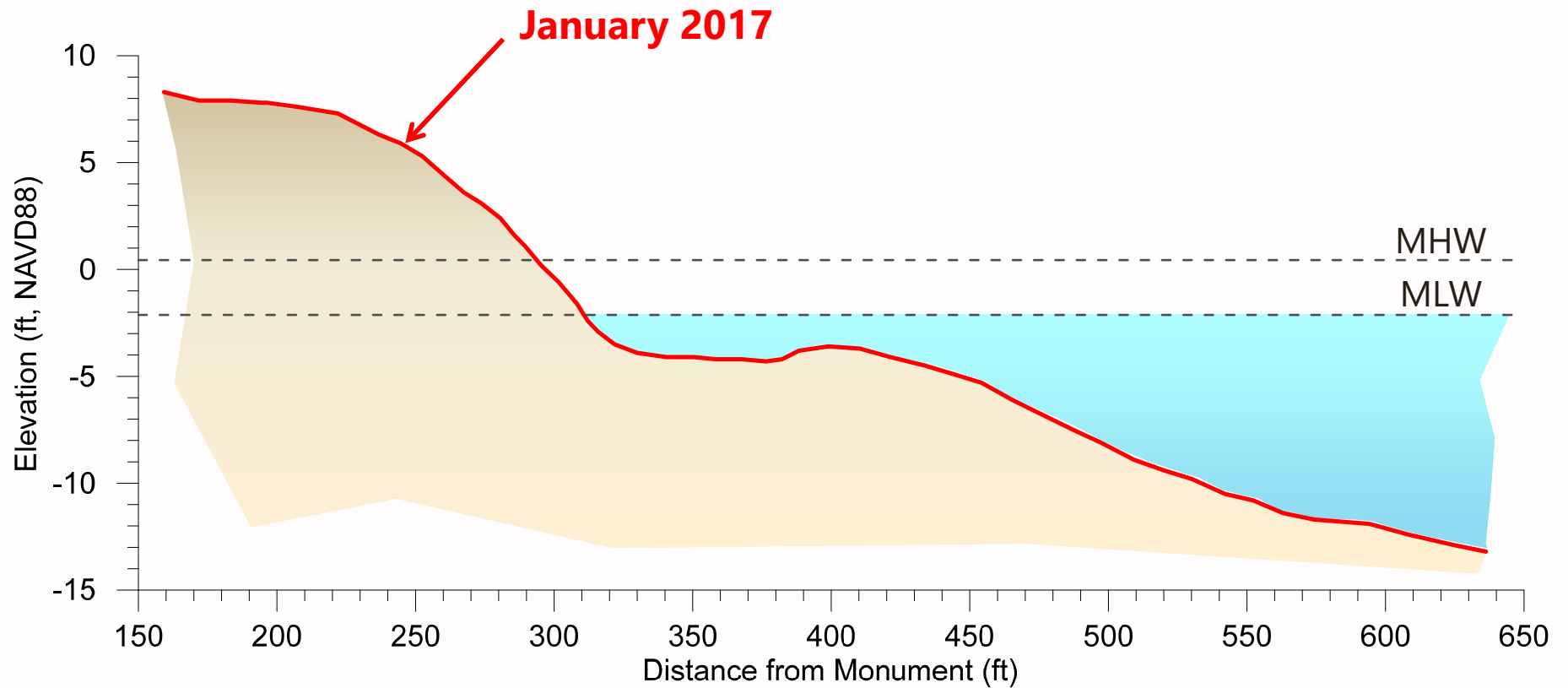
CEECO

2016 Segment II Renourishment

- 710,300 cy (~1 million tons)
- Upland Sand Mine (ER Jahna – Ortona)
- ~43,000 truck loads
- Completed in December 2016

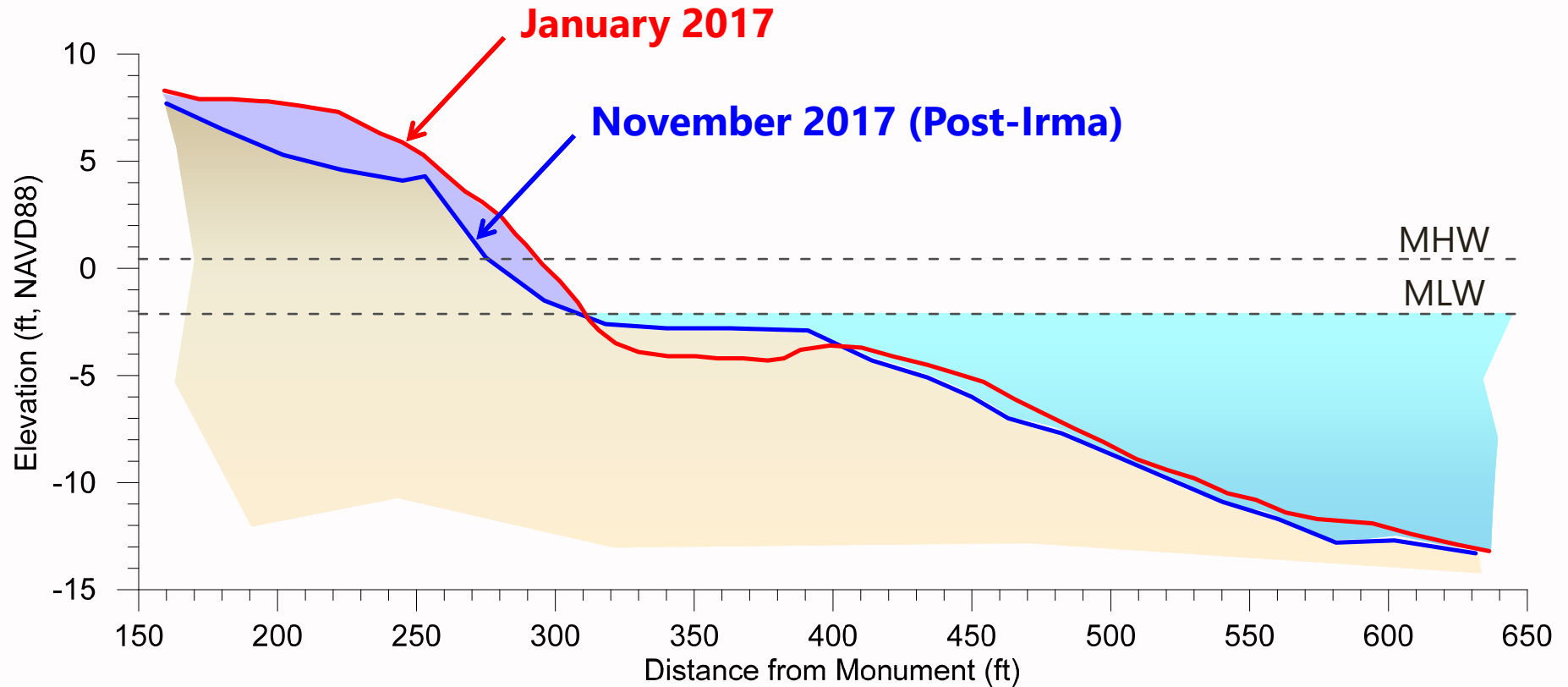


Segment II (R25 – R84.7)



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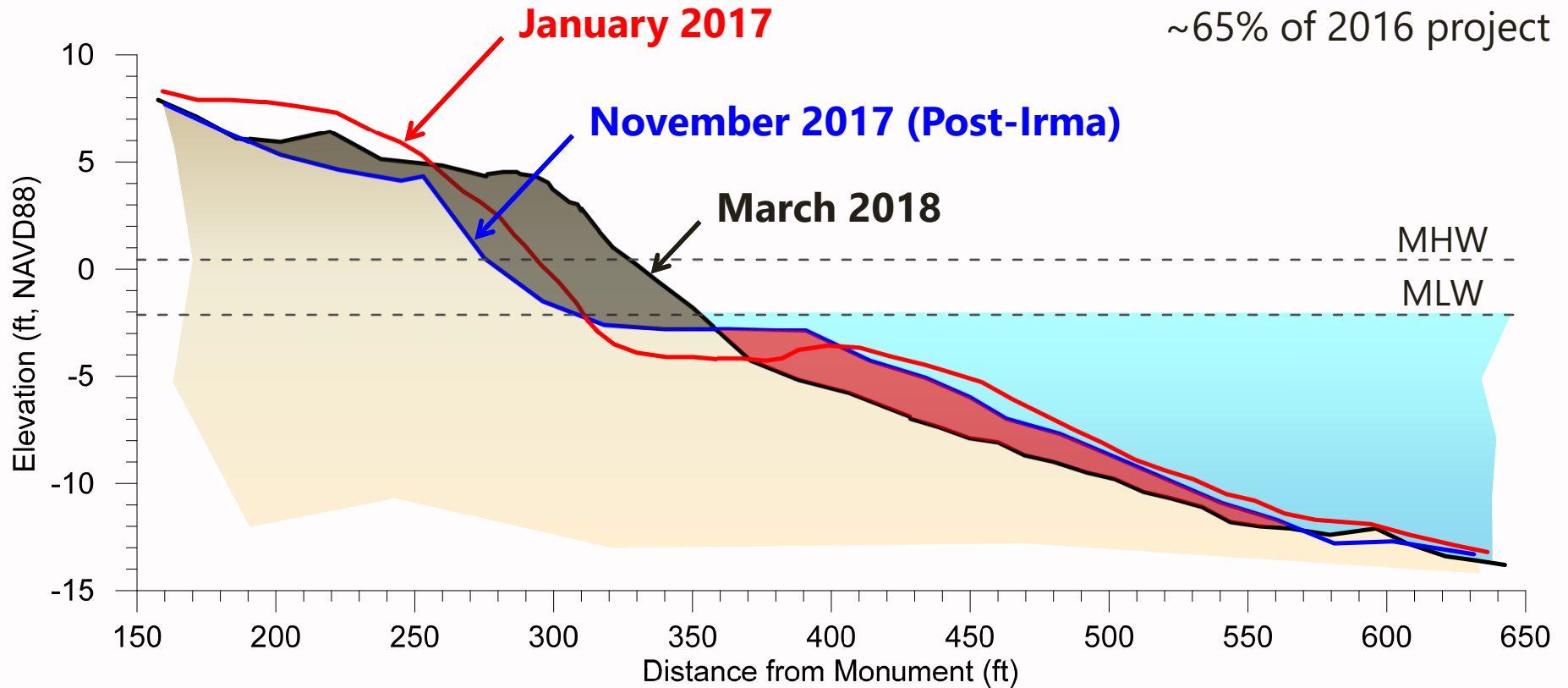
Volume Change above MLW
-113,900 cy (-1.9 cy/ft)



Segment II (R25 – R84.7)

