

# Calibration and Application of SBEACH in Florida

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Beach Preservation Technology*



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# Project Study Purpose and Scope

- ∅ To conduct SBEACH calibration studies for the identified study area and provide recommended model input values and information for simulation of high-frequency (HF) storm events
- ∅ To provide SBEACH model output and erosion profiles for 15- and 25-yr return interval storms for specified county locations within the study area

**Phase I** (completed in May 2009):

Walton and Okaloosa counties on FL Panhandle coast

**Phase 2** (to be completed by June 2010):

St. Johns, Volusia, and Indian River counties on NE and Central Atlantic coast of FL

# **SBEACH model** (acquired from Veri-Tech, Inc.)

SBEACH (Storm-induced BEAch CHange) simulates cross-shore beach, berm, and dune erosion produced by storm waves and water levels.

Dr. Magnus Larson was the principal author of the SBEACH model.

## **Required Model Input**

### **Reach Information:**

- Ø Beach-Dune-Offshore Profile Surveys
- Ø Beach Characteristics (sediment grain size, etc.)
- Ø Sediment Transport Parameters

### **Storm Information:**

- Ø Water elevation (storm tide hydrograph)
- Ø Wave ht.& period, wave direction, initial wave water depth, and wave type information
- Ø Wind speed and direction
- Ø Storm input consisting of computational time step

# SBEACH model calibration

## Needed Information:

- a) measured pre- and post-storm survey profiles,
- b) measured (or model-generated) storm tide, and
- c) measured (or model-generated) wave and weather data for representative storm(s) for the study area

## Available Information:

### FL Panhandle Study Area –

#### Walton & Okaloosa:

- a) Pre- & post-Opal profiles; Ivan & Dennis LiDAR (gaps in offshore)
- b) **NO measured storm tide data**
- c) NDBC measured wave data for Ivan; WIS wave data for Opal

#### Bay Co. (western Panama City Beach):

- a) Pre- & post-Opal, Ivan, & Dennis profiles from project monitoring
- b) NOS tide gage measured storm tide data from PC Bch pier
- c) NDBC measured wave data for Ivan; WIS wave data for Opal

# SBEACH “Reach” Input Parameters - Default Values and Range of Recommended Values

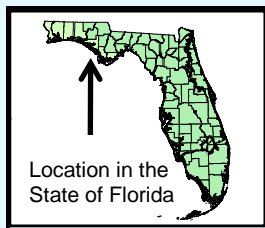
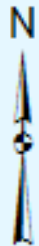
<b>Sediment Transport Parameters</b>	<b>Default Value</b>	<b>Range of Recommended Values</b>
Transport rate coefficient, K	1.75 e <sup>-006</sup> (m <sup>4</sup> /N)	0.25 e <sup>-006</sup> - 2.5 e <sup>-006</sup>
Overwash transport parameter	0.005	0.002 - 0.008
Coefficient for slope dependent term, e	0.002 (m <sup>2</sup> /s)	0.001 - 0.005
Transport rate decay coeff. multiplier, l	0.5 (m <sup>-1</sup> )	0.1 - 0.5
Water temperature	20 (deg C)	0 - 40
<b>Other Coastal Reach Parameters</b>		
Landward surf zone depth	0.3 (m)	0.15 - 0.5
Effective grain size (mean D50)	0.35 (mm)	0.15 - 1.0
Maximum slope prior to avalanching	45 deg	15 - 90 deg

OKALOOSA COUNTY

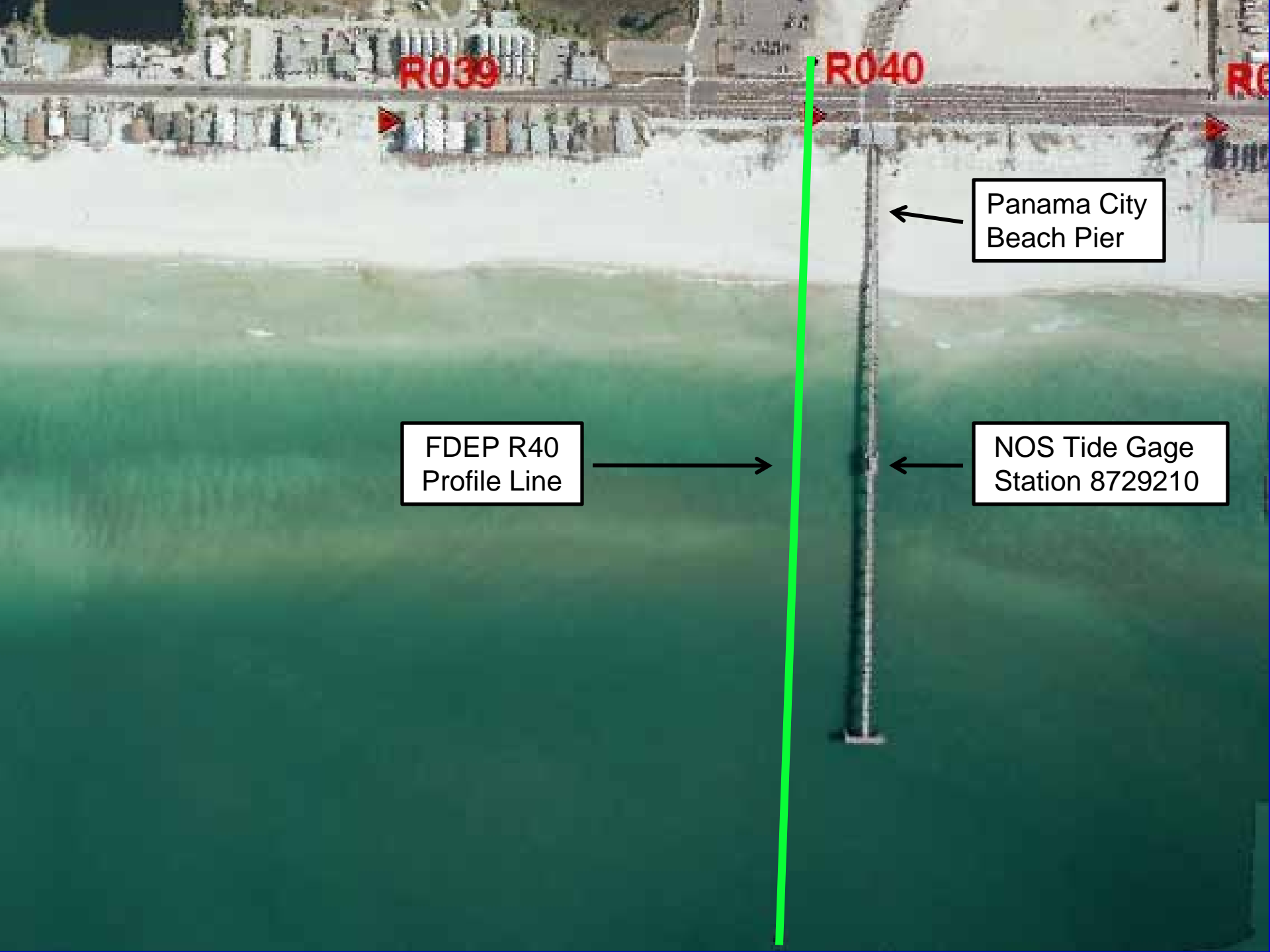
WALTON COUNTY

BAY COUNTY

*Gulf of Mexico*



Panama City Beach Pier –  
NOS Tide Station 8729210



R039

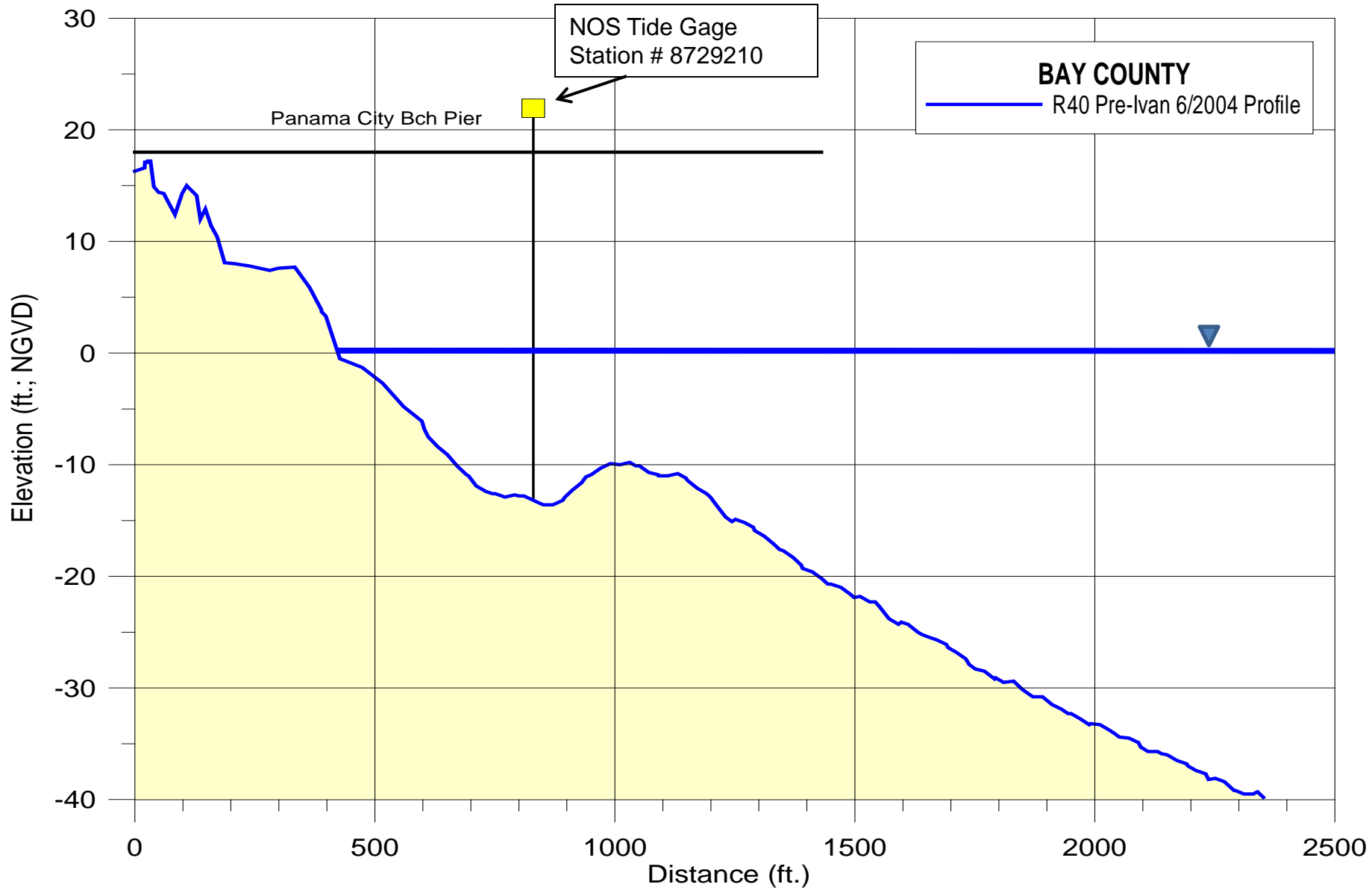
R040

R041

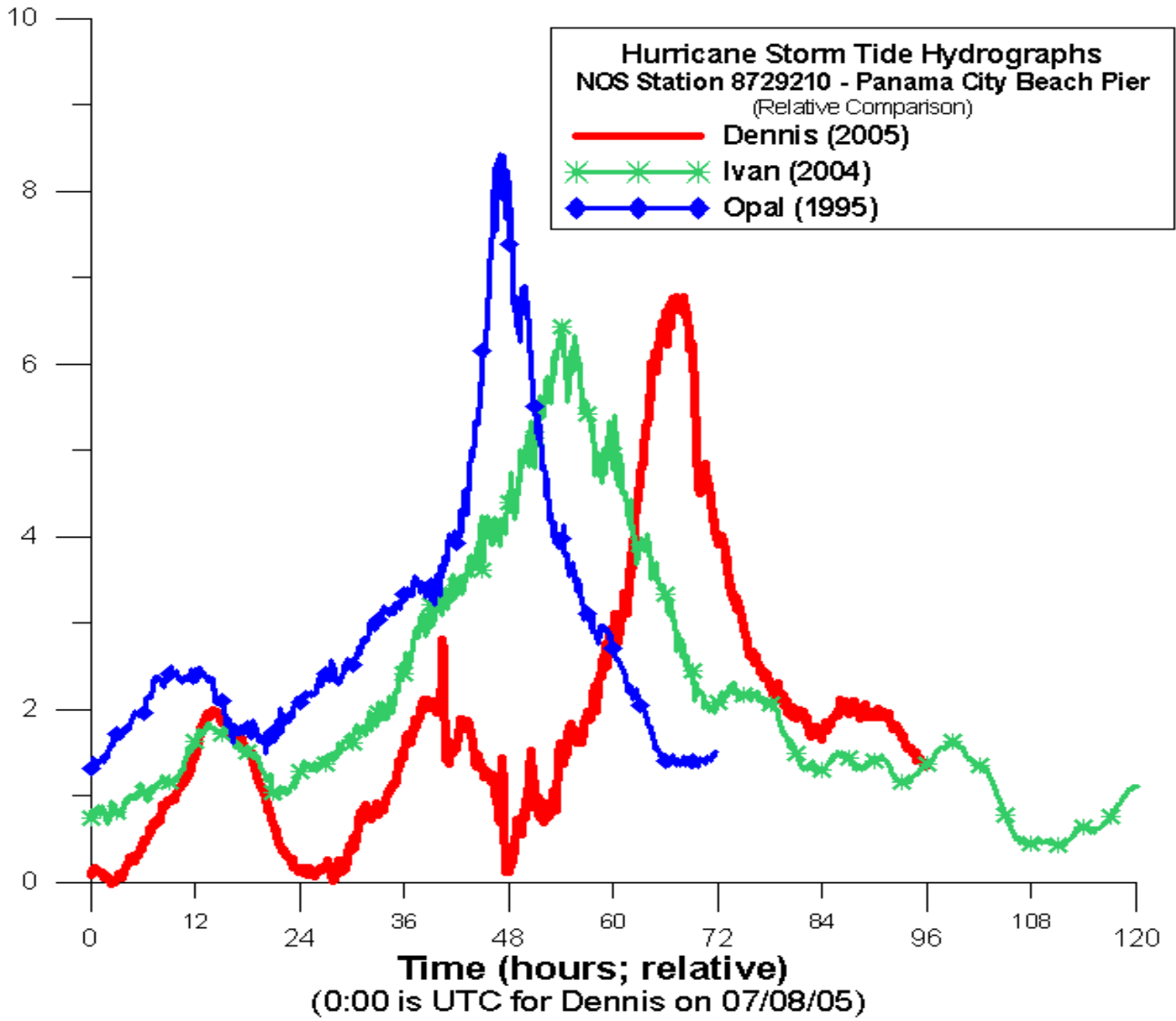
Panama City  
Beach Pier

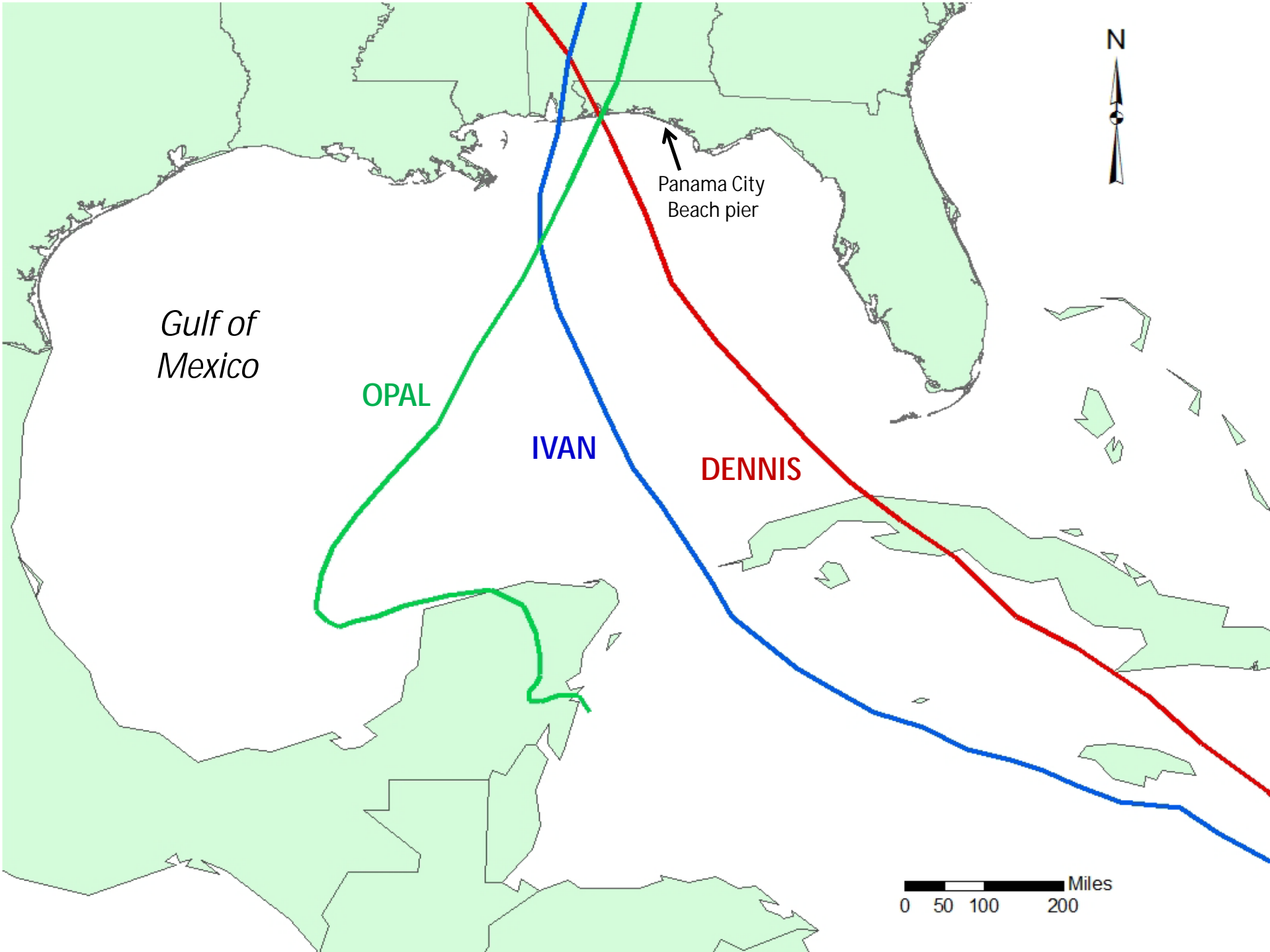
FDEP R40  
Profile Line

NOS Tide Gage  
Station 8729210



Water Level (feet; MLLW; new (2003) epoch)  
(minus 0.2 for NGVD29; minus 0.63 for NAVD88)