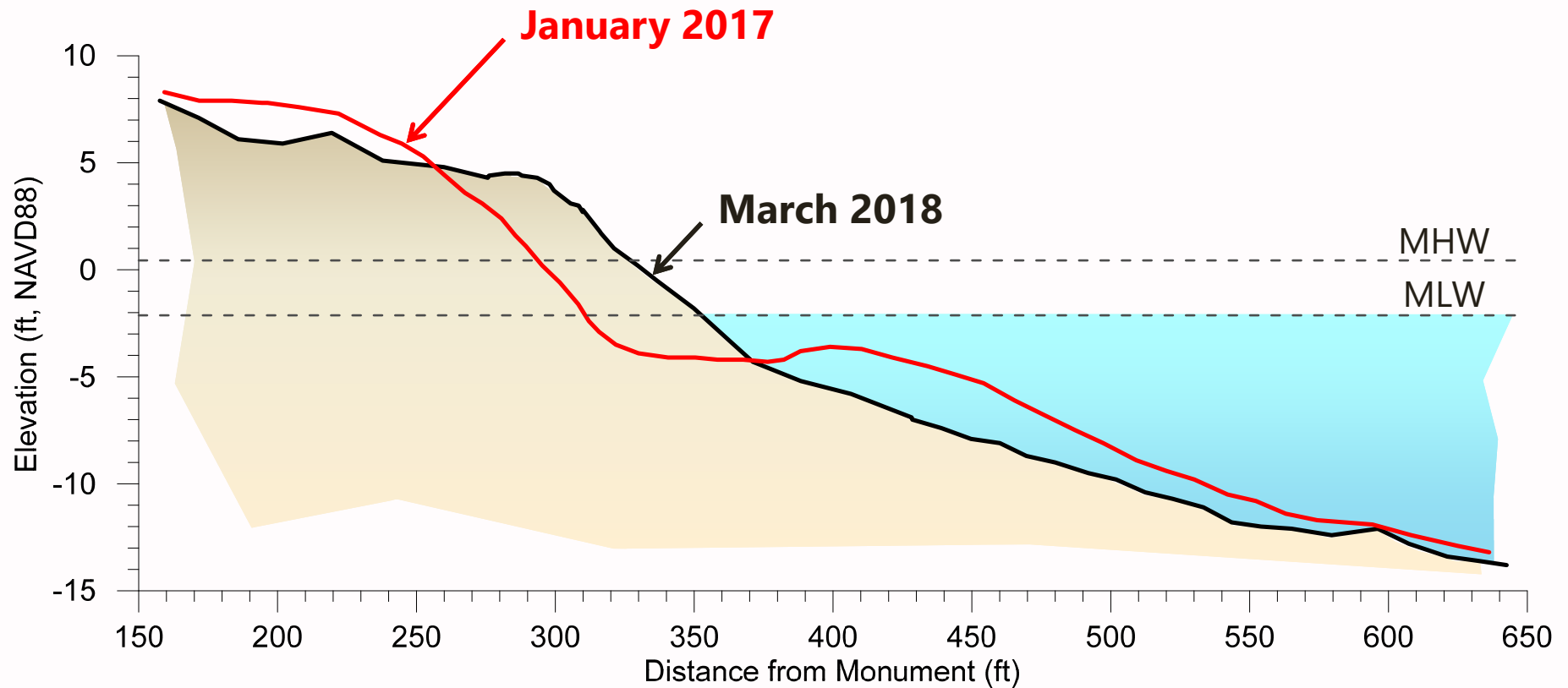
Volume Change above MLW
+454,500 cy (+7.6 cy/ft)

~65% of 2016 project

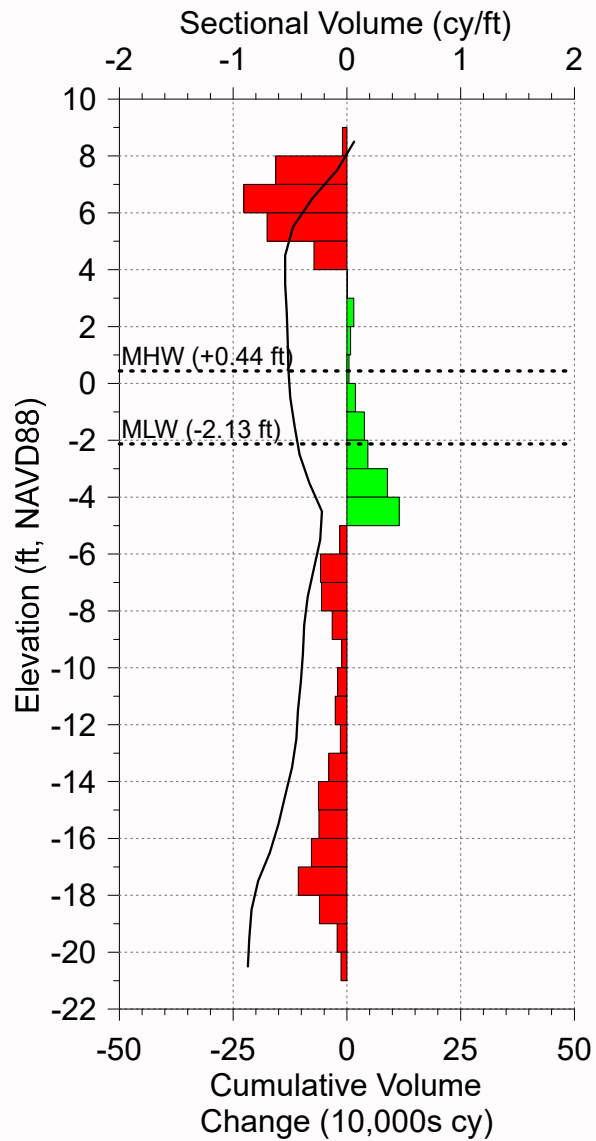


Segment II (R25 – R84.7)

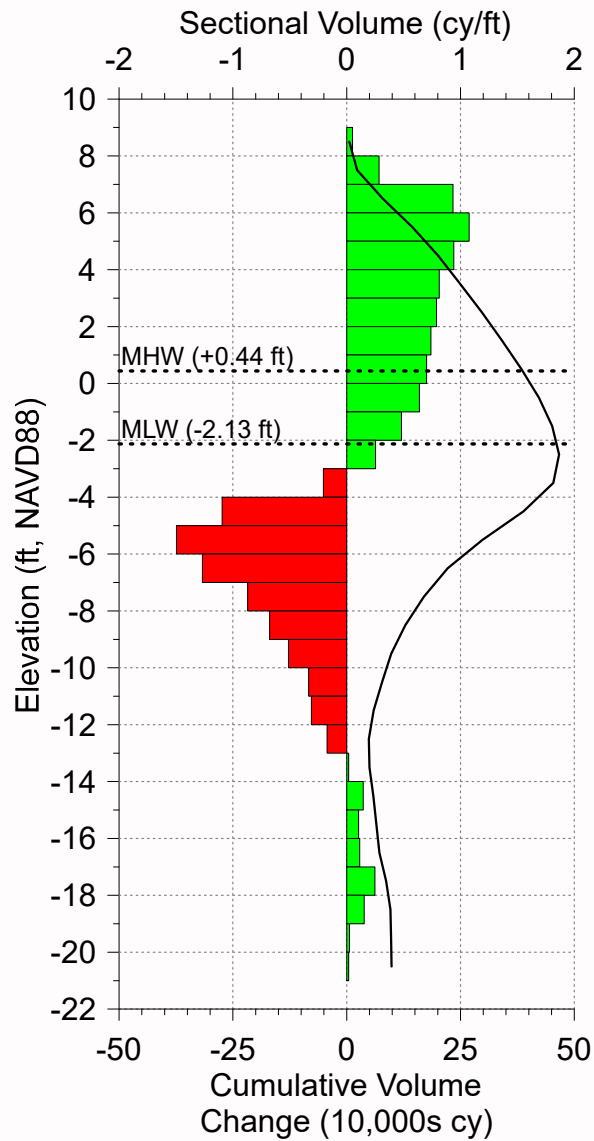
Volume Change above MLW
+341,500 cy (+5.7 cy/ft)



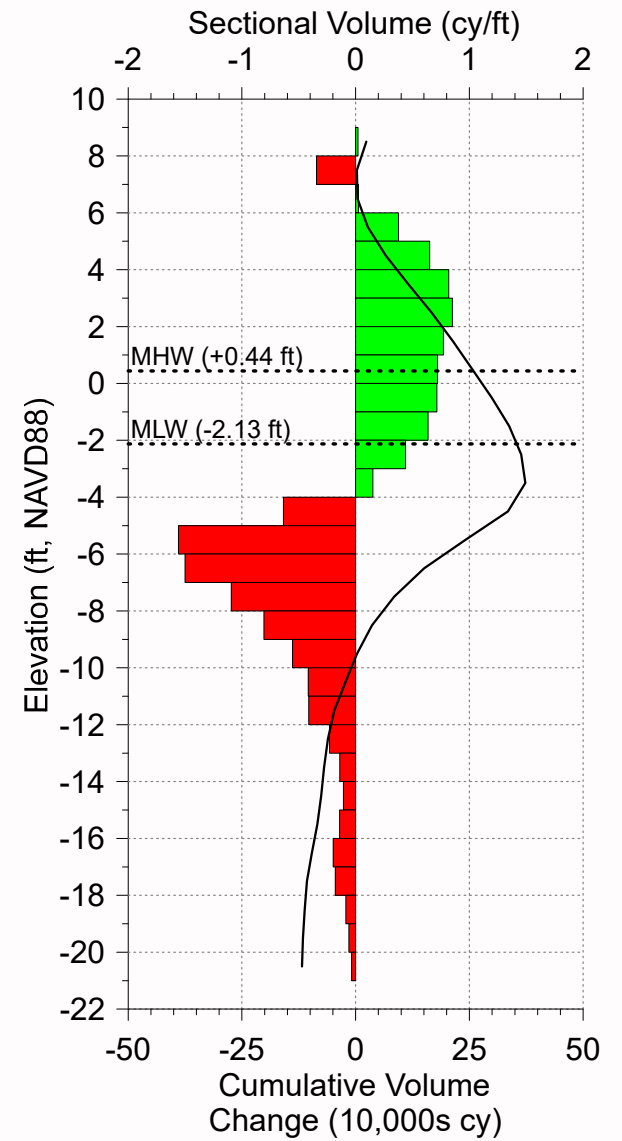
January 2017 to November 2017

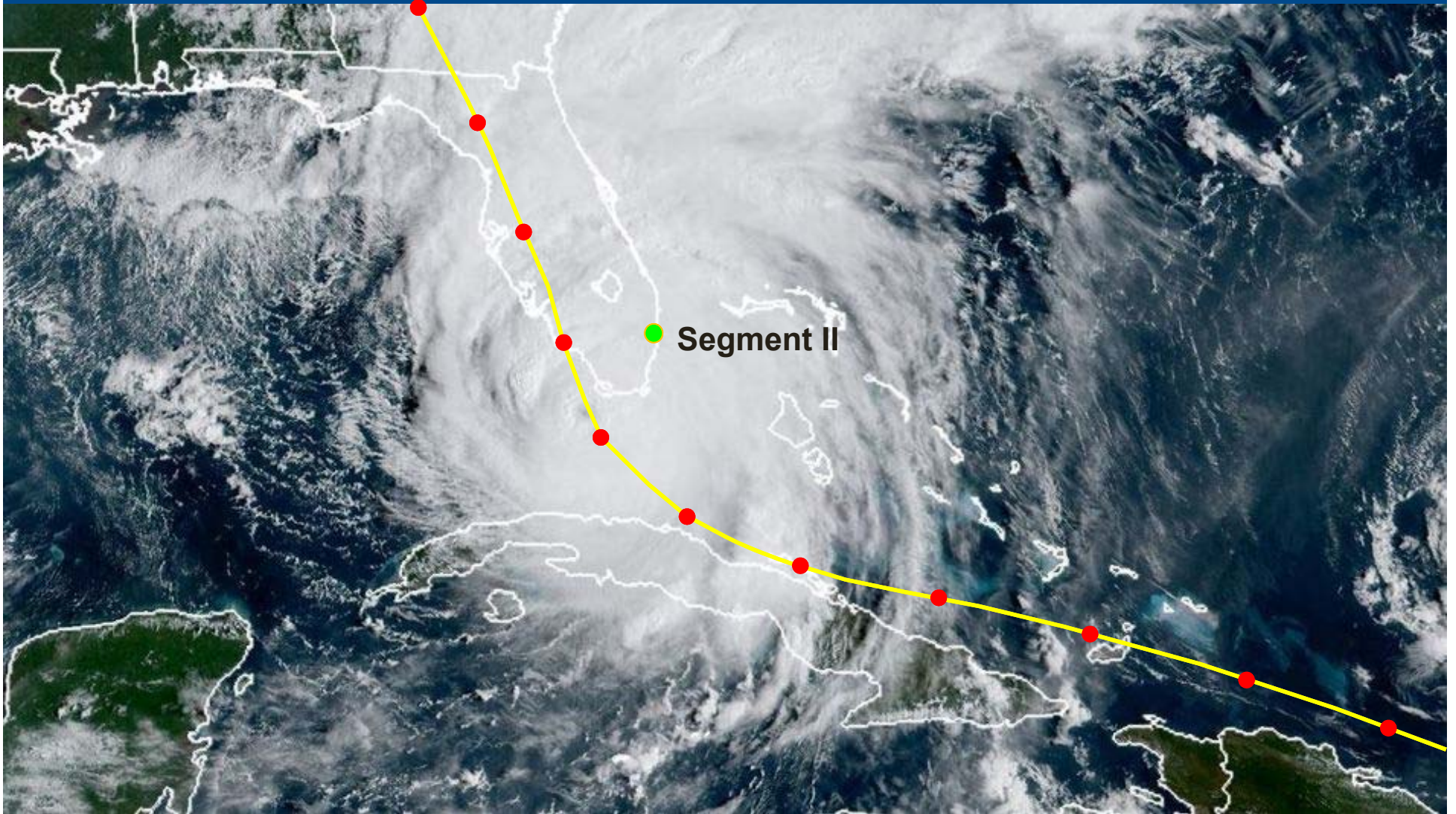


November 2017 to March 2018



January 2017 to March 2018

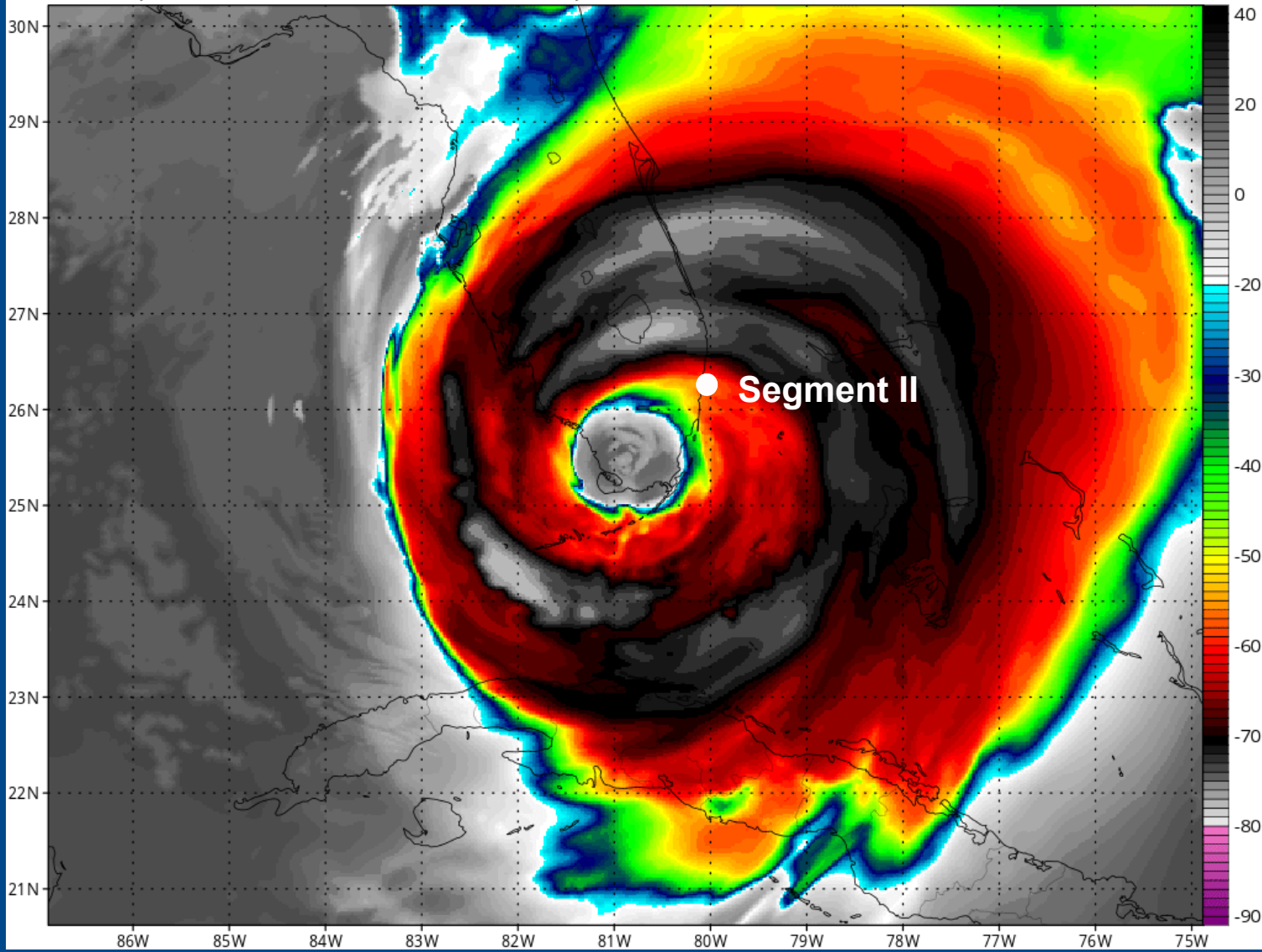




HWRf IRMA-11L Simulated IR4 Brightness Temperature (°C)

Init: 06z Sep 08 2017 Forecast Hour: [54] valid at 12z Sun, Sep 10 2017

TROPICALTIDBITS.COM



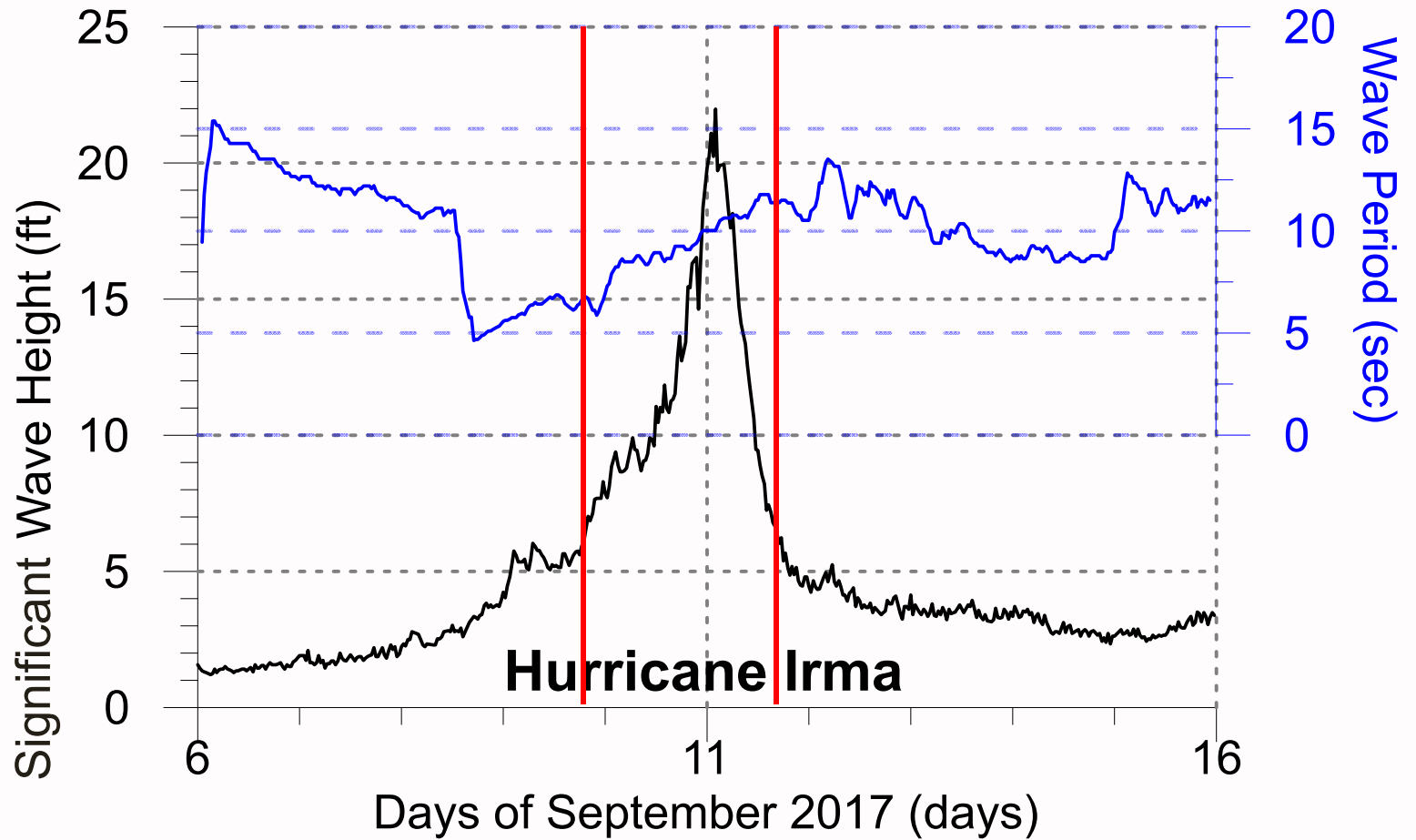
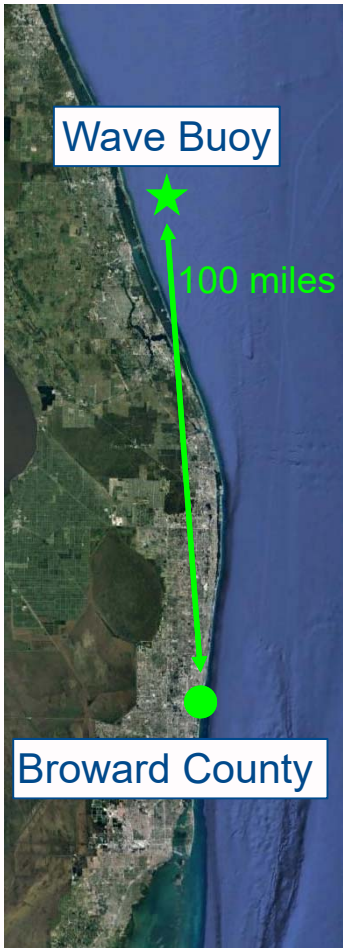
The Mercury News