*Gulf of Mexico*

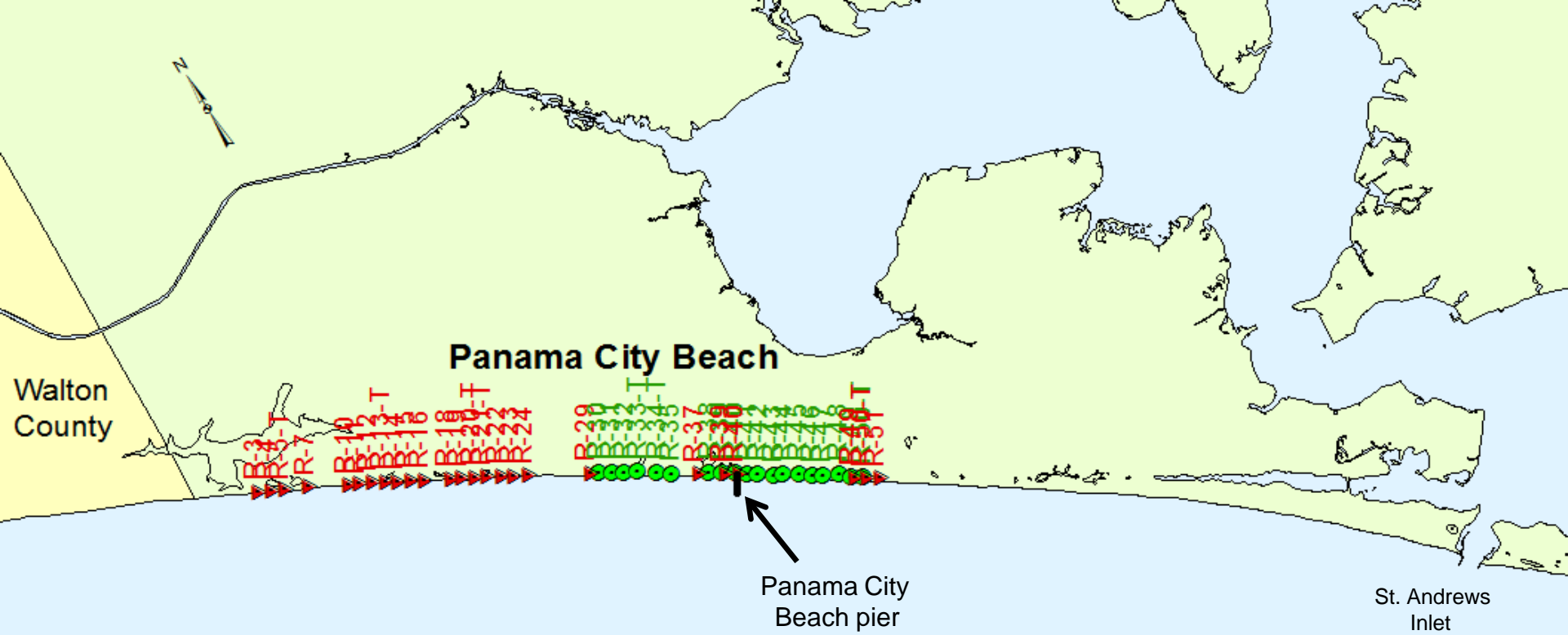
**OPAL**

**IVAN**

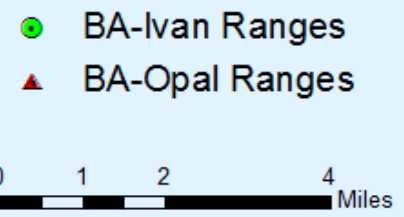
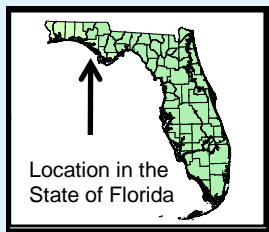
**DENNIS**

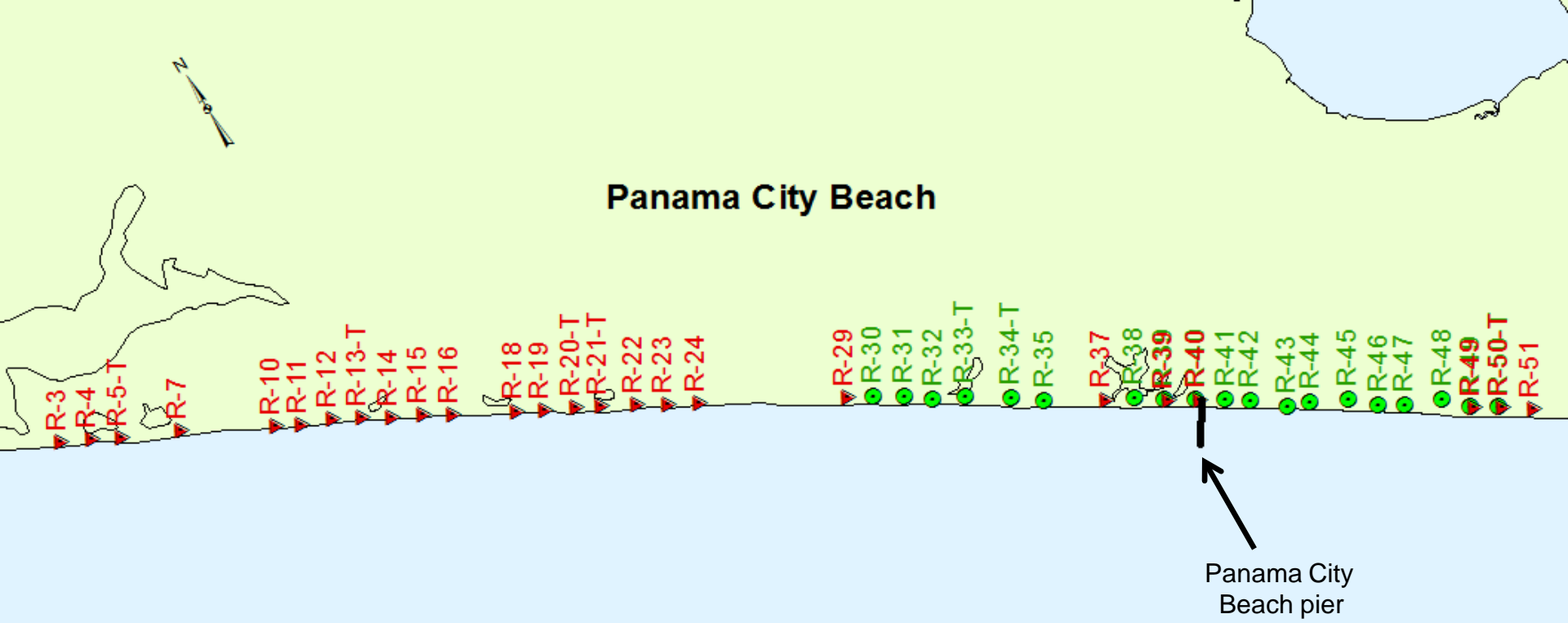
Panama City Beach pier

Miles  
0 50 100 200



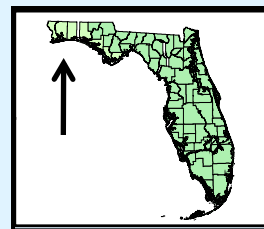
**SBEACH Calibration  
Study Area – Bay County**





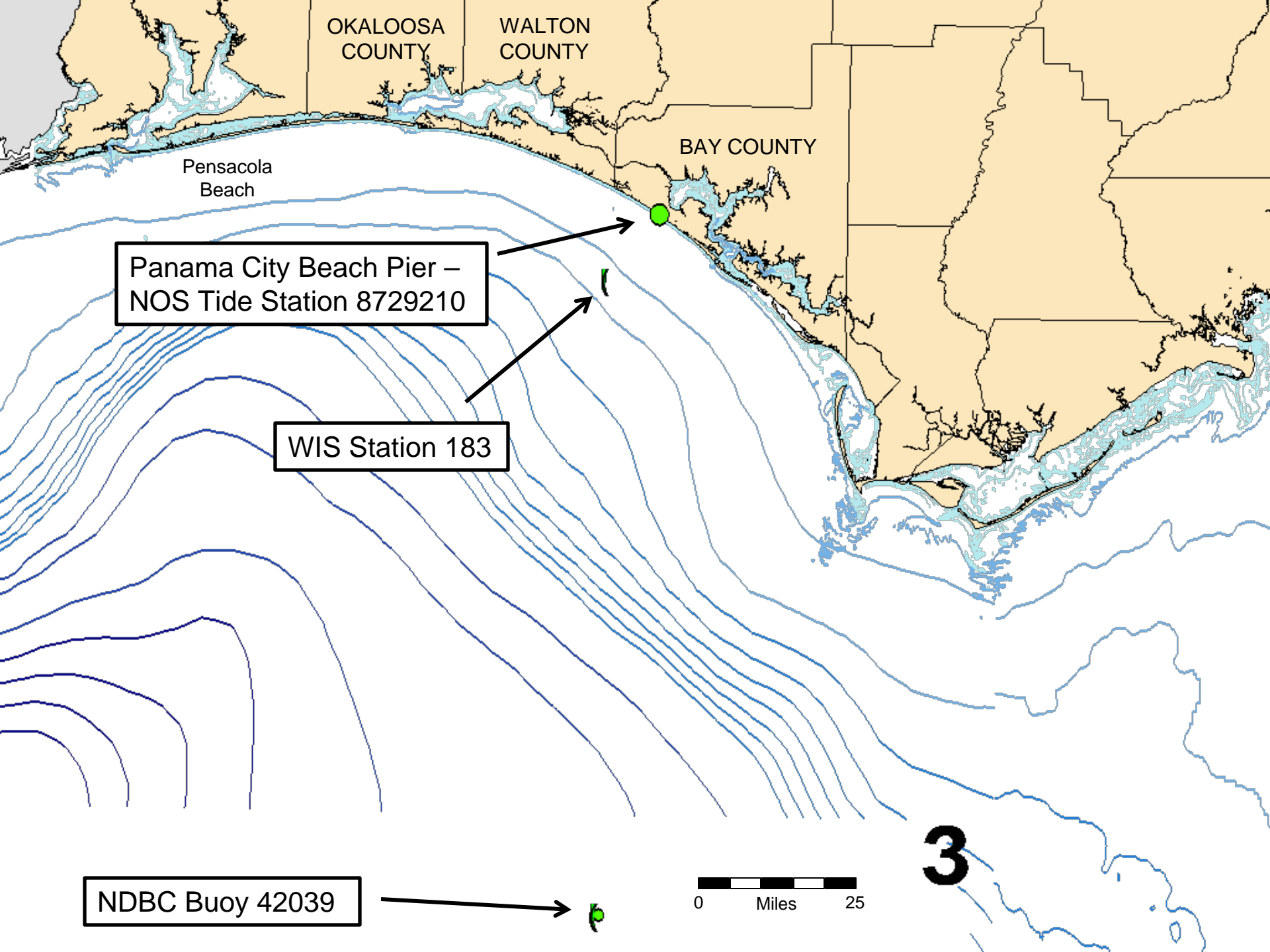
**SBEACH Calibration  
Study Area – Bay County**

**Gulf of Mexico**



- BA-Ivan Ranges
- ▲ BA-Opal Ranges





OKALOOSA  
COUNTY

WALTON  
COUNTY

BAY COUNTY

Pensacola  
Beach

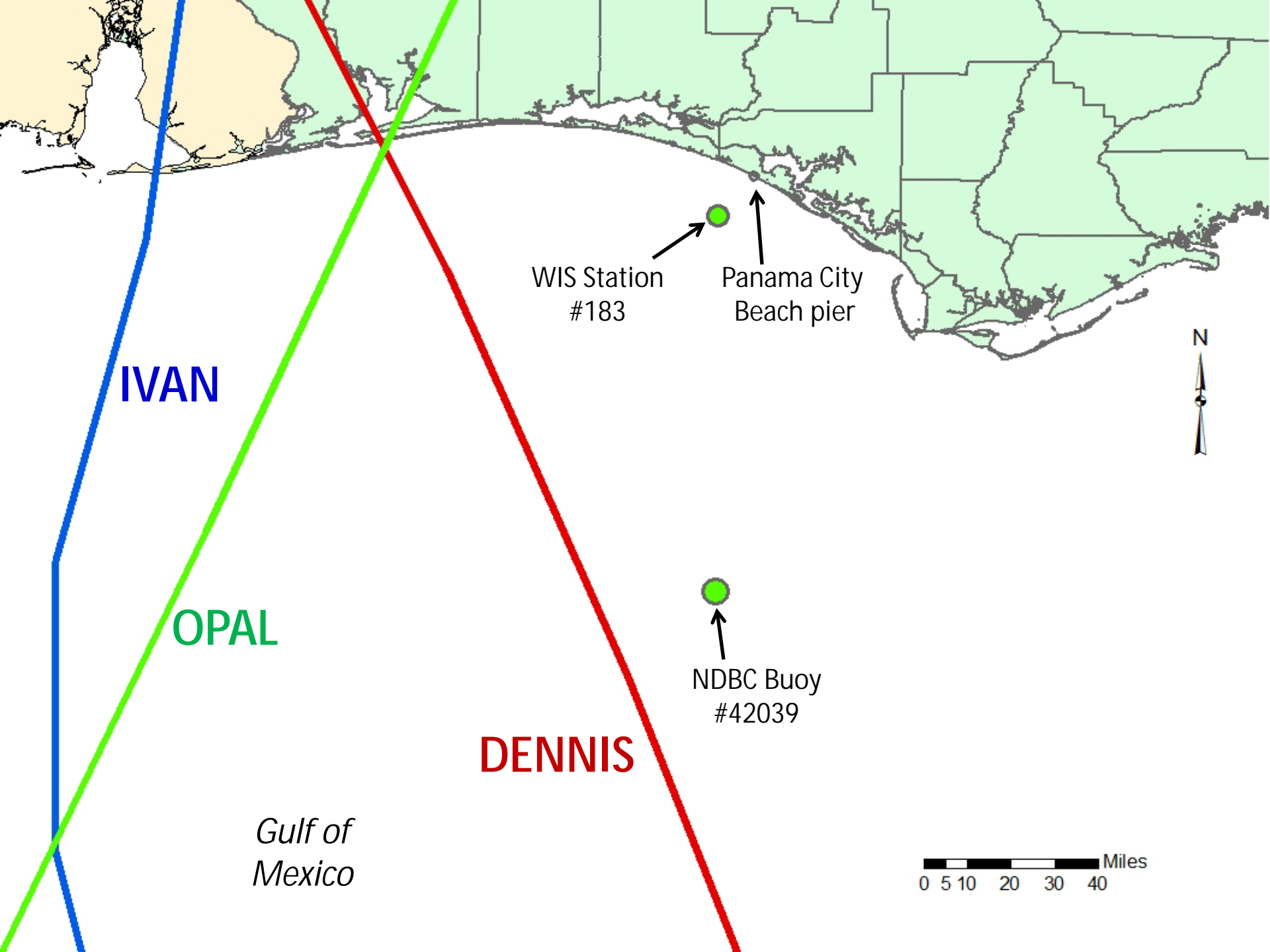
Panama City Beach Pier –  
NOS Tide Station 8729210