The Mercury News



**Anglin's Fishing Pier
Lauderdale-By-The-Sea
(Segment II)**



Station 41114 - Fort Pierce, FL
7 miles NE of Fort Pierce Inlet
Water Depth = 16.2 m (53.2 ft)

Max. Wave Height = 22 ft (6.4 m)
Wave Period = 10 seconds
Wave Direction = 107 degs



HURRICANE IRMA (Sept 2017)



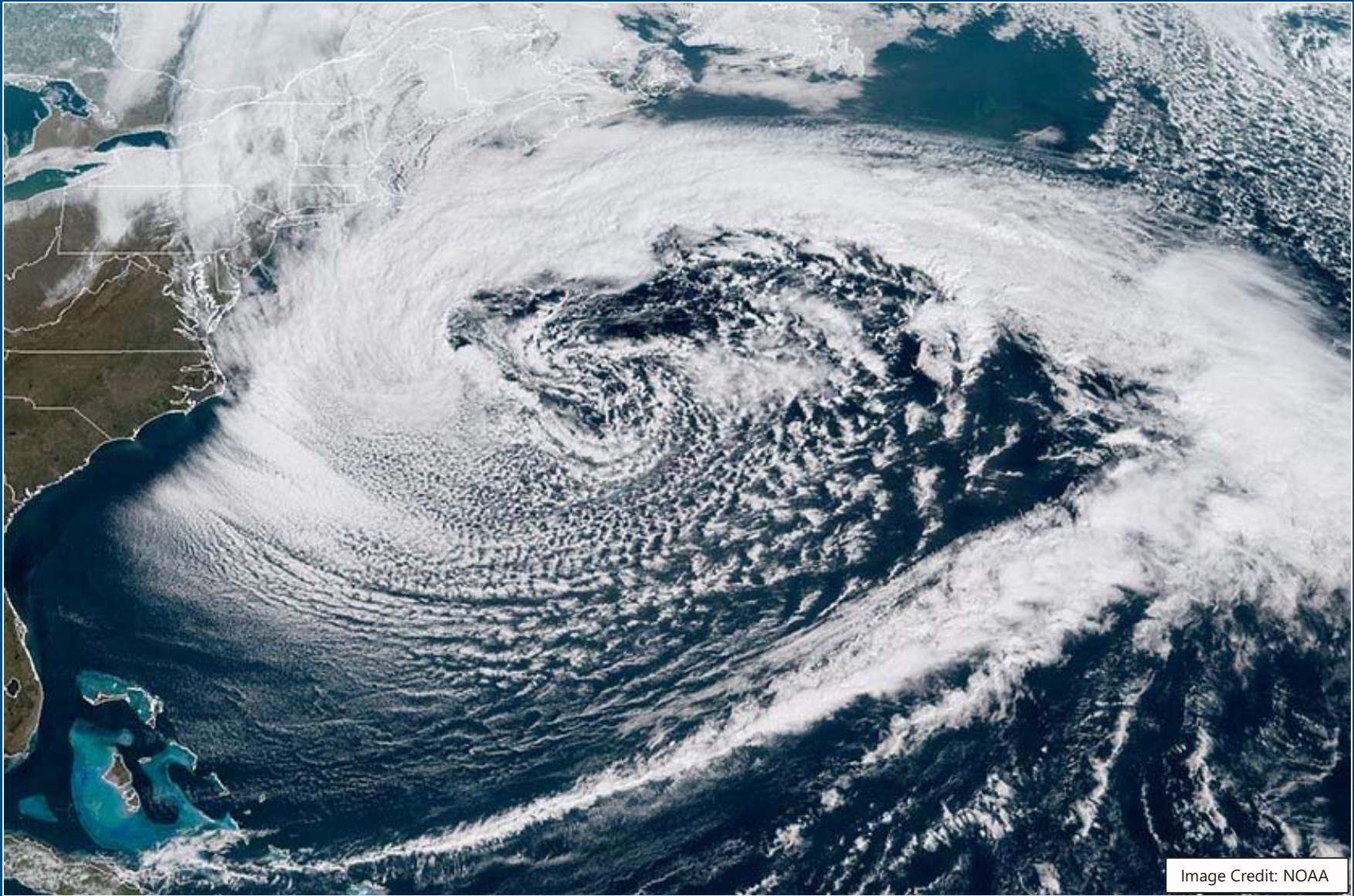
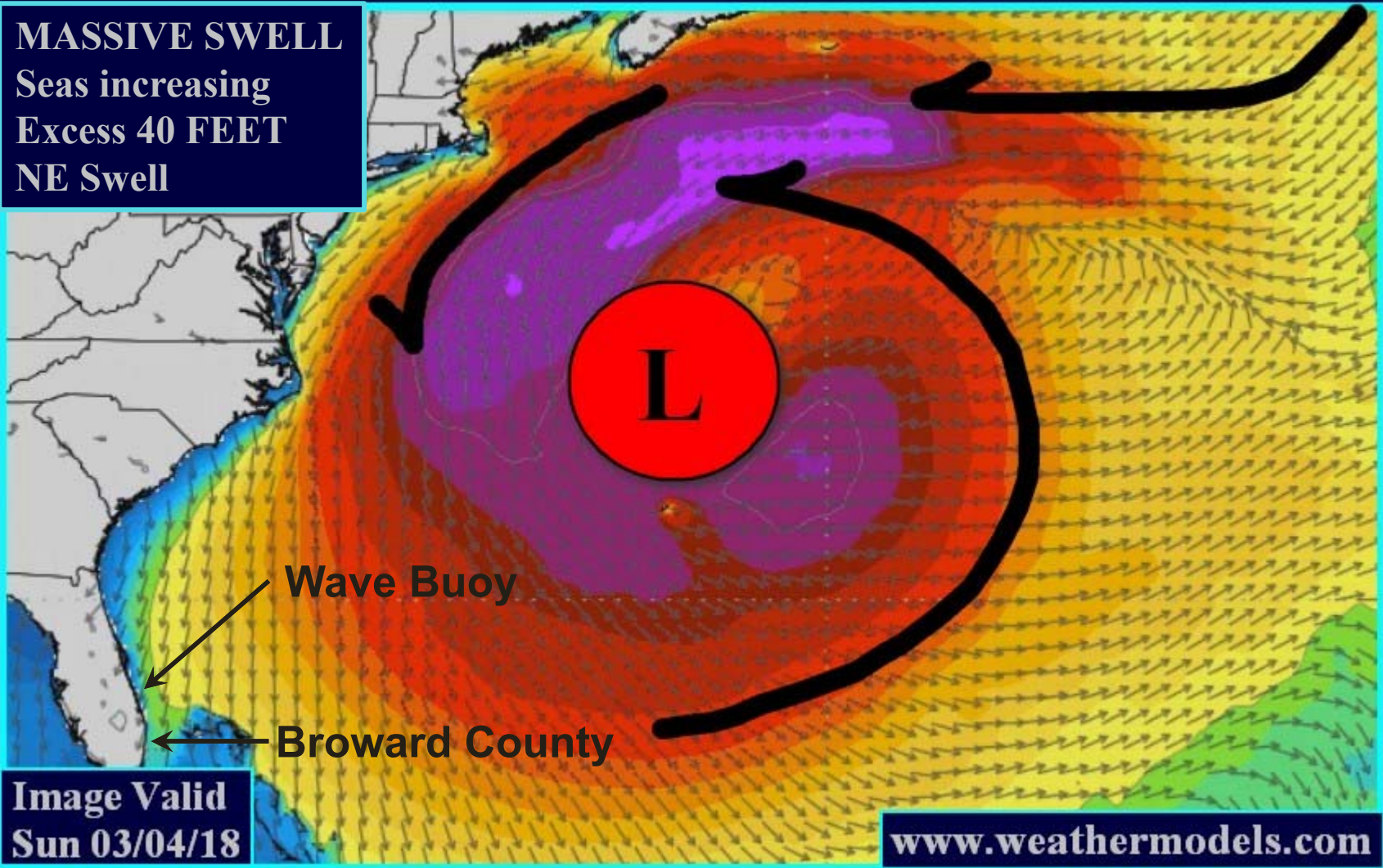


Image Credit: NOAA

MASSIVE SWELL
Seas increasing
Excess 40 FEET
NE Swell



Wave Buoy

Broward County

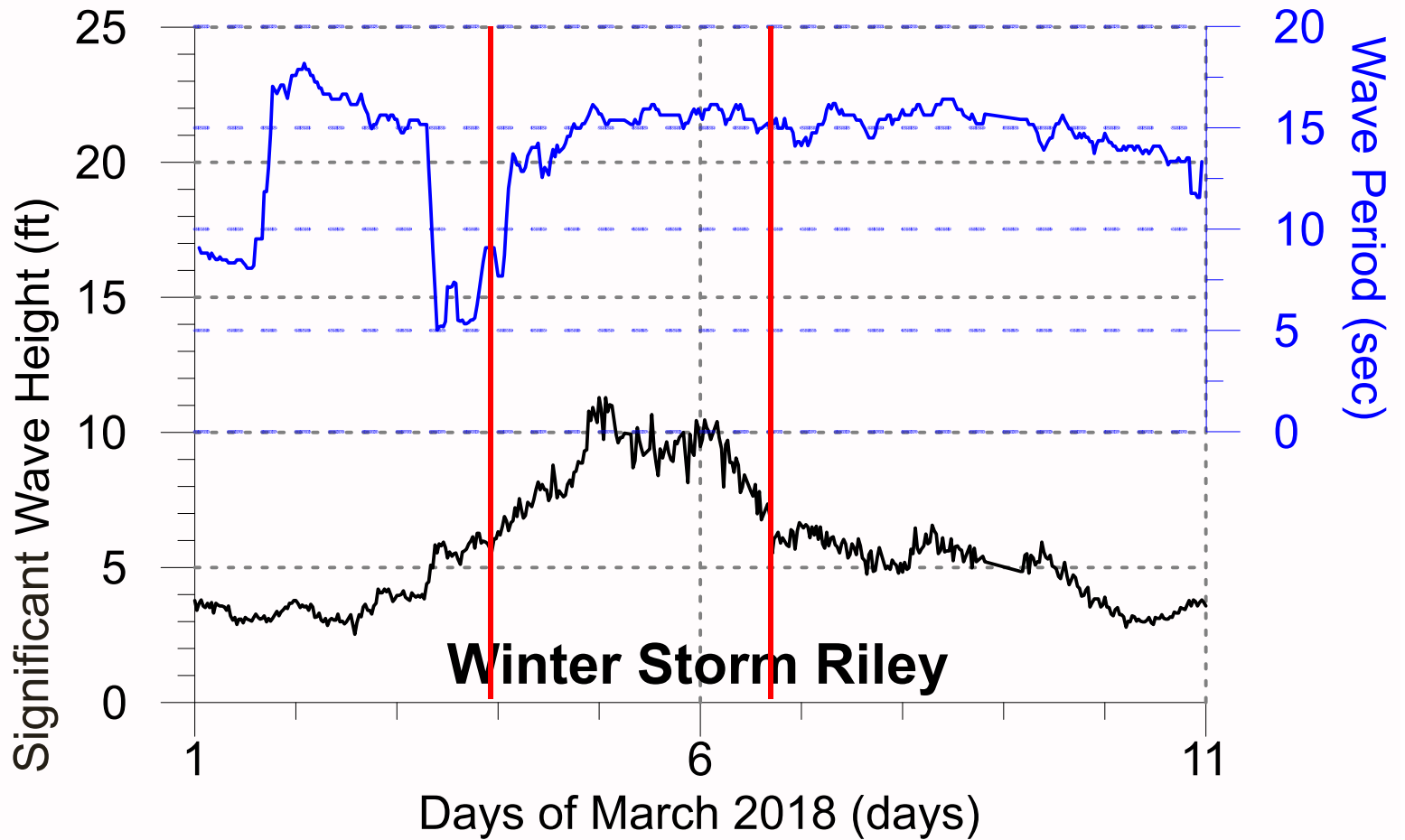
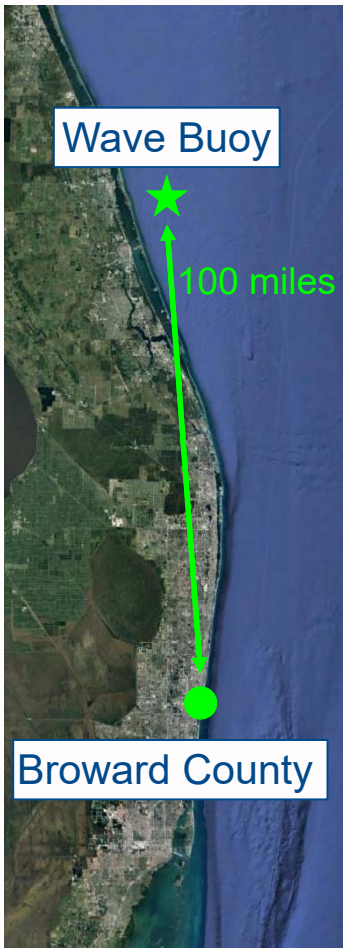
Image Valid
Sun 03/04/18

www.weathermodels.com



Void Magazine (Cornell)





Station 41114 - Fort Pierce, FL
7 miles NE of Fort Pierce Inlet
Water Depth = 16.2 m (53.2 ft)

Typ. Wave Height = 11.3 ft (3.4 m)
Wave Period = 16 seconds
Wave Direction = 63 degs



WINTER STORM RILEY (March 2018)

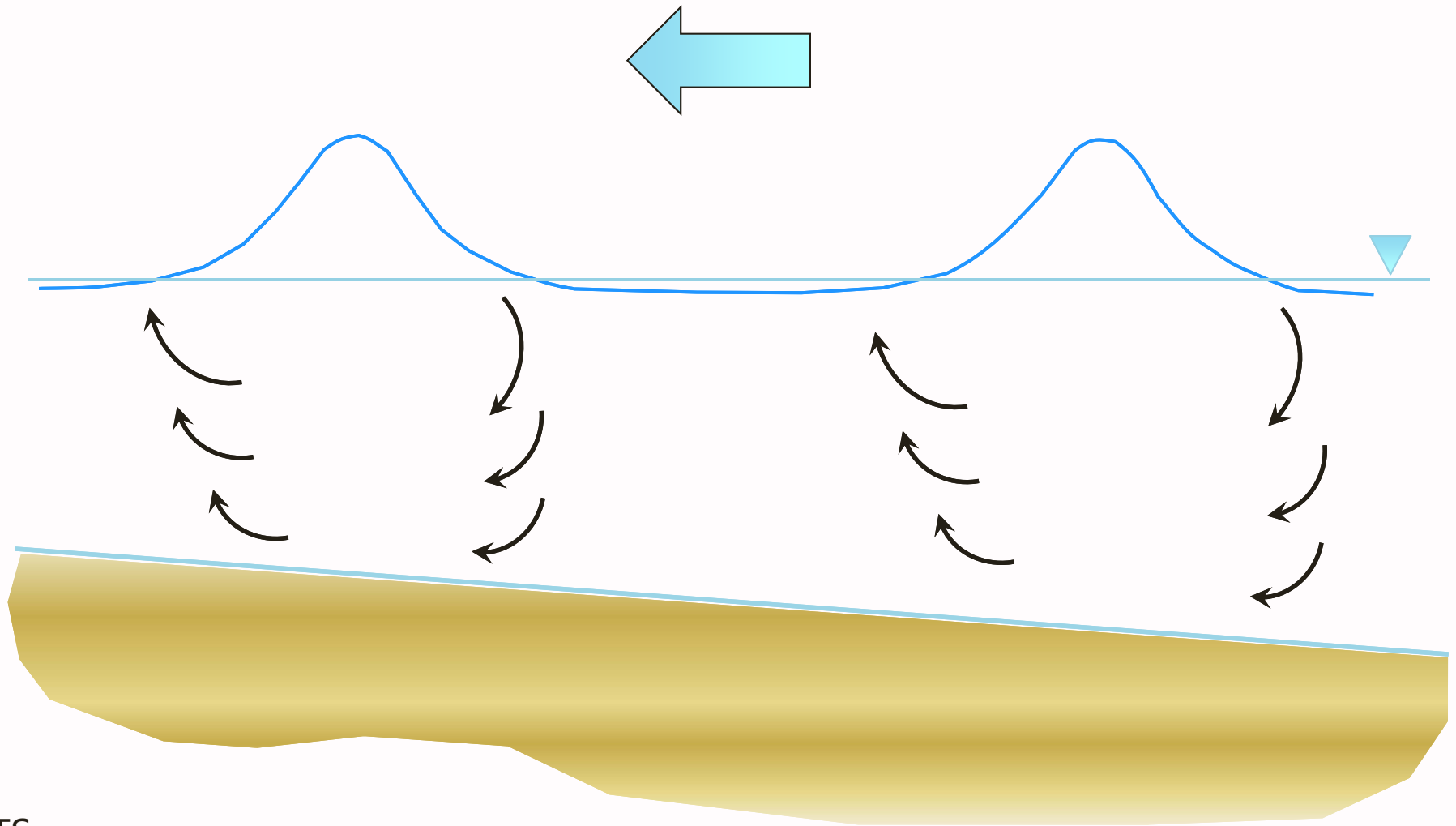


$$\text{Dean (1973)} = \frac{H}{wT}$$

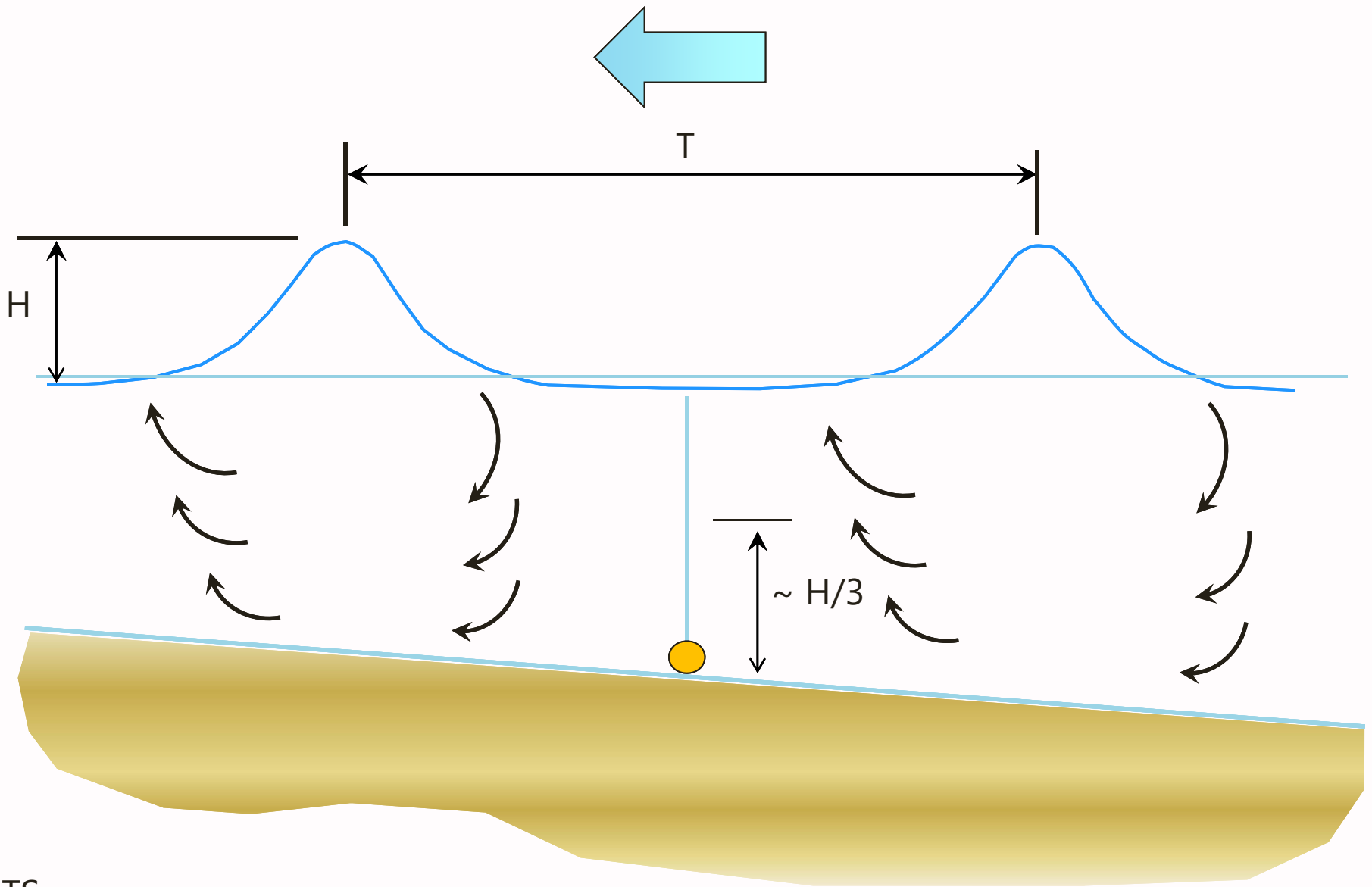
H = wave height (m)

w = sediment fall velocity (m/s)