WIS Station 183

NDBC Buoy 42039

0 Miles 25

**3**



**IVAN**

**OPAL**

**DENNIS**

*Gulf of Mexico*

WIS Station  
#183

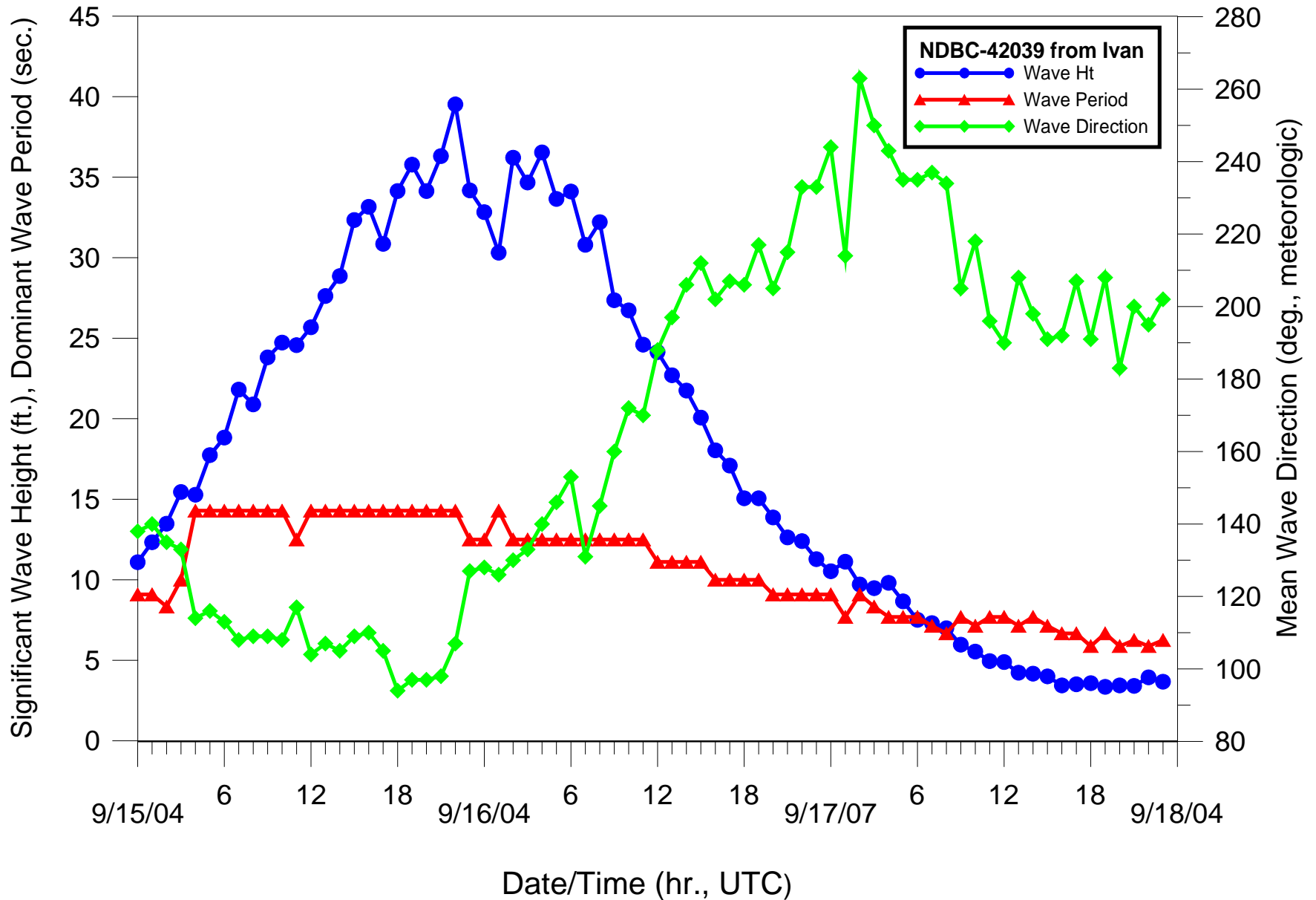
Panama City  
Beach pier

NDBC Buoy  
#42039

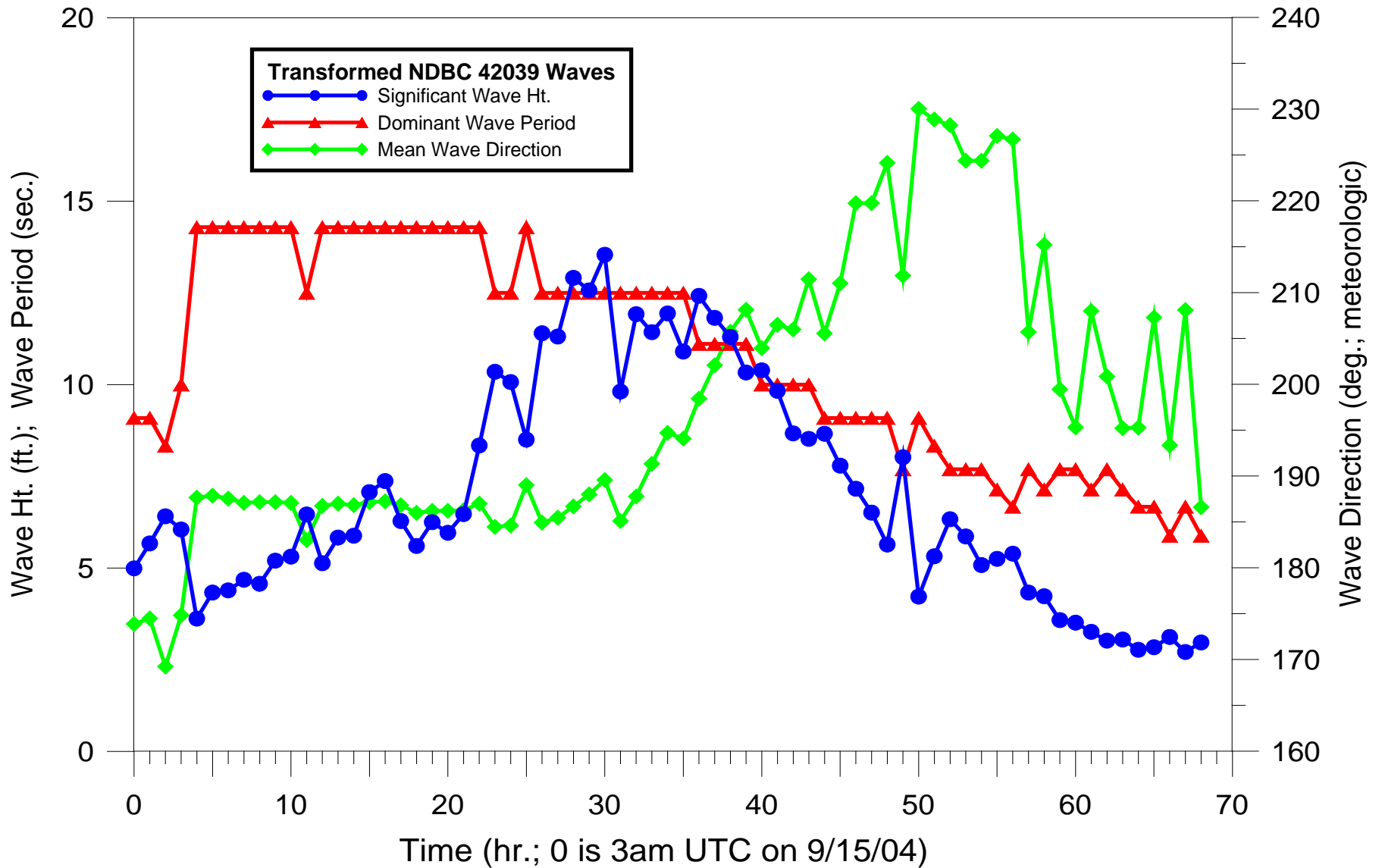
Miles  
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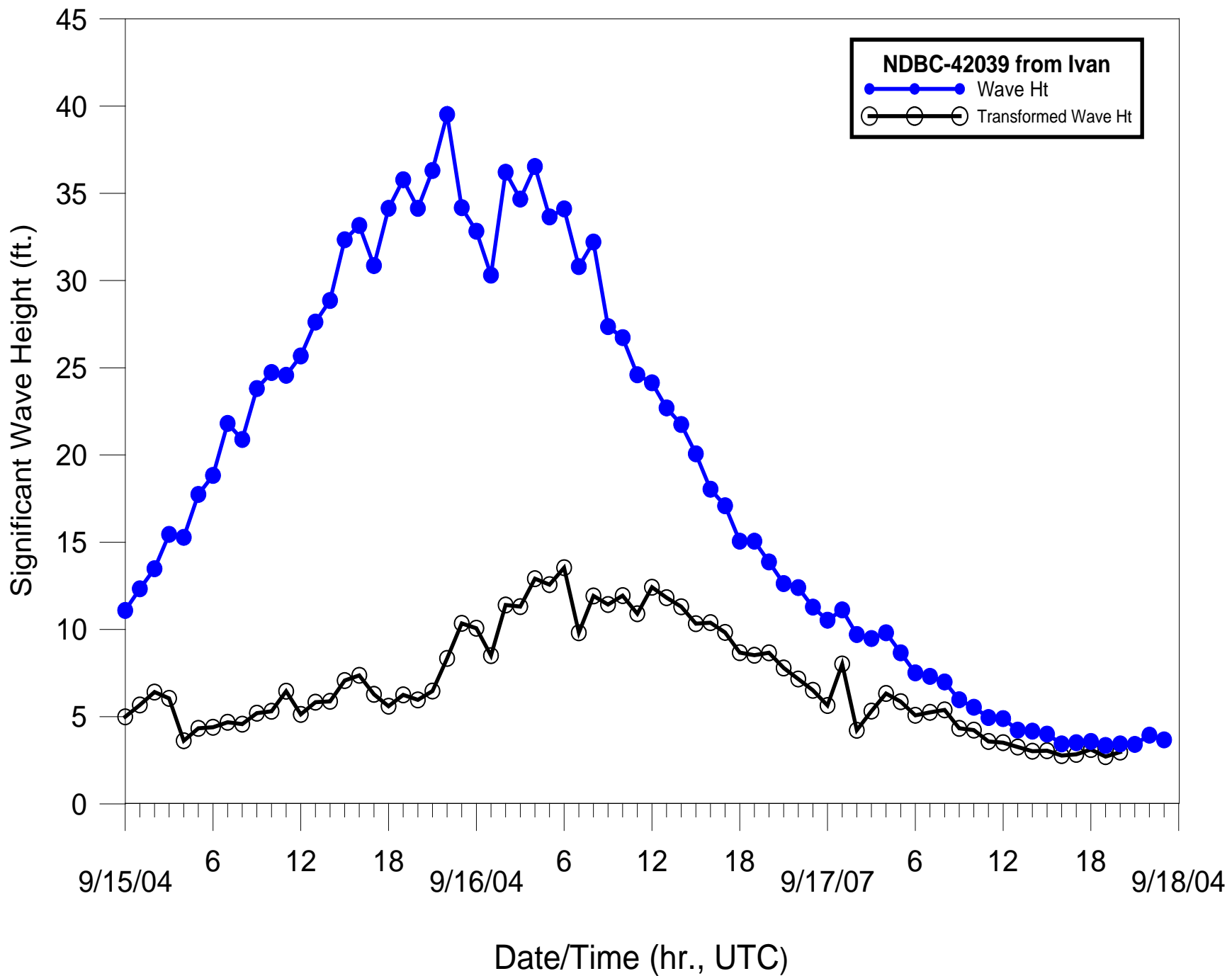


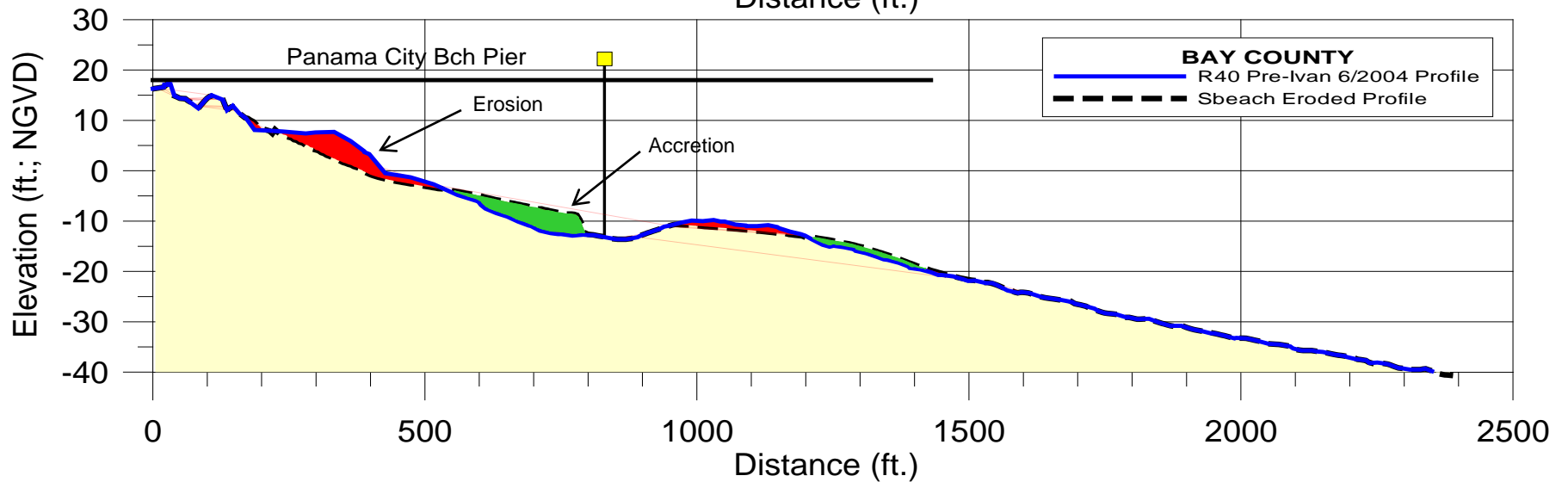
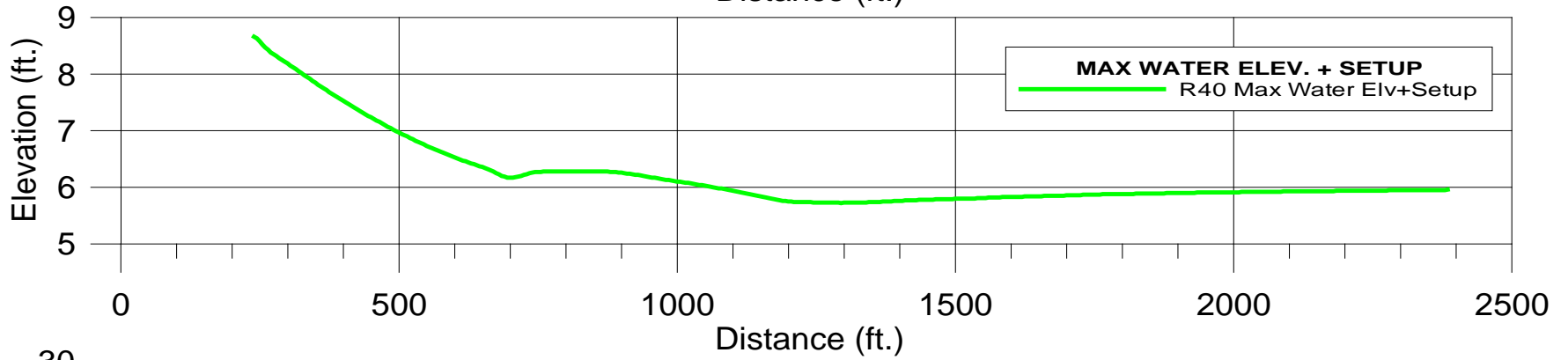
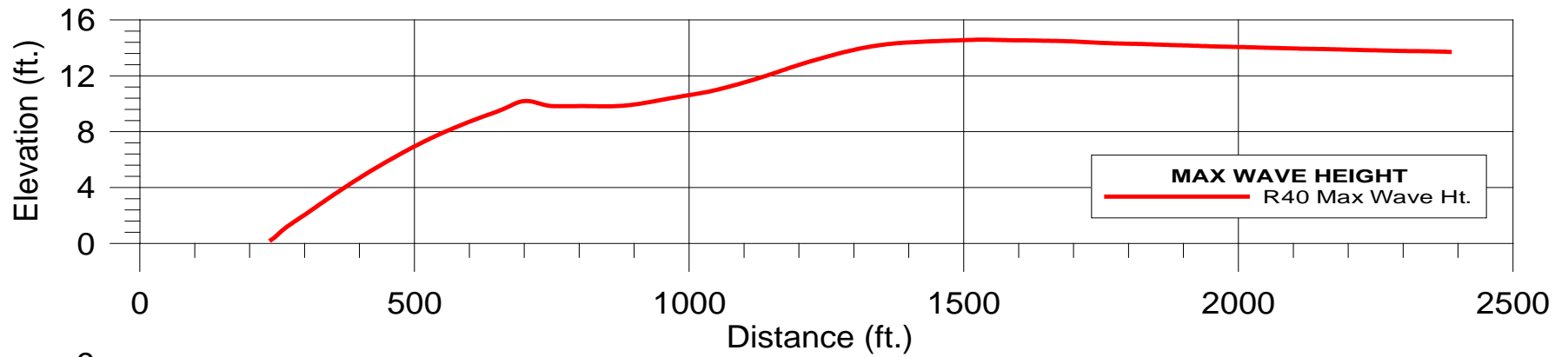
# Deep water wave conditions for Hurricane Ivan at NDBC buoy 42039

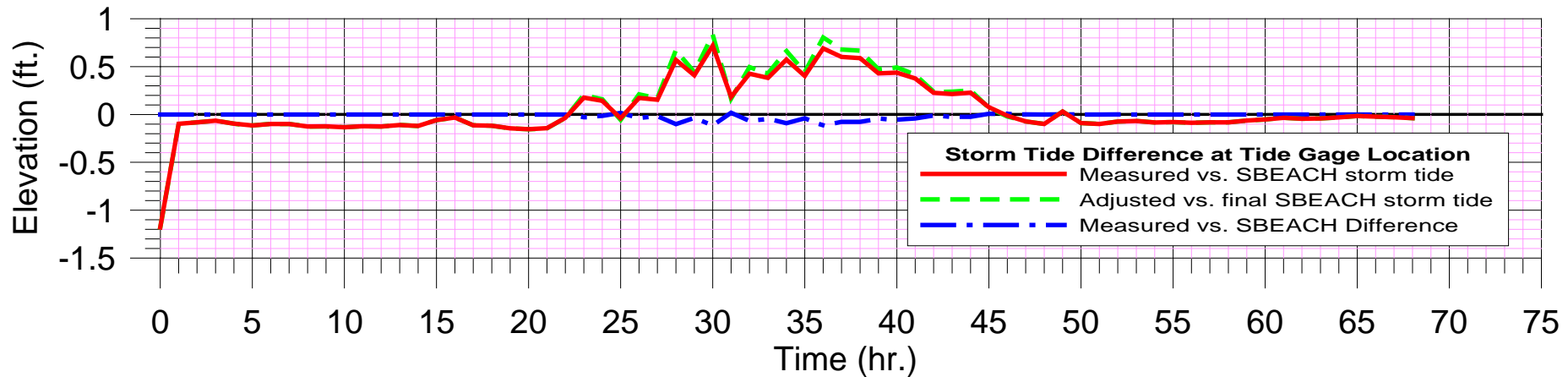
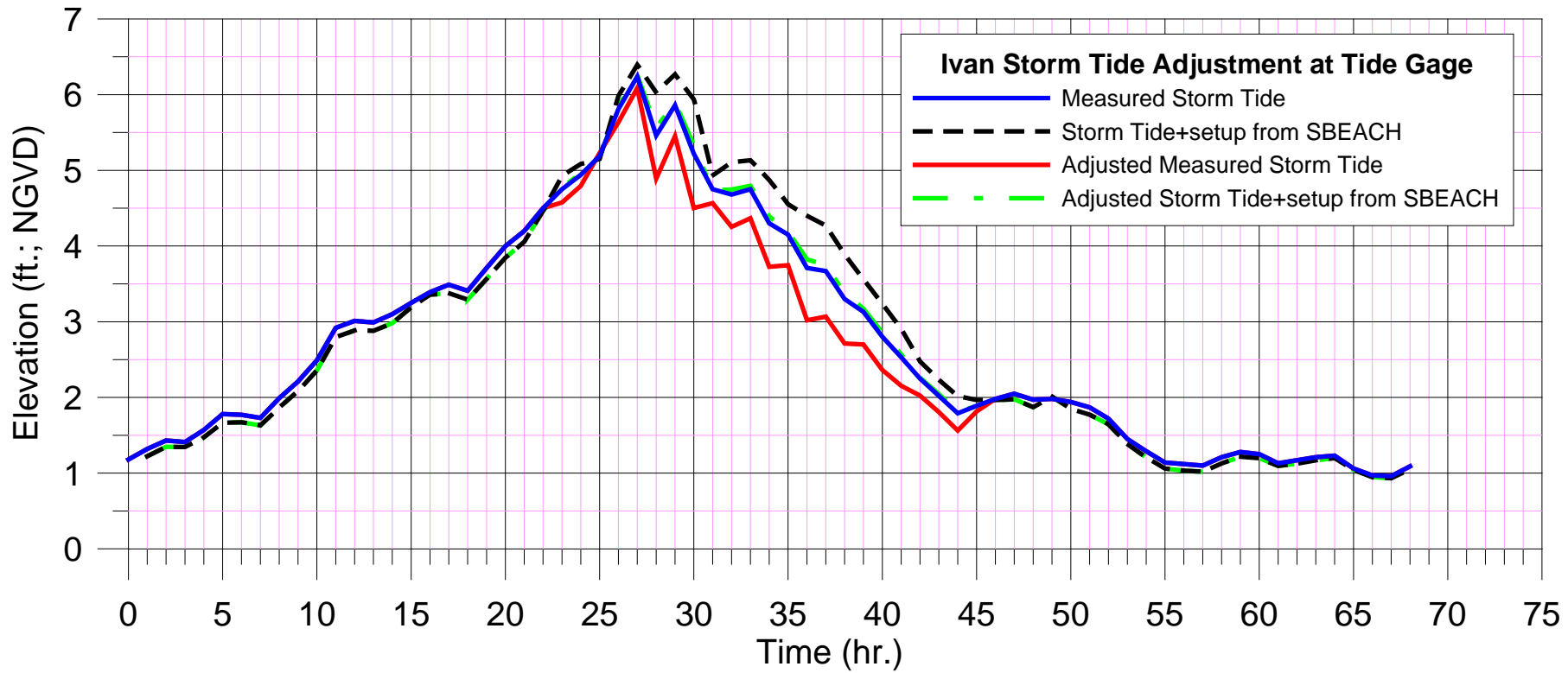


# Transformed NDBC buoy wave conditions at 40 ft. depth for Hurricane Ivan



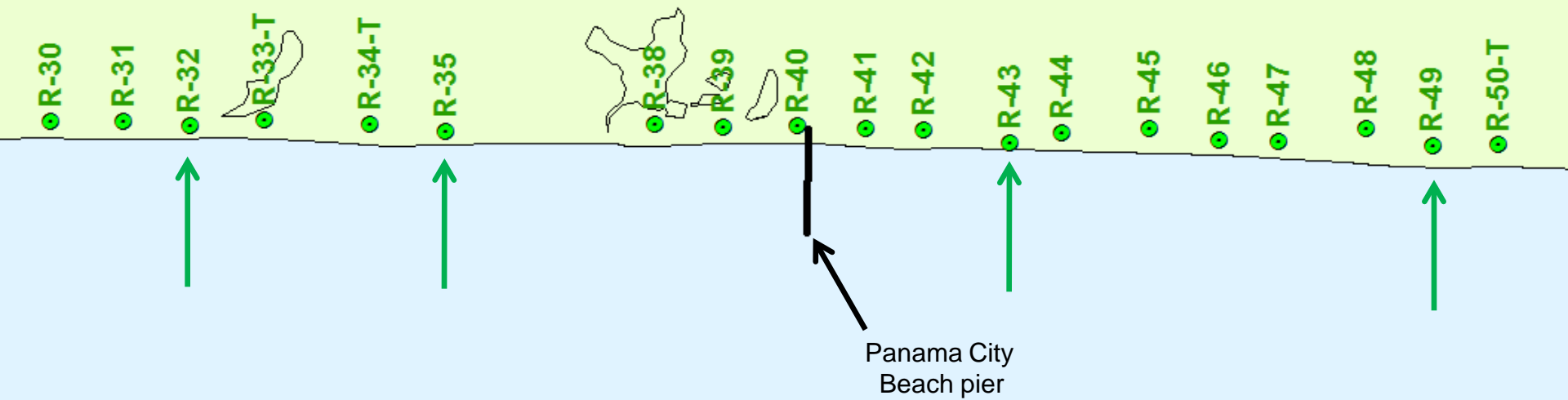






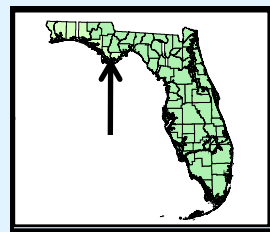


# Panama City Beach

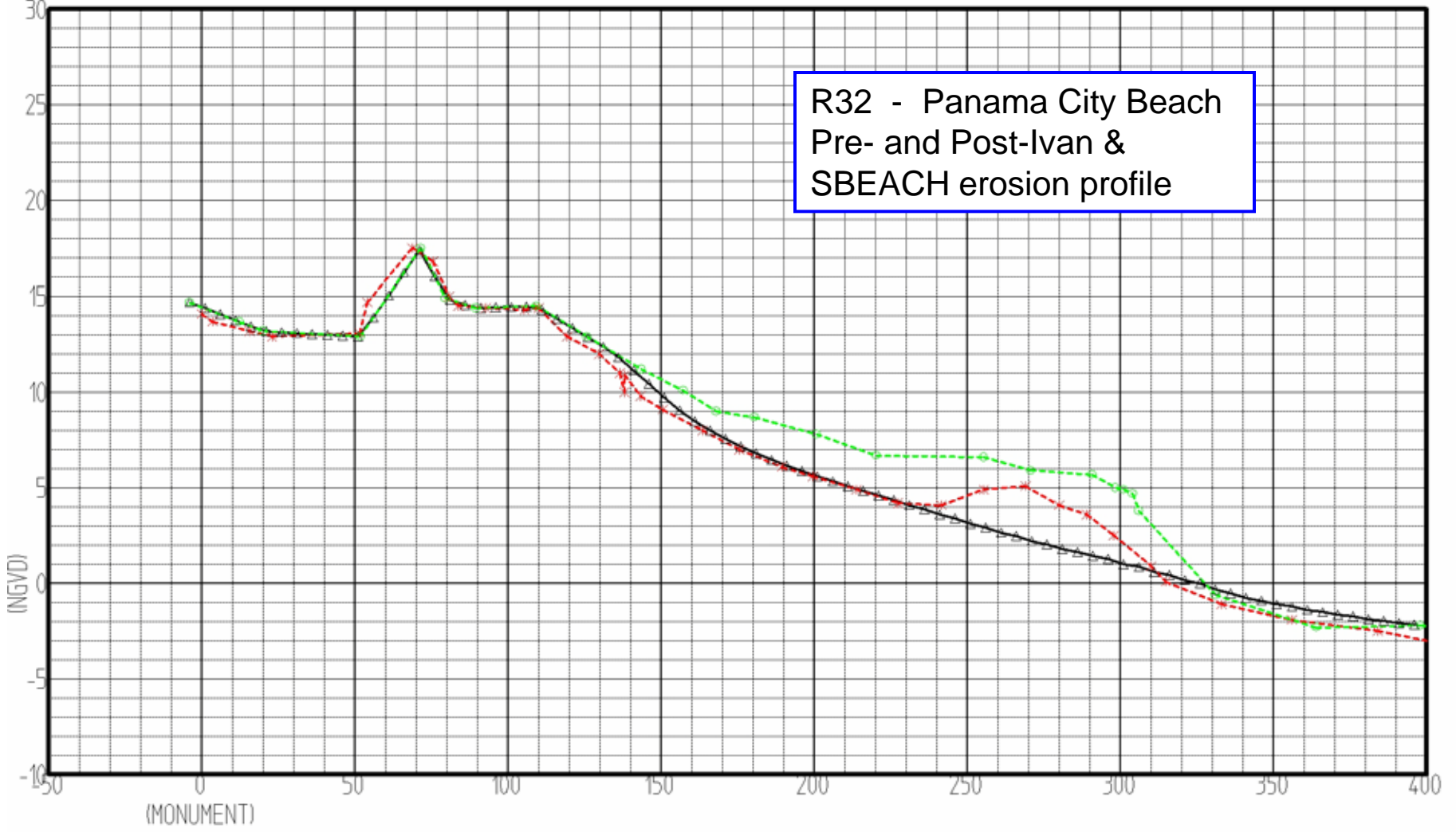


SBEACH Calibration  
Study Area – Bay County  
Ivan Profile Locations

*Gulf of Mexico*



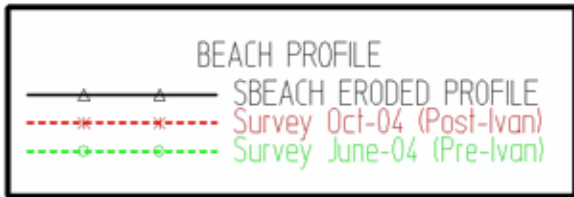
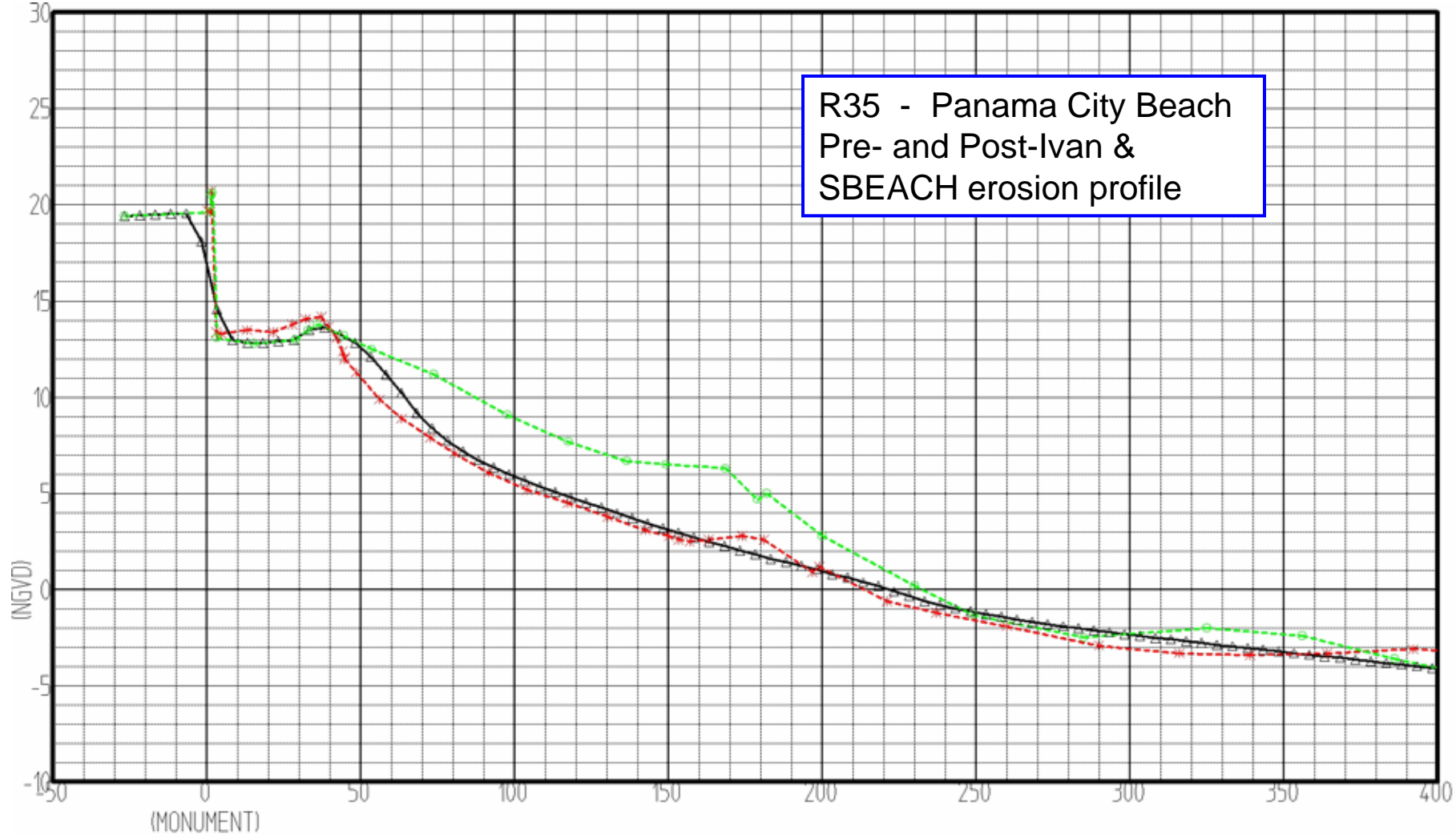
R32 - Panama City Beach  
Pre- and Post-Ivan &  
SBEACH erosion profile



BEACH PROFILE  
 —▲—▲— SBEACH ERODED PROFILE  
 - - \* - - \* - - Survey Oct-04 (Post-Ivan)  
 - - o - - o - - Survey June-04 (Pre-Ivan)