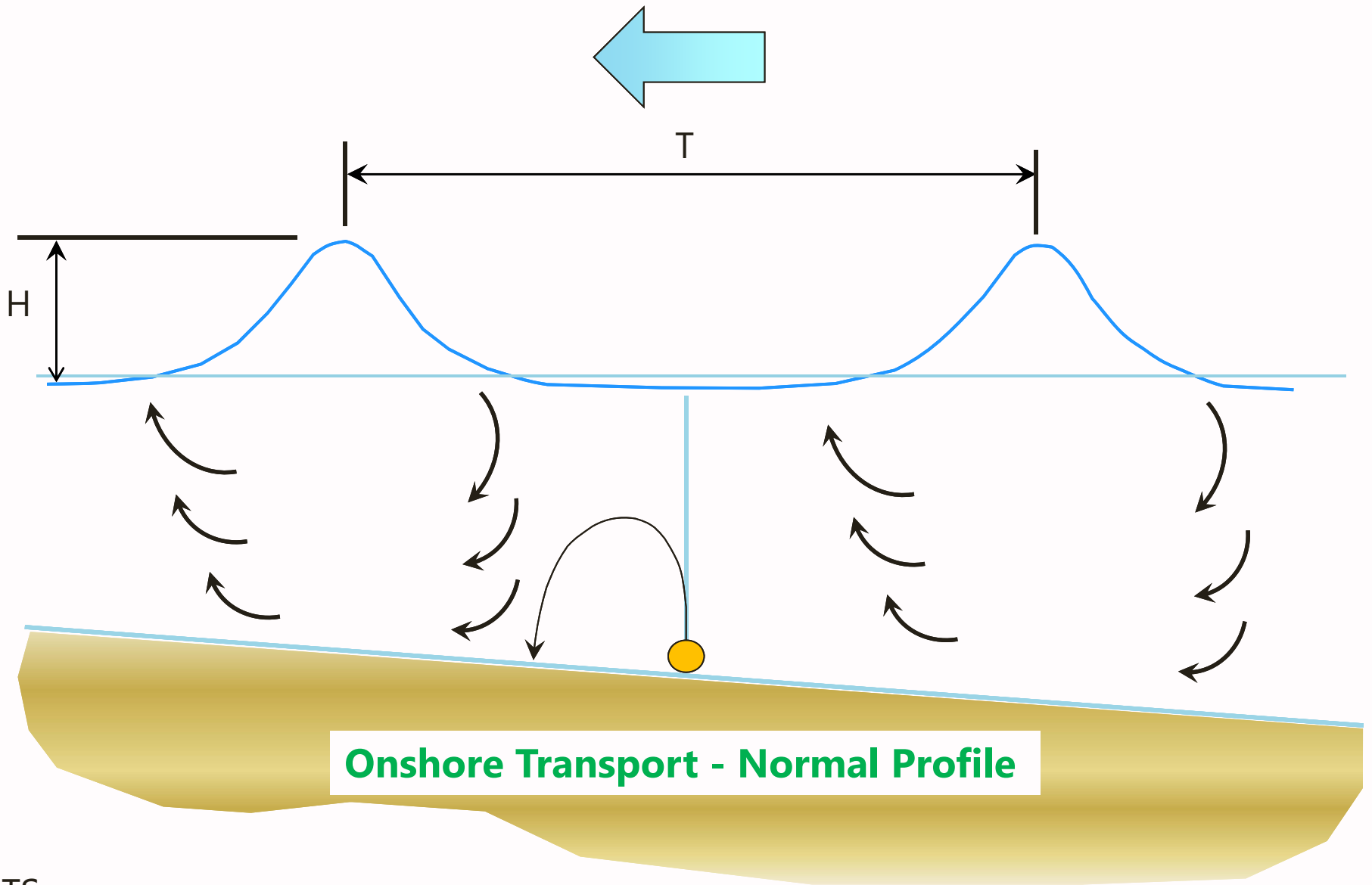
T = wave period (seconds)