BAY-IVAN  
 BUREAU OF BEACHES & COASTAL SYSTEMS  
 FLA. DEPT OF ENVIRONMENTAL PROTECTION

Range: R-32 1/2  
 BEARING: .00

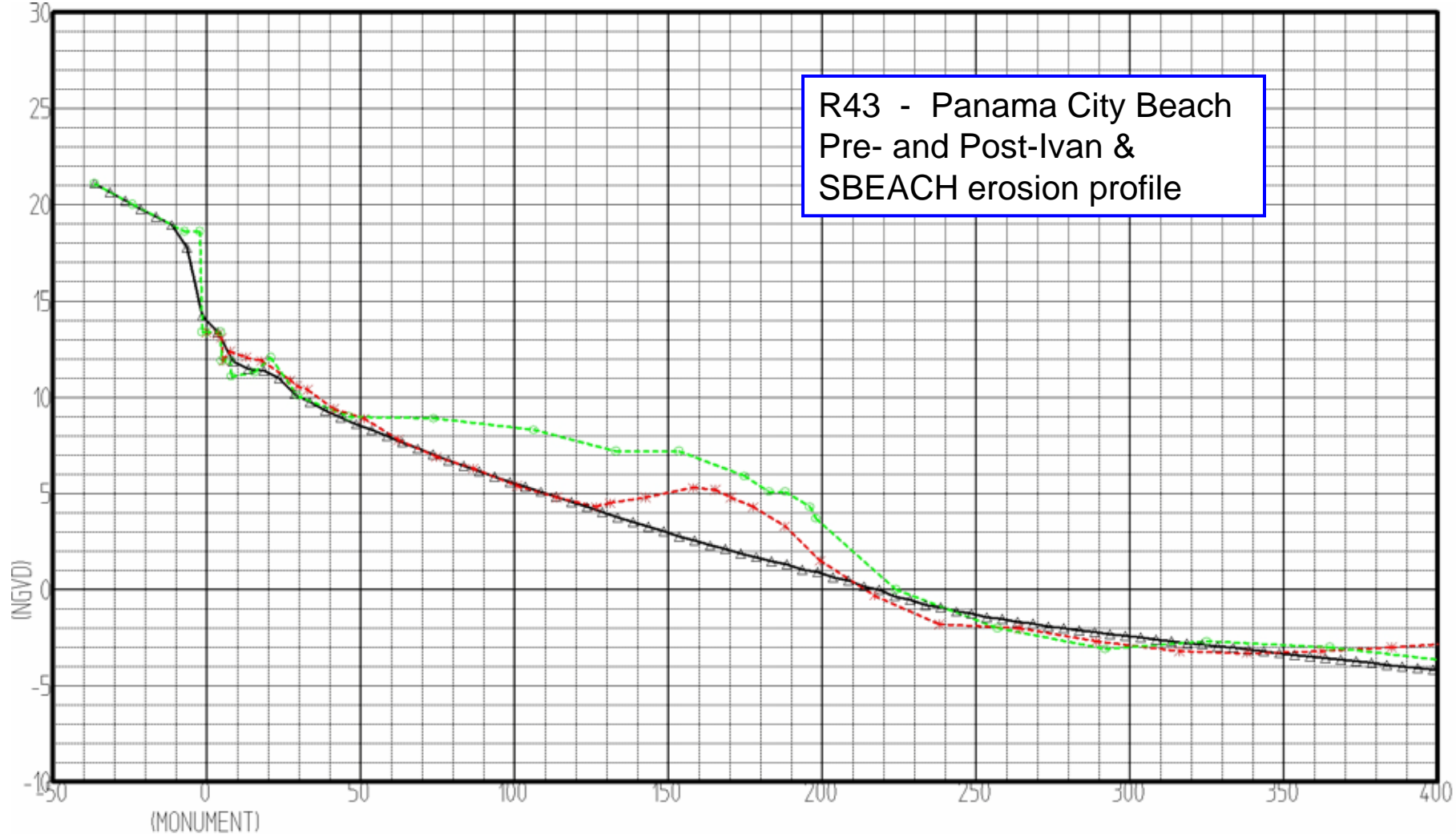


BAY-IVAN

BUREAU OF BEACHES & COASTAL SYSTEMS  
FLA. DEPT OF ENVIRONMENTAL PROTECTION

Range: R-35 1/2

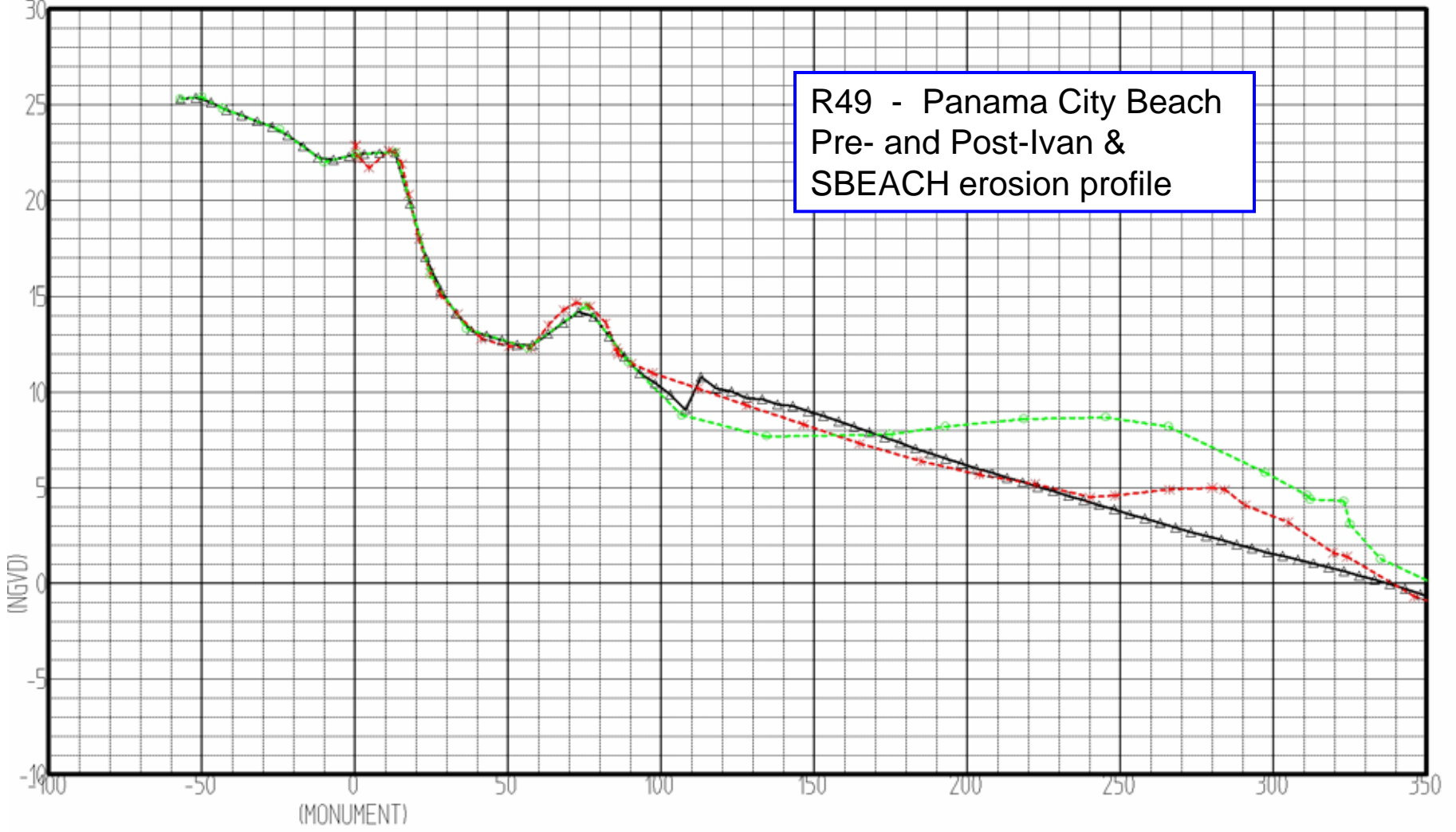
BEARING: .00



BEACH PROFILE  
 —▲—▲— SBEACH ERODED PROFILE  
 - - \* - \* - Survey Oct-04 (Post-Ivan)  
 - - o - o - Survey June-04 (Pre-Ivan)

BAY-IVAN  
 BUREAU OF BEACHES & COASTAL SYSTEMS  
 FLA. DEPT. OF ENVIRONMENTAL PROTECTION

Range: R-43 1/2  
 BEARING: .00



R49 - Panama City Beach  
Pre- and Post-Ivan &  
SBEACH erosion profile

BEACH PROFILE

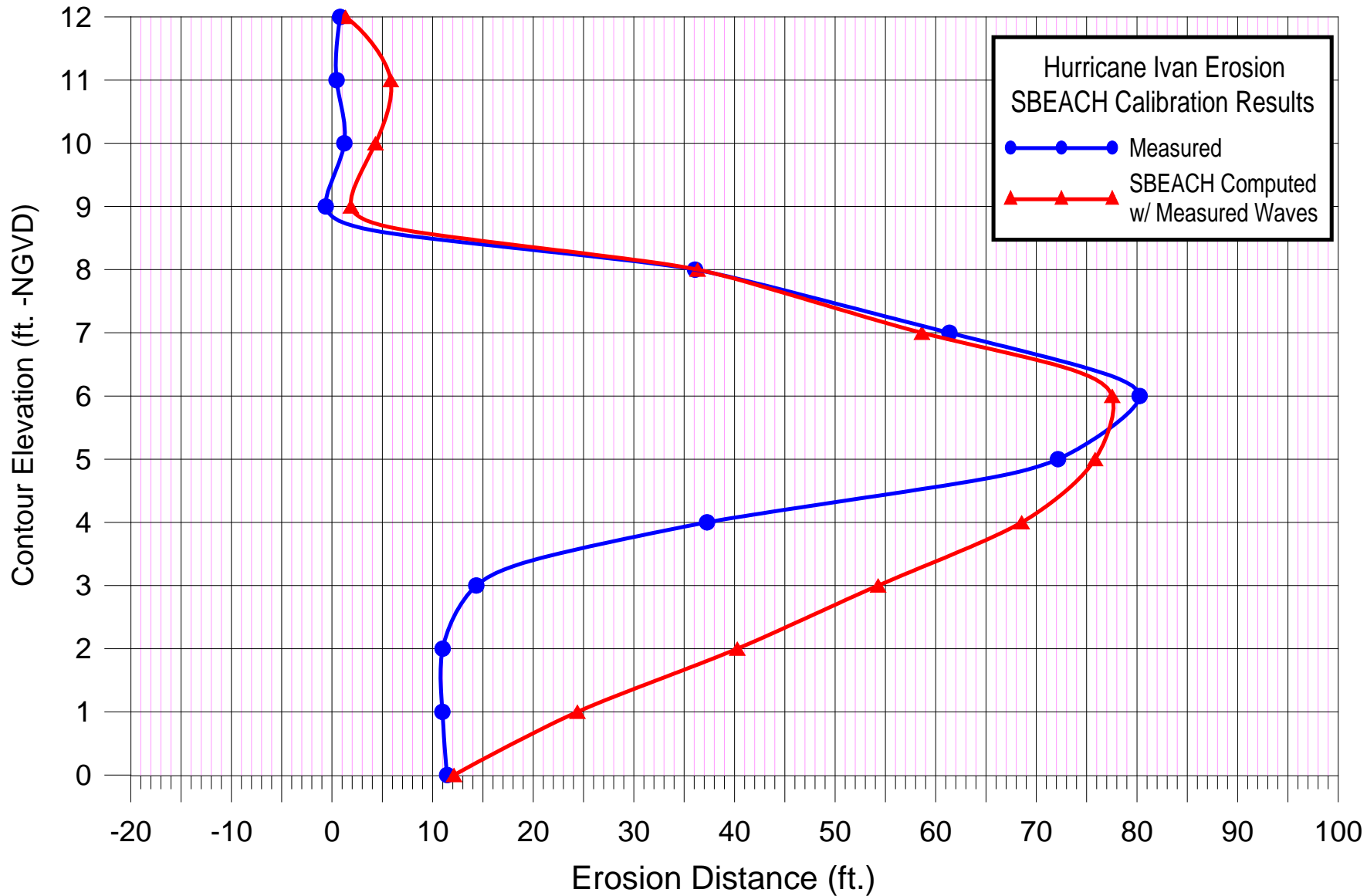
- ▲—▲— SBEACH ERODED PROFILE
- - - \* - - - Survey Oct-04 (Post-Ivan)
- - - o - - - Survey June-04 (Pre-Ivan)

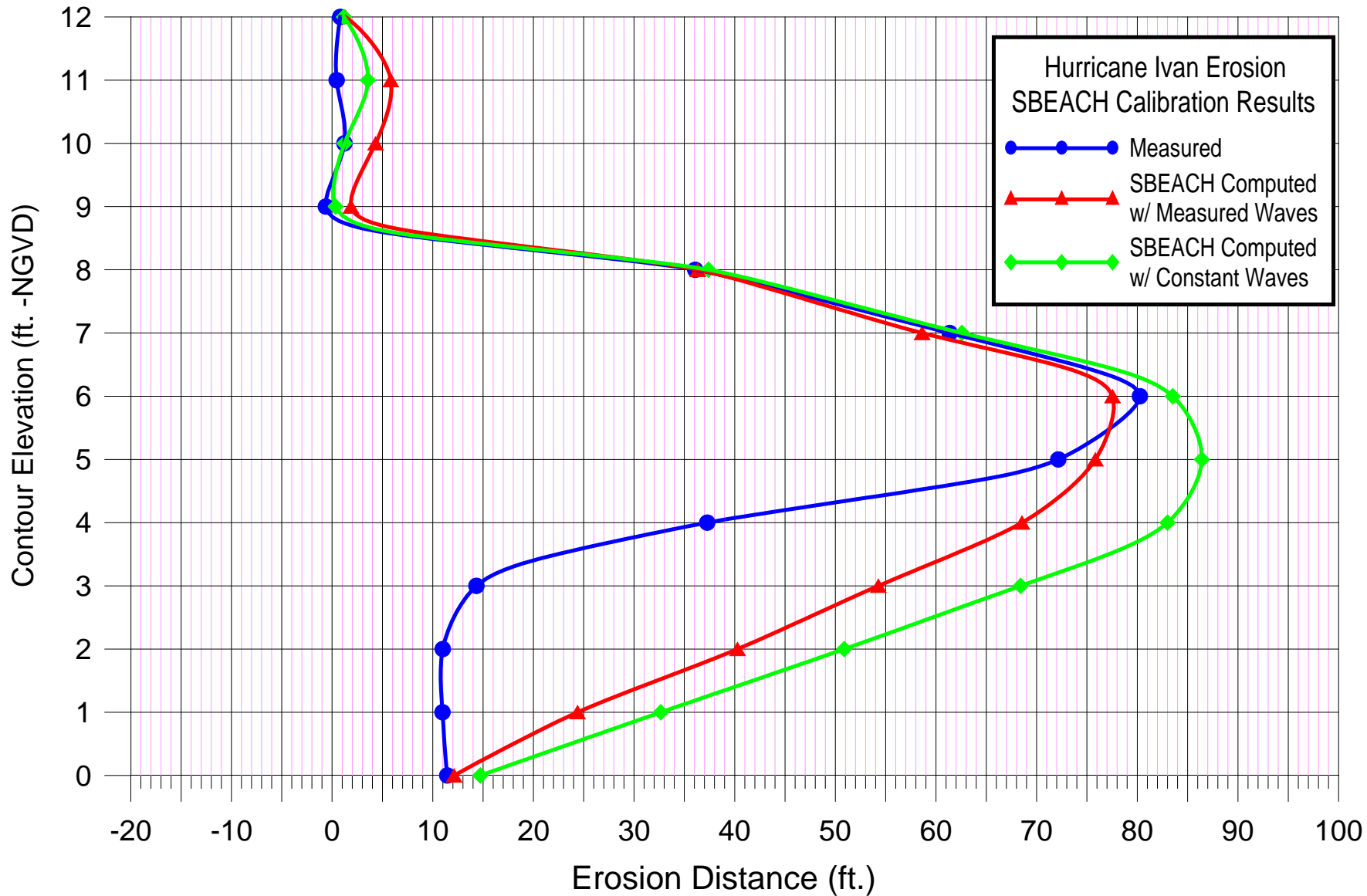
BAY-IVAN

BUREAU OF BEACHES & COASTAL SYSTEMS  
FLA. DEPT. OF ENVIRONMENTAL PROTECTION

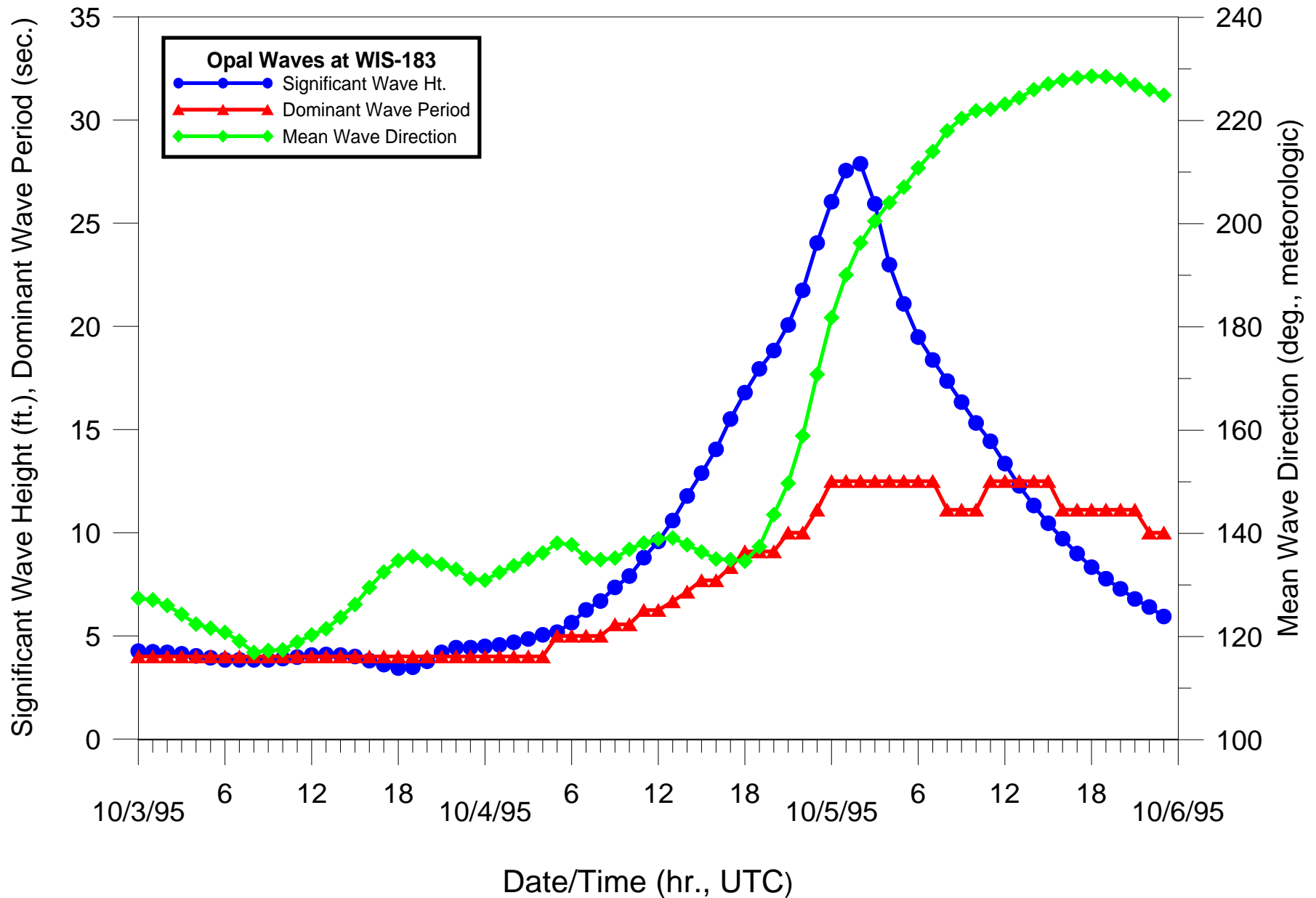
Range: R-49 1/2

BEARING: .00

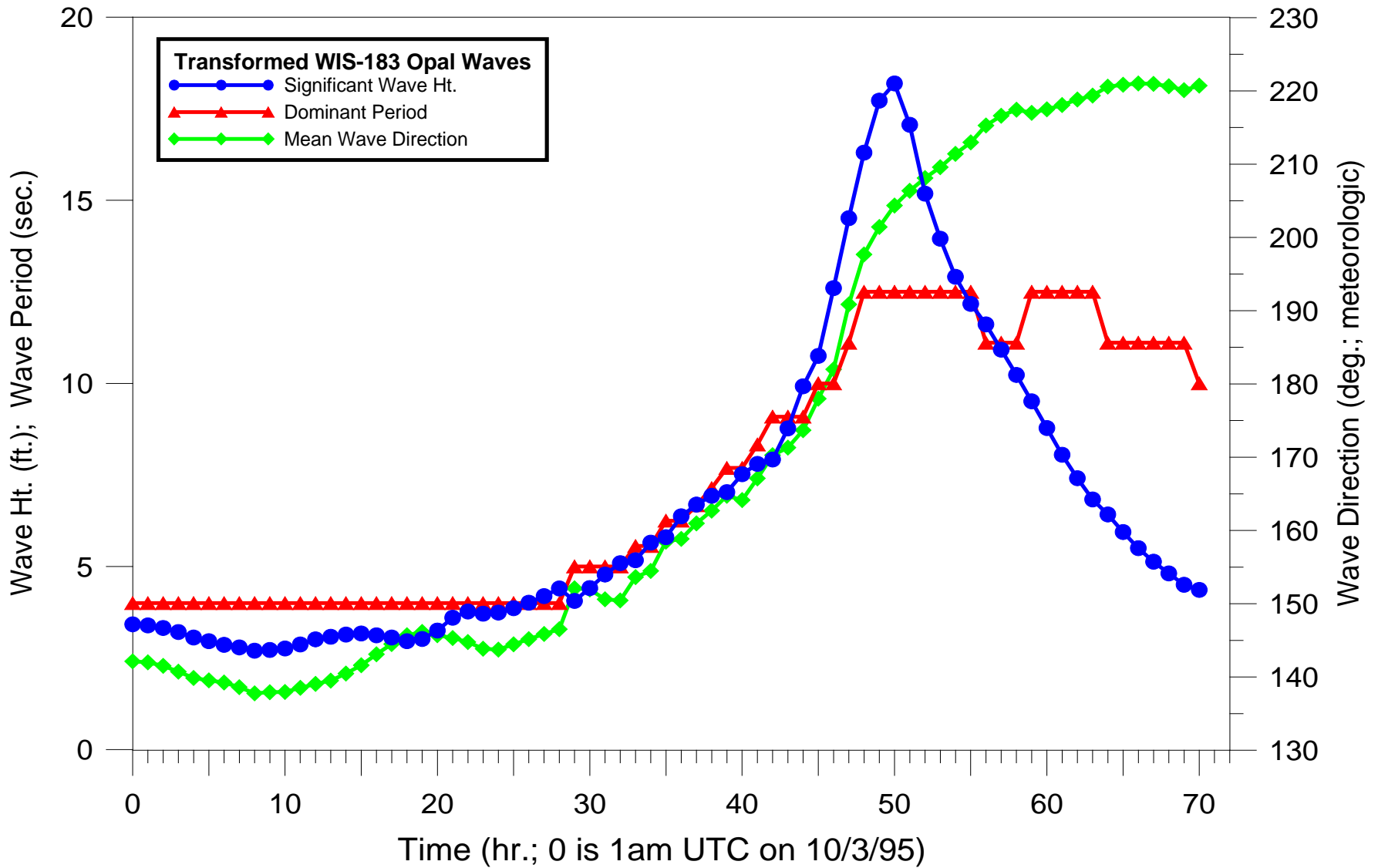


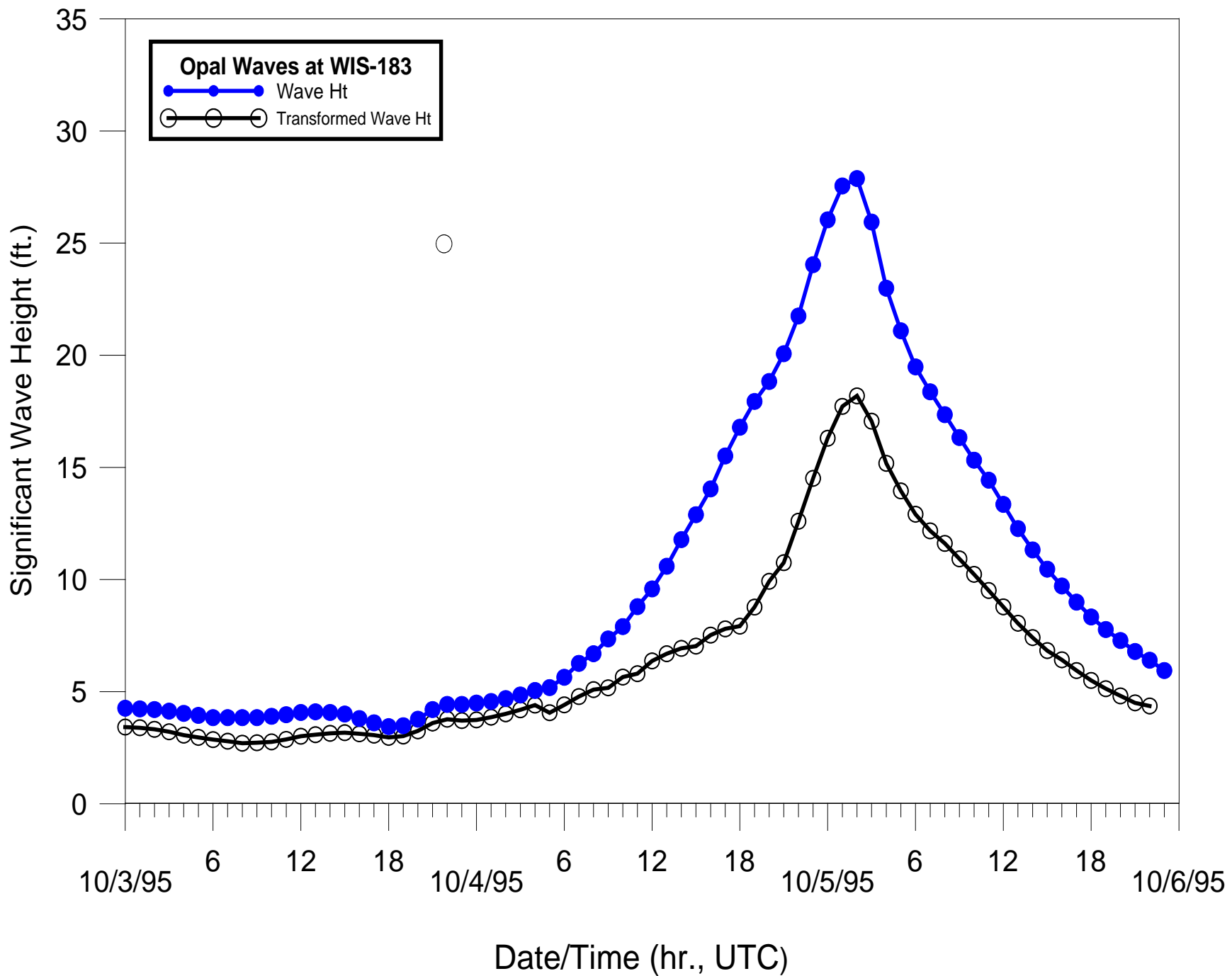


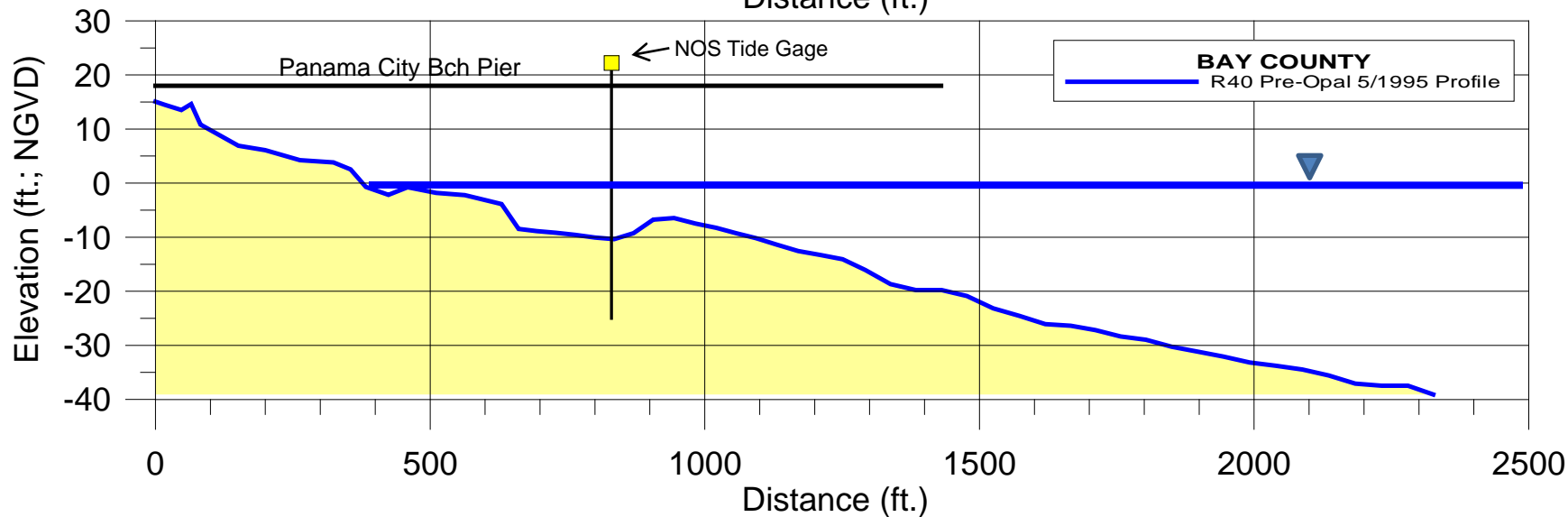
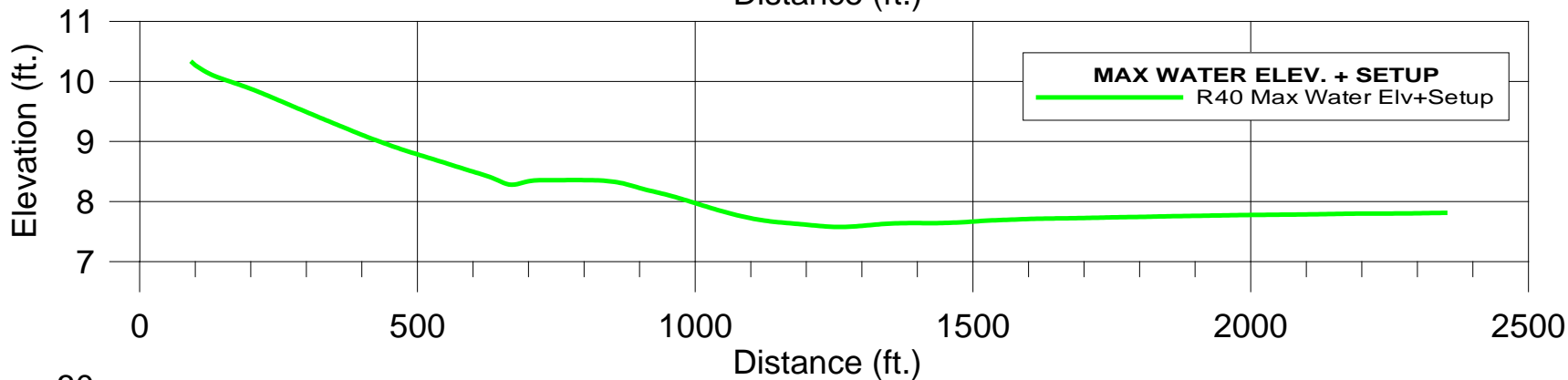
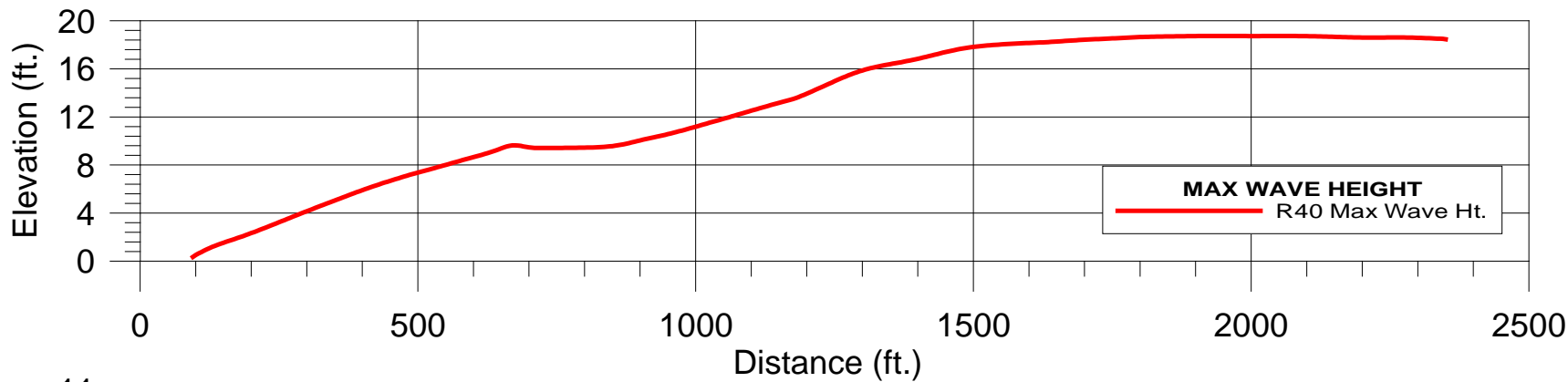
# Hurricane Opal wave conditions at WIS Station 183 near Panama City Beach

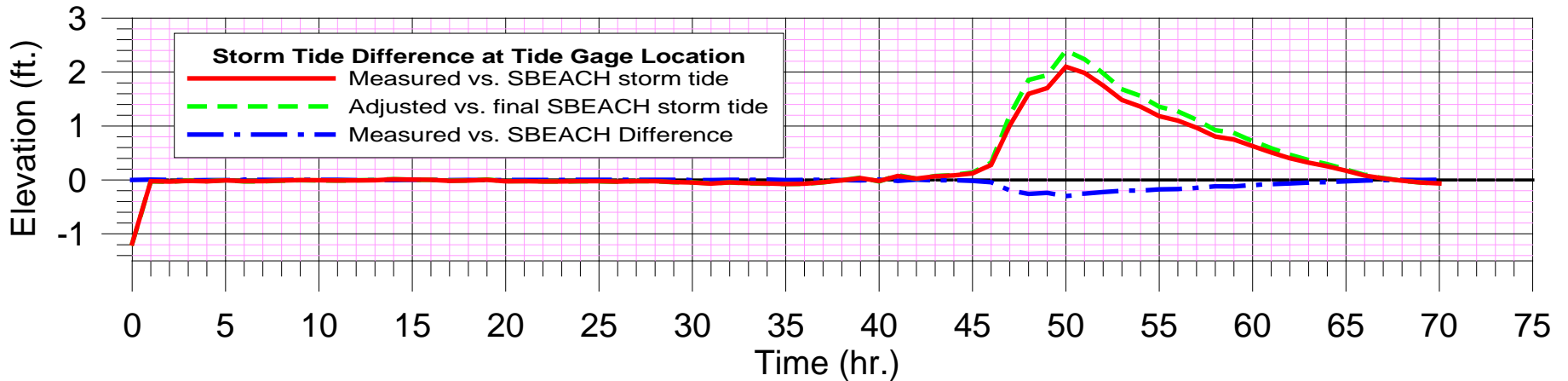
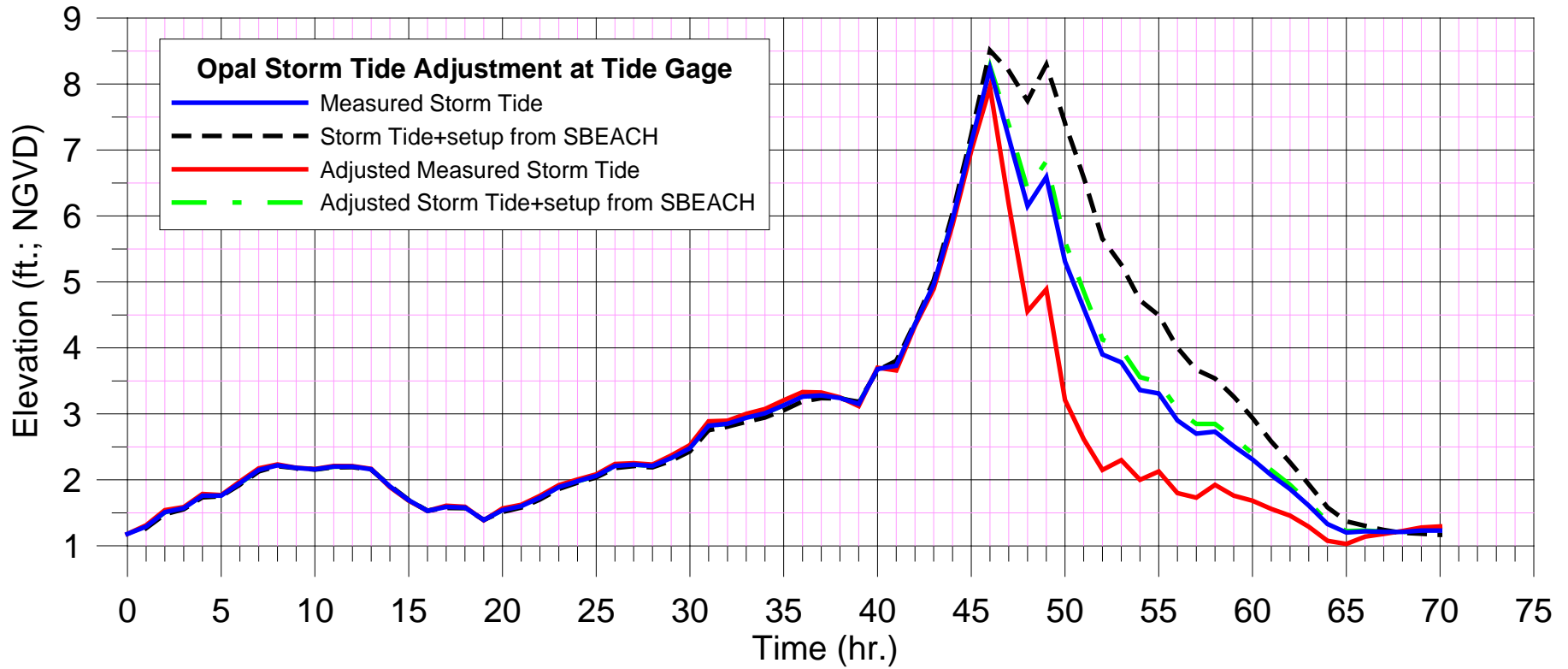