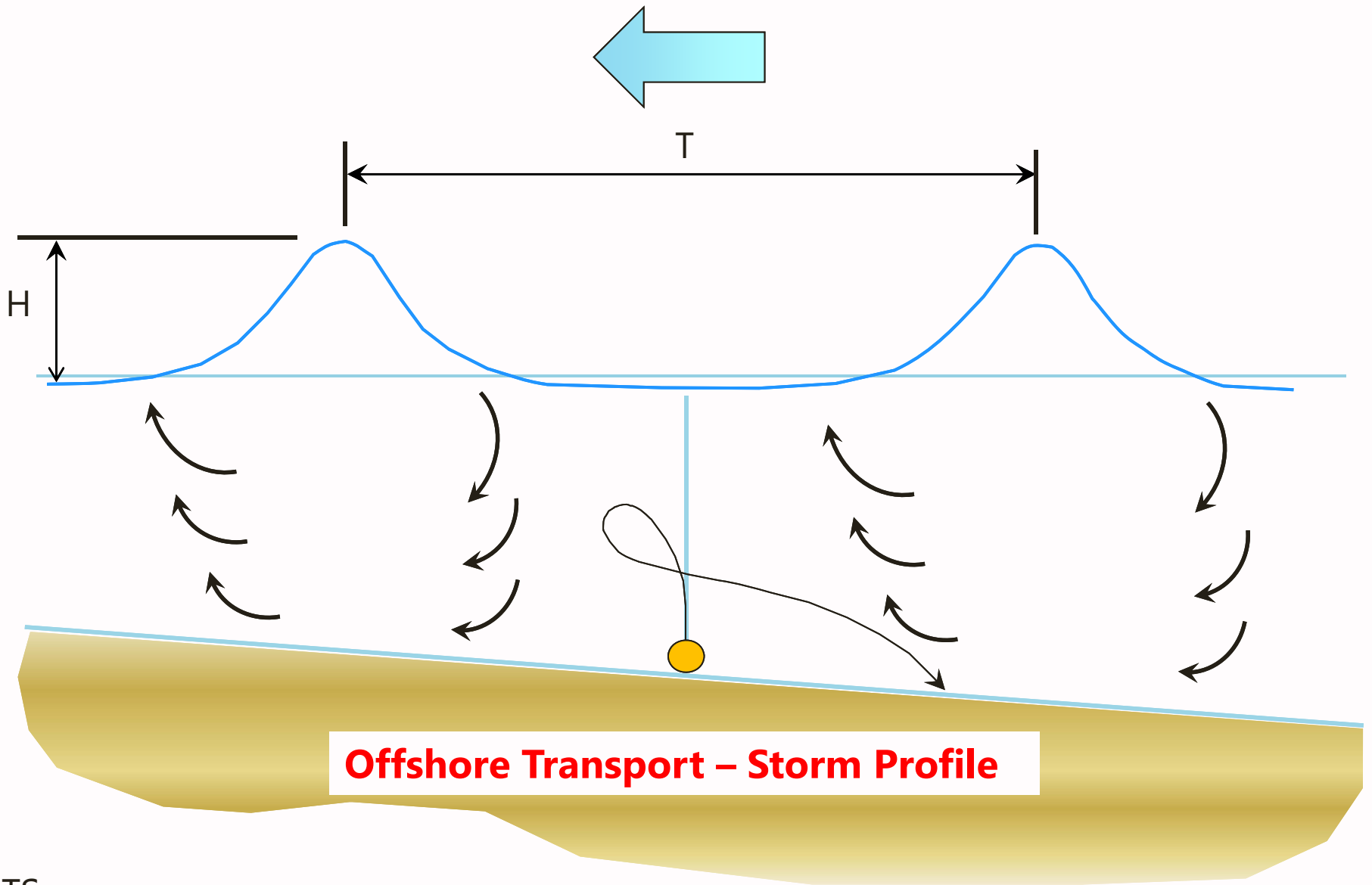
NTS



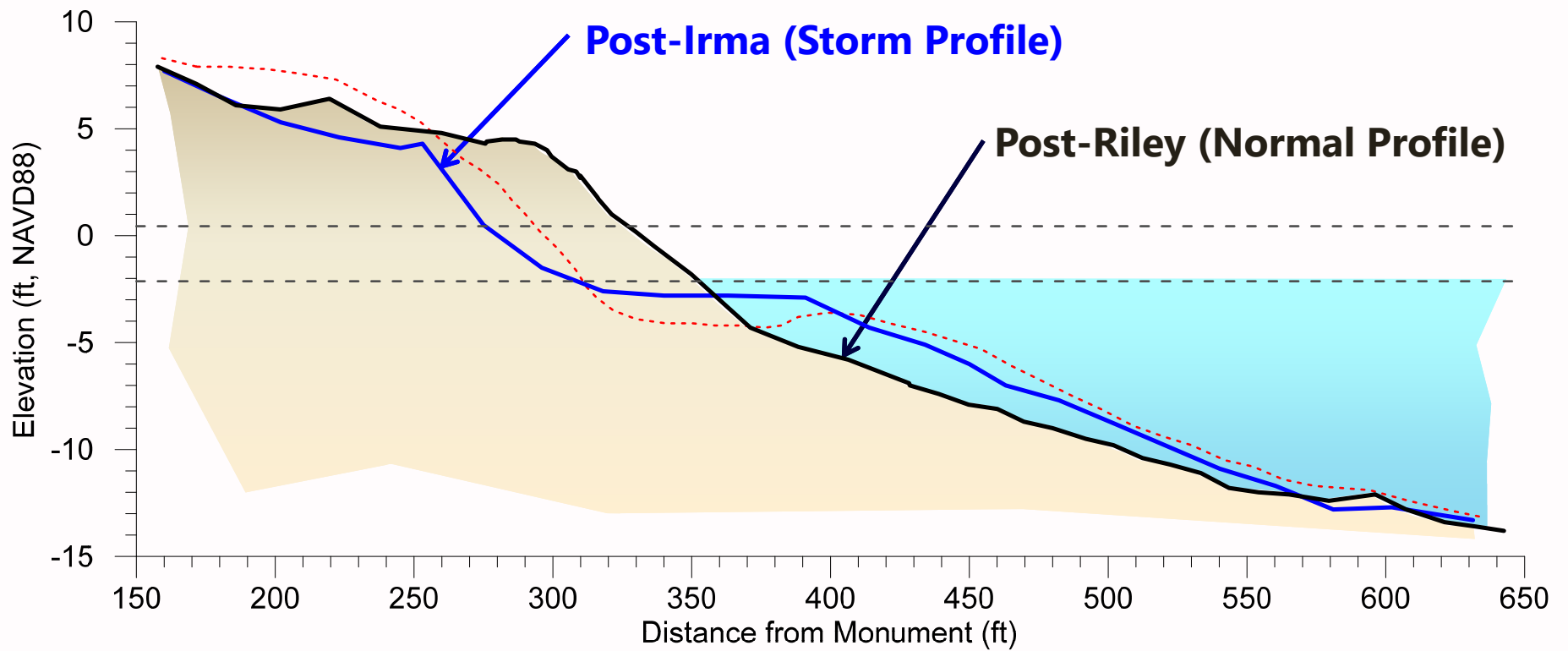
NTS



NTS



NTS



$$\frac{H_b}{wT} > 3.4$$

H_b = wave height (m)

w = sediment fall velocity (m/s)

T = wave period (seconds)

Offshore Transport – Storm Profile

$$\frac{H_b}{wT} > 3.4$$

Onshore Transport - Normal Profile

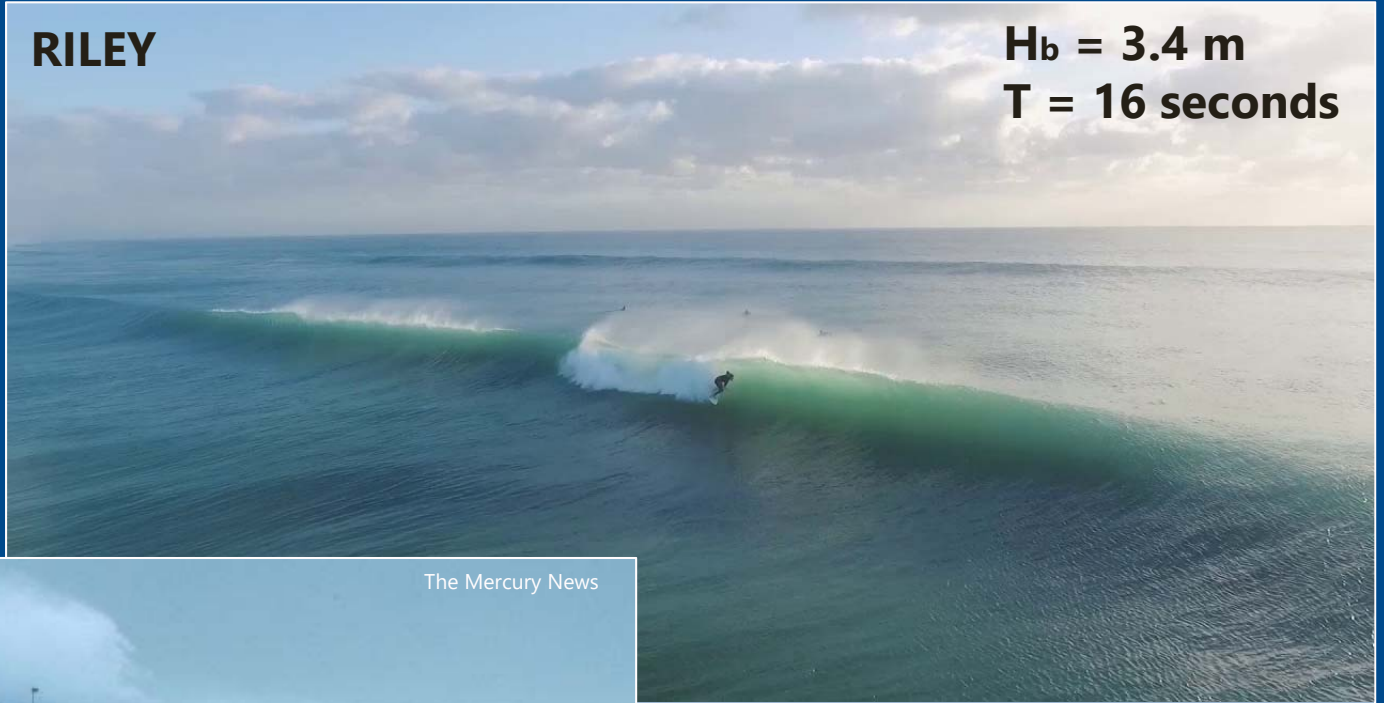
H_b = wave height (m)

w = sediment fall velocity (m/s)

T = wave period (seconds)

RILEY

$H_b = 3.4 \text{ m}$
 $T = 16 \text{ seconds}$



IRMA

The Mercury News



$H_b = 4.6 \text{ m}$
 $T = 10 \text{ seconds}$

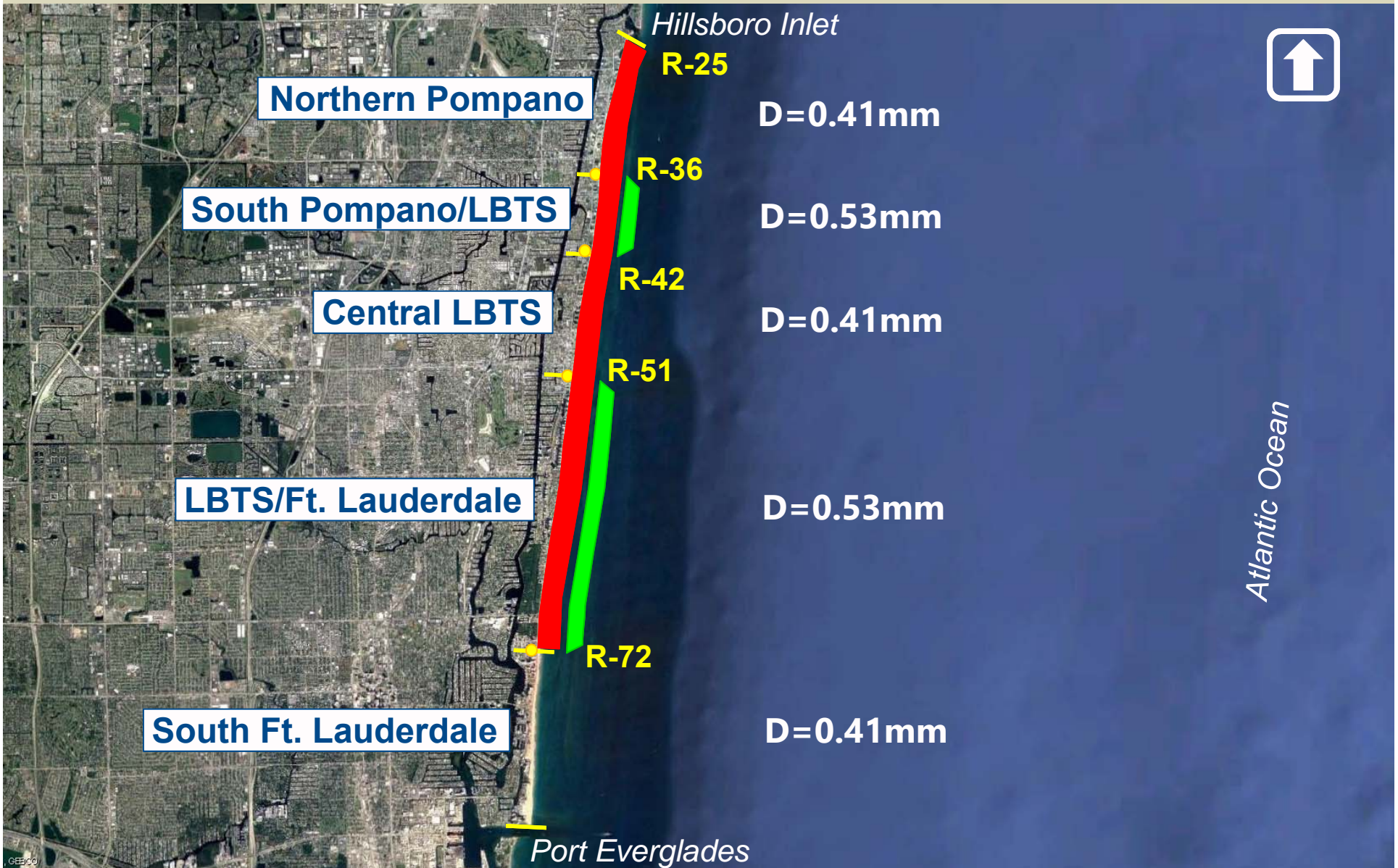
$$\frac{H_b}{wT} \begin{matrix} > \\ < \end{matrix} 3.4$$