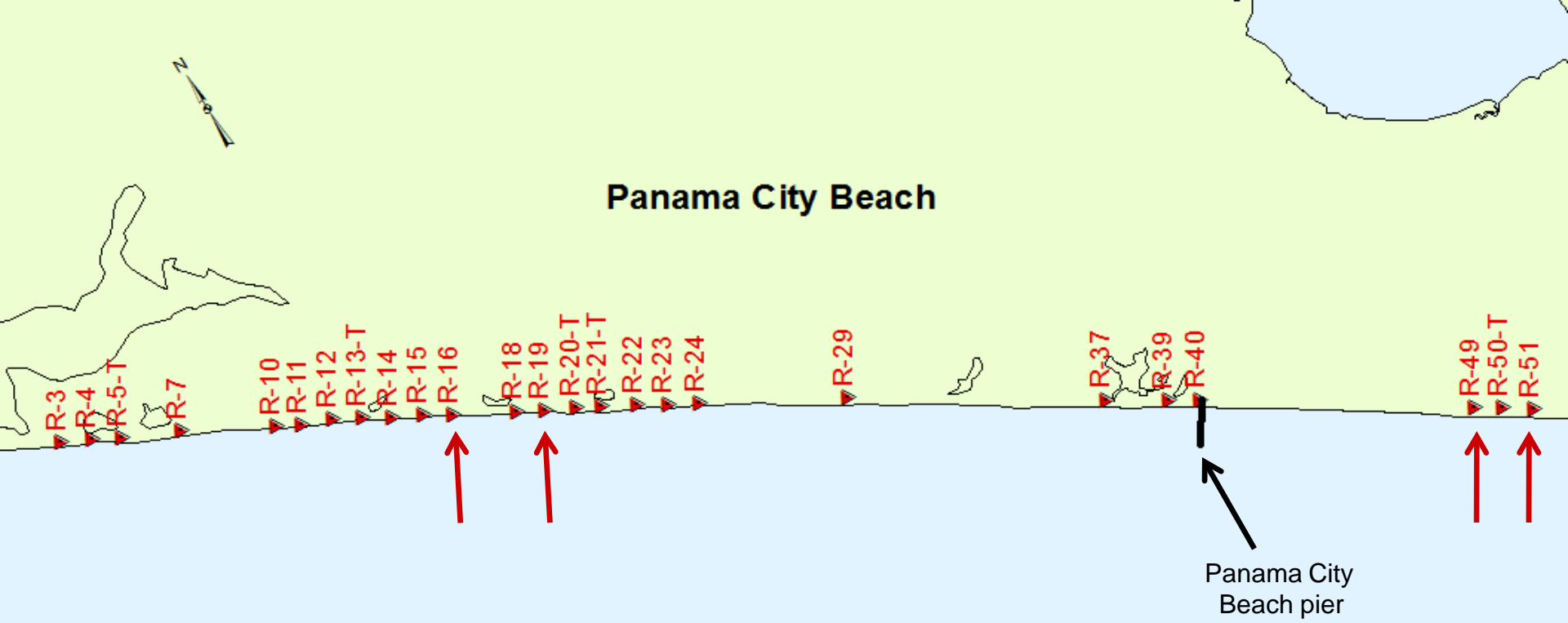
# Transformed WIS wave conditions at 40 ft. depth for Hurricane Opal





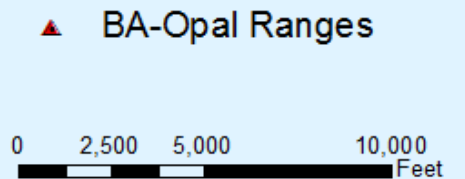
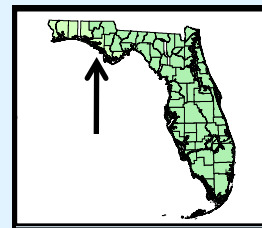




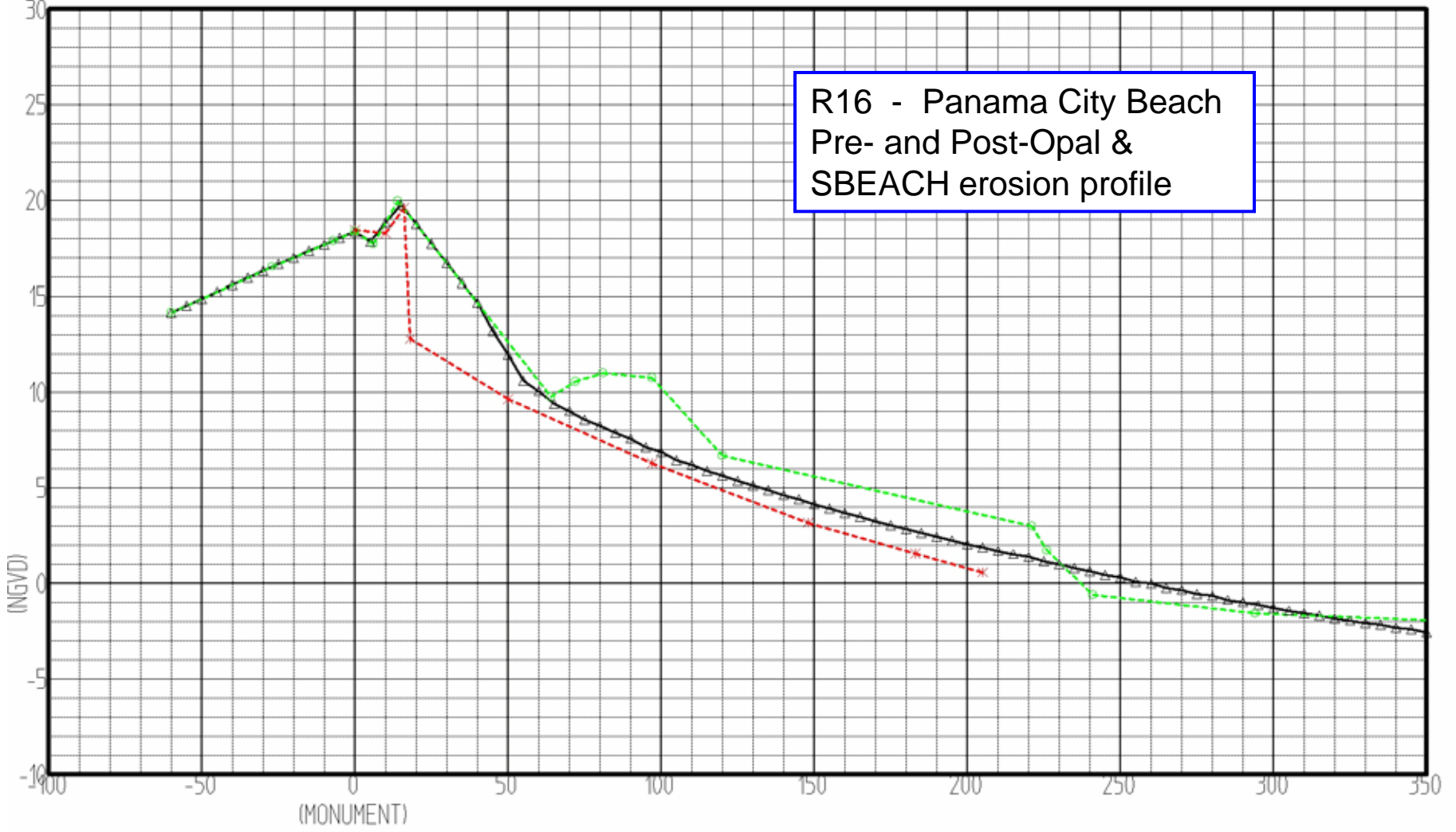


SBEACH Calibration  
 Study Area – Bay County  
 Opal Profile Locations

*Gulf of Mexico*



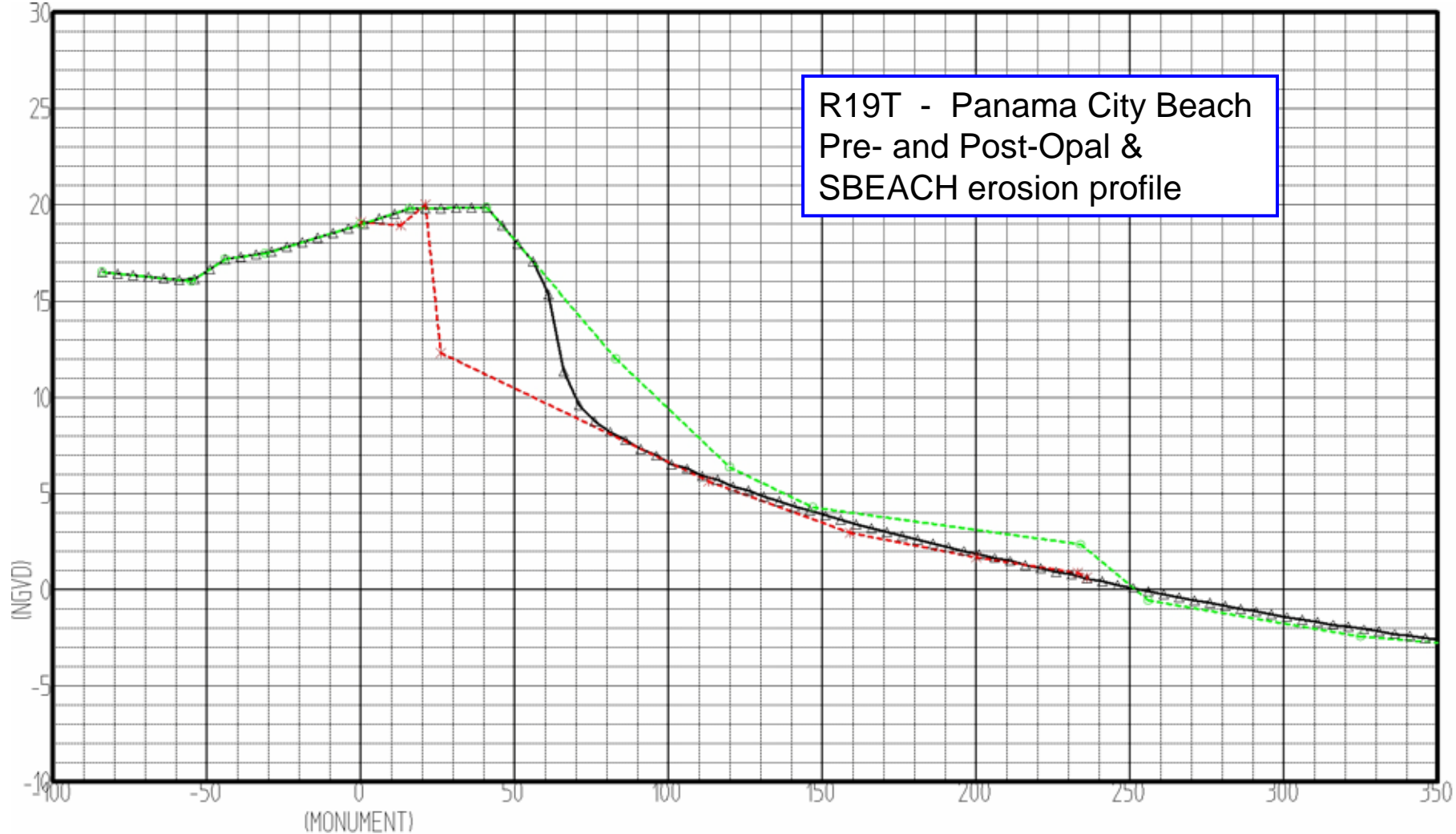
R16 - Panama City Beach  
Pre- and Post-Opal &  
SBEACH erosion profile



BEACH PROFILE  
 —▲—▲— SBEACH ERODED PROFILE  
 - - \* - - \* - - SURVEY OCT-95 (POST-OPAL)  
 - - o - - o - - SURVEY APRIL-95 (PRE-OPAL)

BAY-OPAL  
 BUREAU OF BEACHES & COASTAL SYSTEMS  
 FLA. DEPT. OF ENVIRONMENTAL PROTECTION

Range: R-16 1/2  
 BEARING: .00

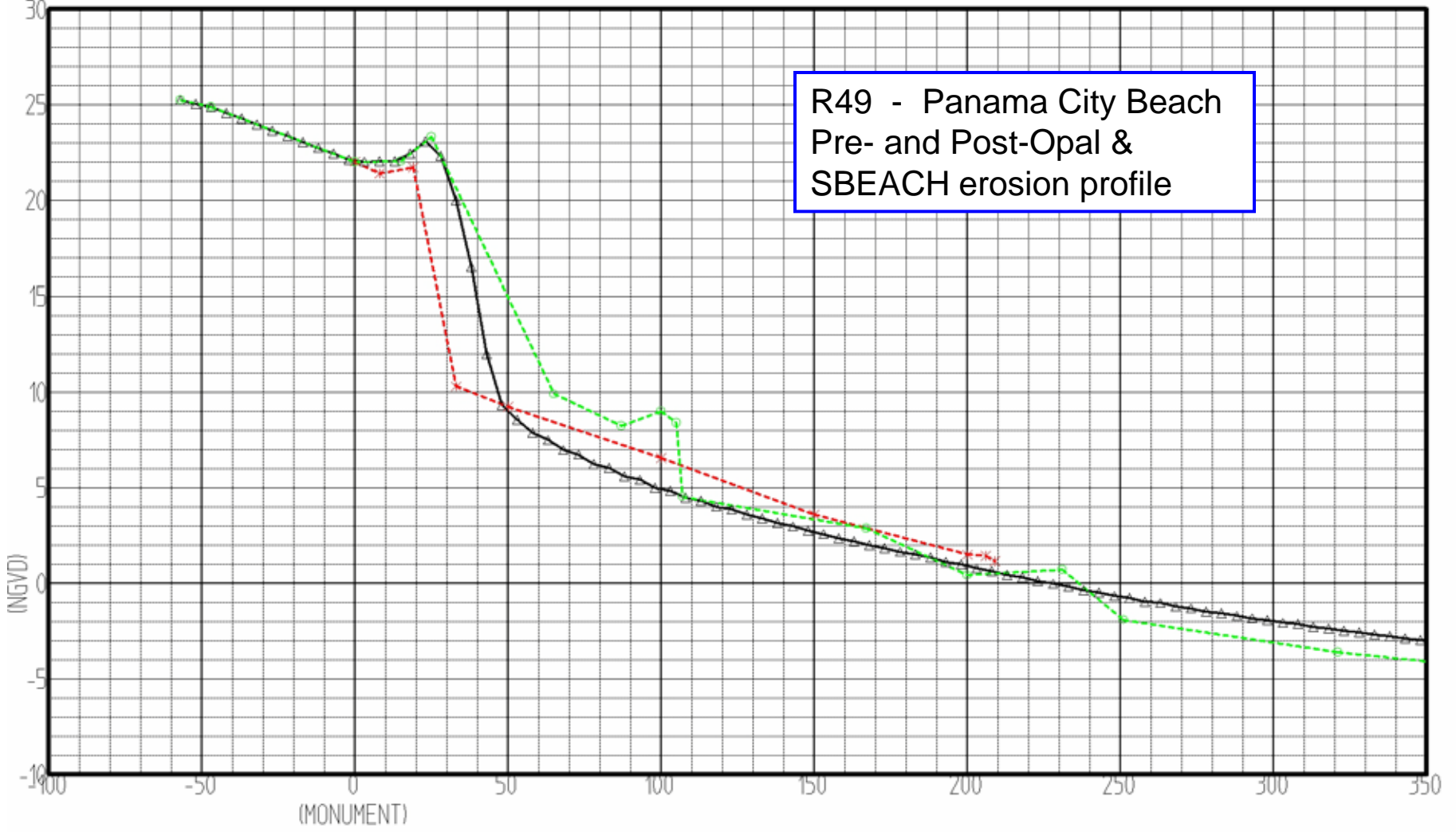


BEACH PROFILE  
 —▲—▲— SBEACH ERODED PROFILE  
 - - - \* - - - SURVEY OCT-95 (POST-OPAL)  
 - - - o - - - SURVEY APRIL-95 (PRE-OPAL)