Riley = 3.0

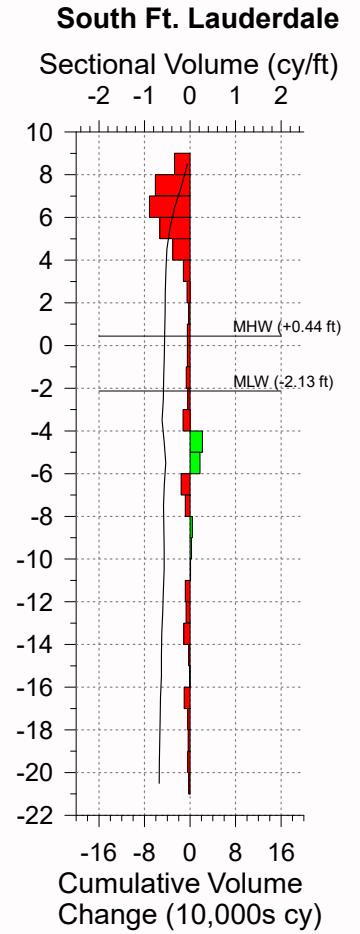
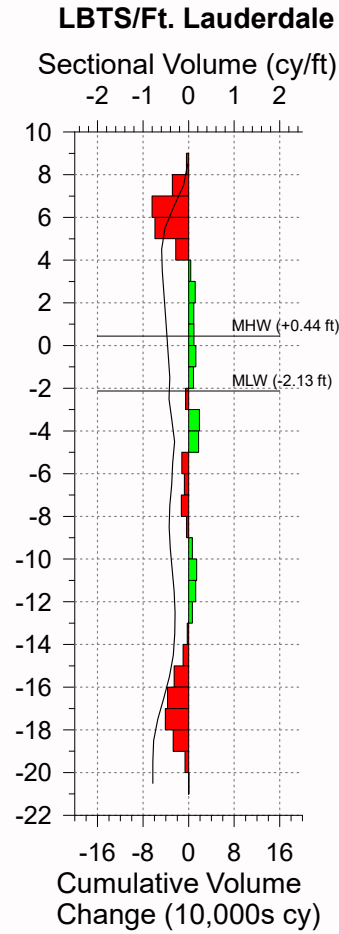
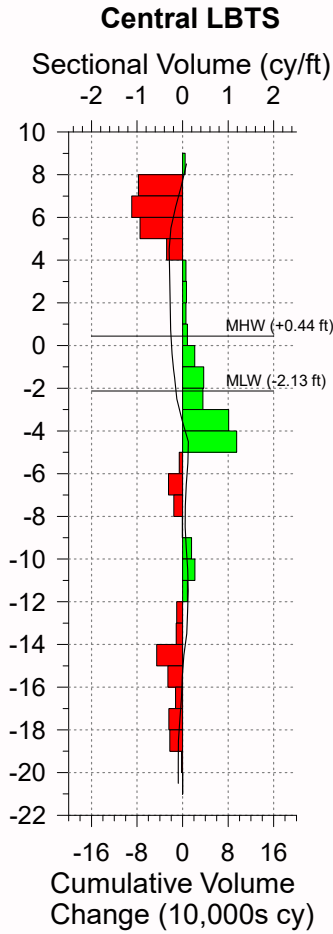
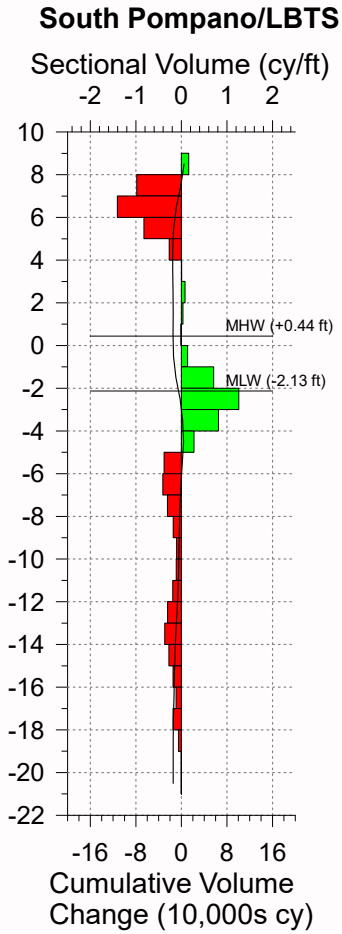
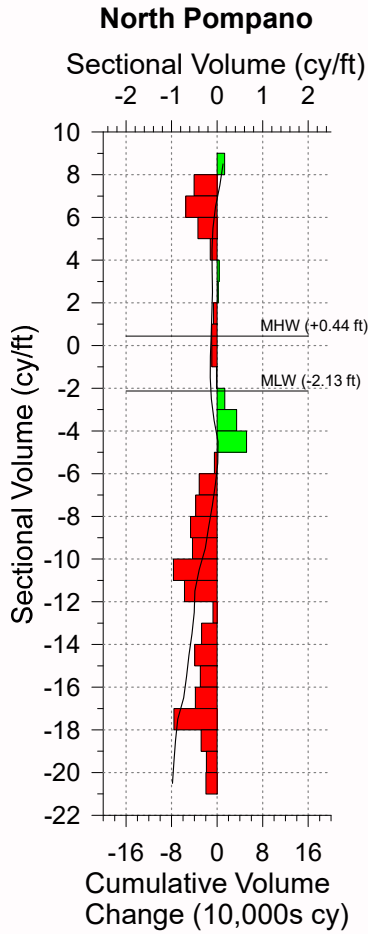
Irma = 6.6

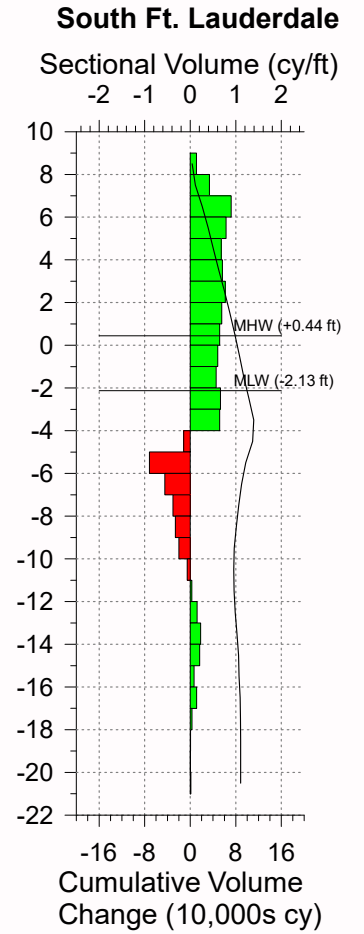
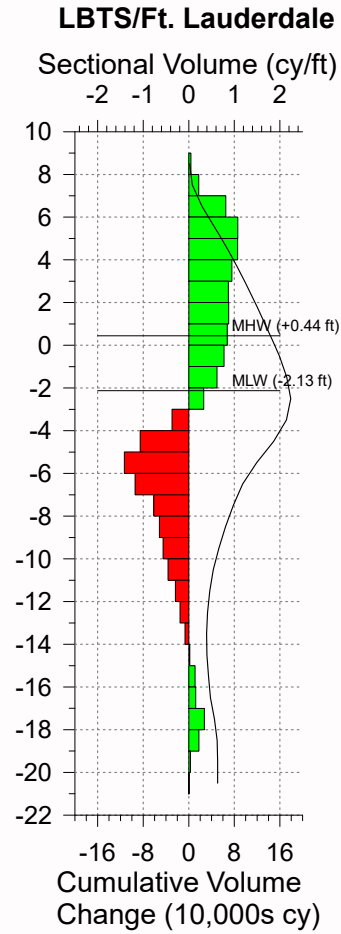
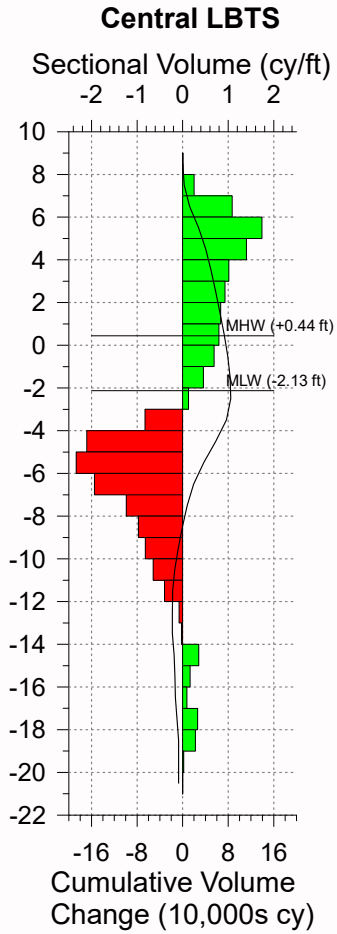
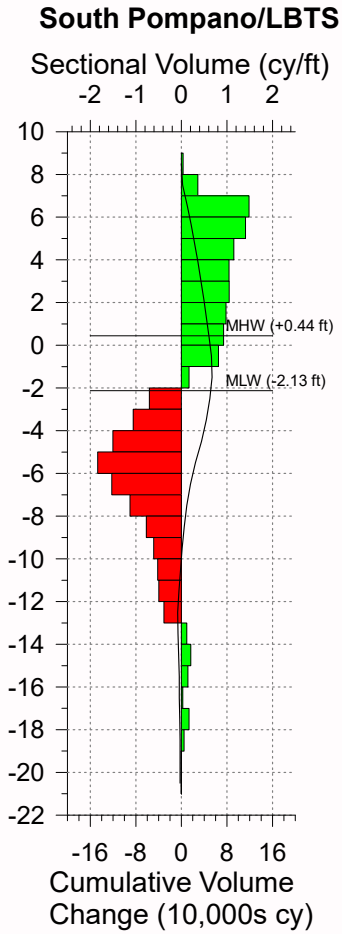
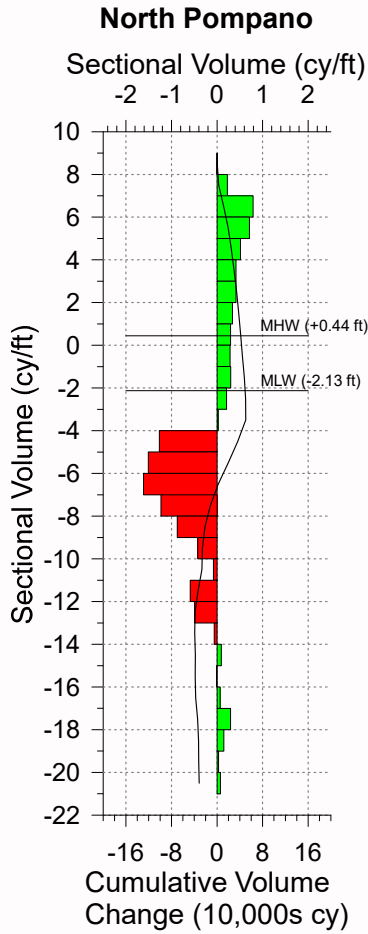
Storm	H _b (m)	T(sec)	D(mm)	w (m/s)	H _b /wT	Result
Irma	4.6	10	0.46	0.070	6.6	Storm
Riley	3.4	16	0.46	0.070	3.0	Normal

BROWARD COUNTY SHORE PROTECTION PROJECT – SEGMENT II



CEECO





Summary

- Both Hurricane Irma and Winter Storm Riley had measurable effects to the Broward County Segment II shoreline.
 - Irma -> marginal loss of sand from upper beach
 - Riley -> contributed to significant offshore to onshore sand transport and berm widening
- As of March 2018, the upper beach along the Segment II shoreline was 20 feet wider, on average, than immediate post-2016 project conditions.
- Observed profile change was consistent with the heuristic beach profile condition concept of Dean (1973).
- The long-term effect of Winter Storm Riley is unclear at this time. Spring 2019 monitoring will investigate the condition of upper beach and typical bar reformation.





@JAKEWUB



THANK YOU