BAY-OPAL  
 BUREAU OF BEACHES & COASTAL SYSTEMS  
 FLA. DEPT OF ENVIRONMENTAL PROTECTION

Range: R-19-T 1/2  
 BEARING: .00

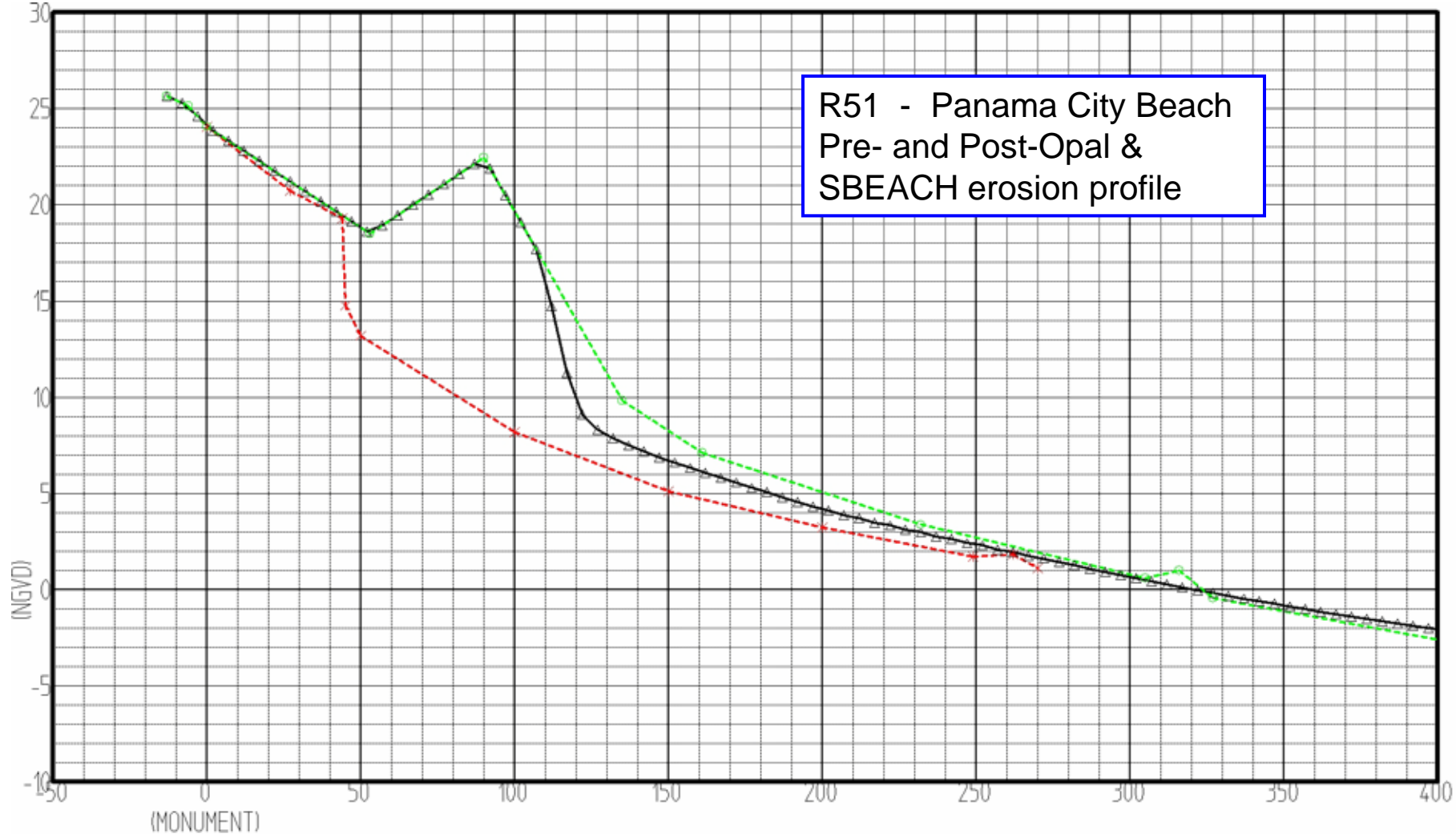
R49 - Panama City Beach  
Pre- and Post-Opal &  
SBEACH erosion profile



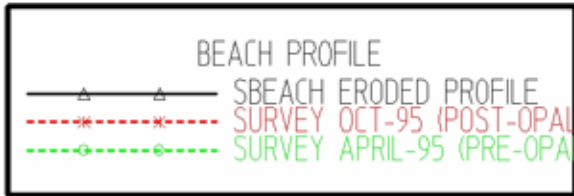
BEACH PROFILE  
 —▲—▲— SBEACH ERODED PROFILE  
 - - - \* - - - SURVEY OCT-95 (POST-OPAL)  
 - - - o - - - SURVEY APRIL-95 (PRE-OPAL)

BAY-OPAL  
 BUREAU OF BEACHES & COASTAL SYSTEMS  
 FLA. DEPT. OF ENVIRONMENTAL PROTECTION

Range: R-49 1/2  
 BEARING: .00



R51 - Panama City Beach  
Pre- and Post-Opal &  
SBEACH erosion profile

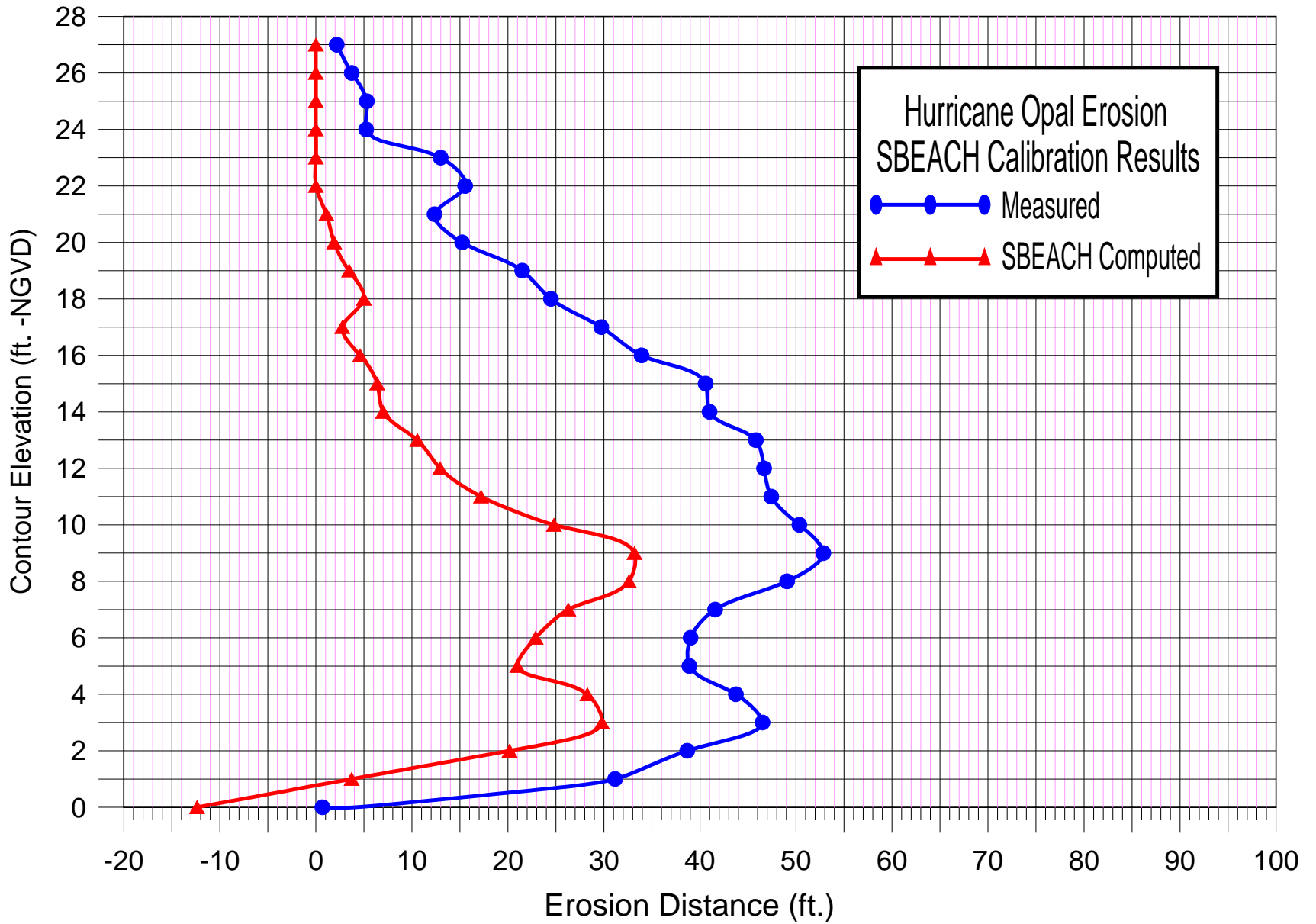


BAY-OPAL

BUREAU OF BEACHES & COASTAL SYSTEMS  
FLA. DEPT. OF ENVIRONMENTAL PROTECTION

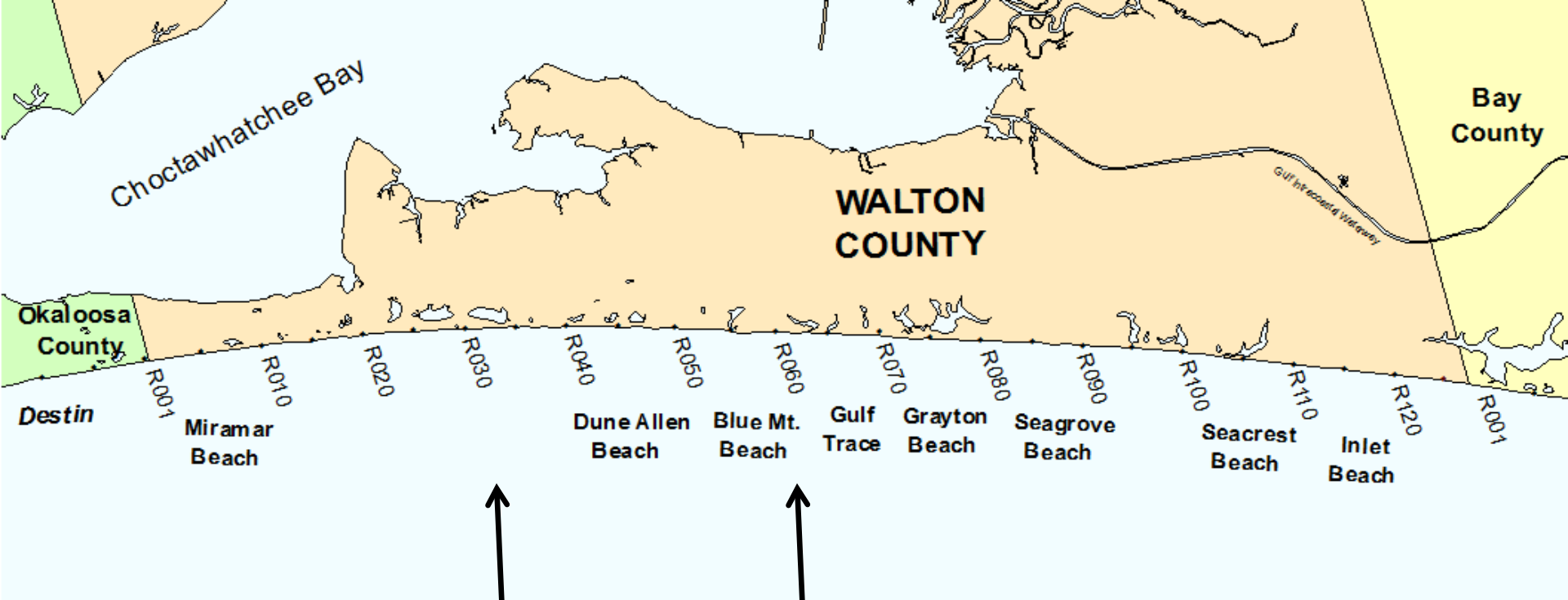
Range: R-51 1/2

Bearing: .00



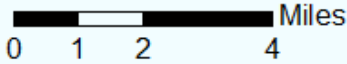
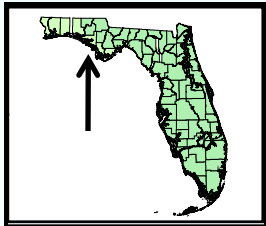
# Recommended SBEACH Input Parameters for HF storm for PC Bch and WL & OK counties

<b>Sediment Transport Parameters</b>	<b>Recommended Values for HF Storm for Panama City Beach, WL &amp; OK Co.</b>
Transport rate coefficient, K	$2.5 \times 10^{-6}$ (m <sup>4</sup> /N)
Overwash transport parameter	0.005
Coefficient for slope dependent term, e	0.005 (m <sup>2</sup> /s)
Transport rate decay coeff. multiplier, l	0.5 (m <sup>-1</sup> )
Water temperature	27 (deg C)
<b>Other Coastal Reach Parameters</b>	
Landward surf zone depth	0.3 (m)
Effective grain size (mean D50)	0.30 (mm) (PCBch)
	0.30 (mm) (WL Co.)
	0.34 (mm) (OK Co.)
Maximum slope prior to avalanching	45 deg
<b>Suggested Wave Input Conditions</b>	
Wave Height, H (ft)	10 (ft) (constant)
Wave Period, T (sec)	12 (sec) (constant)
Wave Direction, a (deg)	0 (deg; i.e., shore-normal)

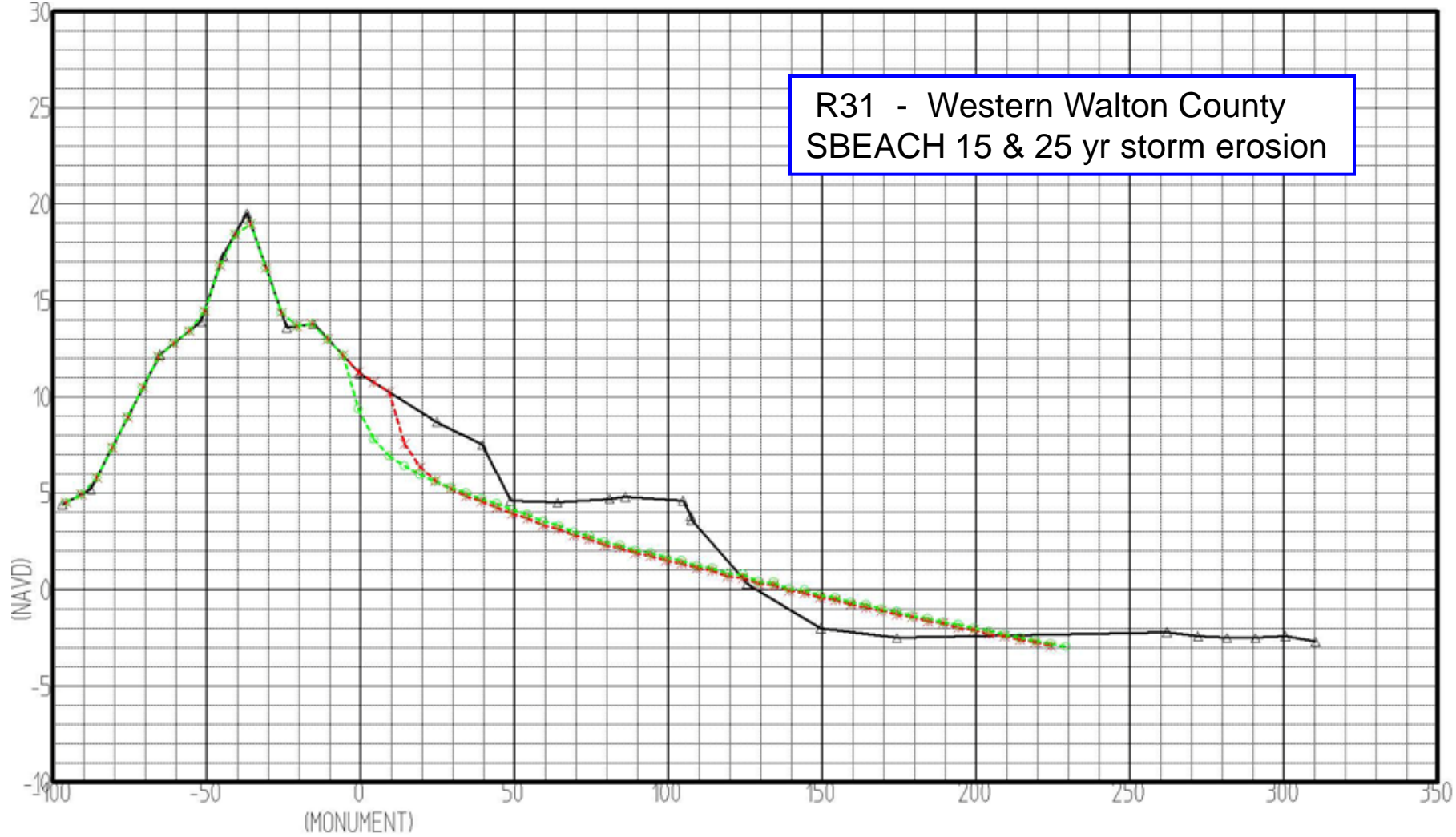


**SBEACH Erosion Profiles  
for Walton County  
15 & 25 yr. storms – R1-R127**

***Gulf of Mexico***



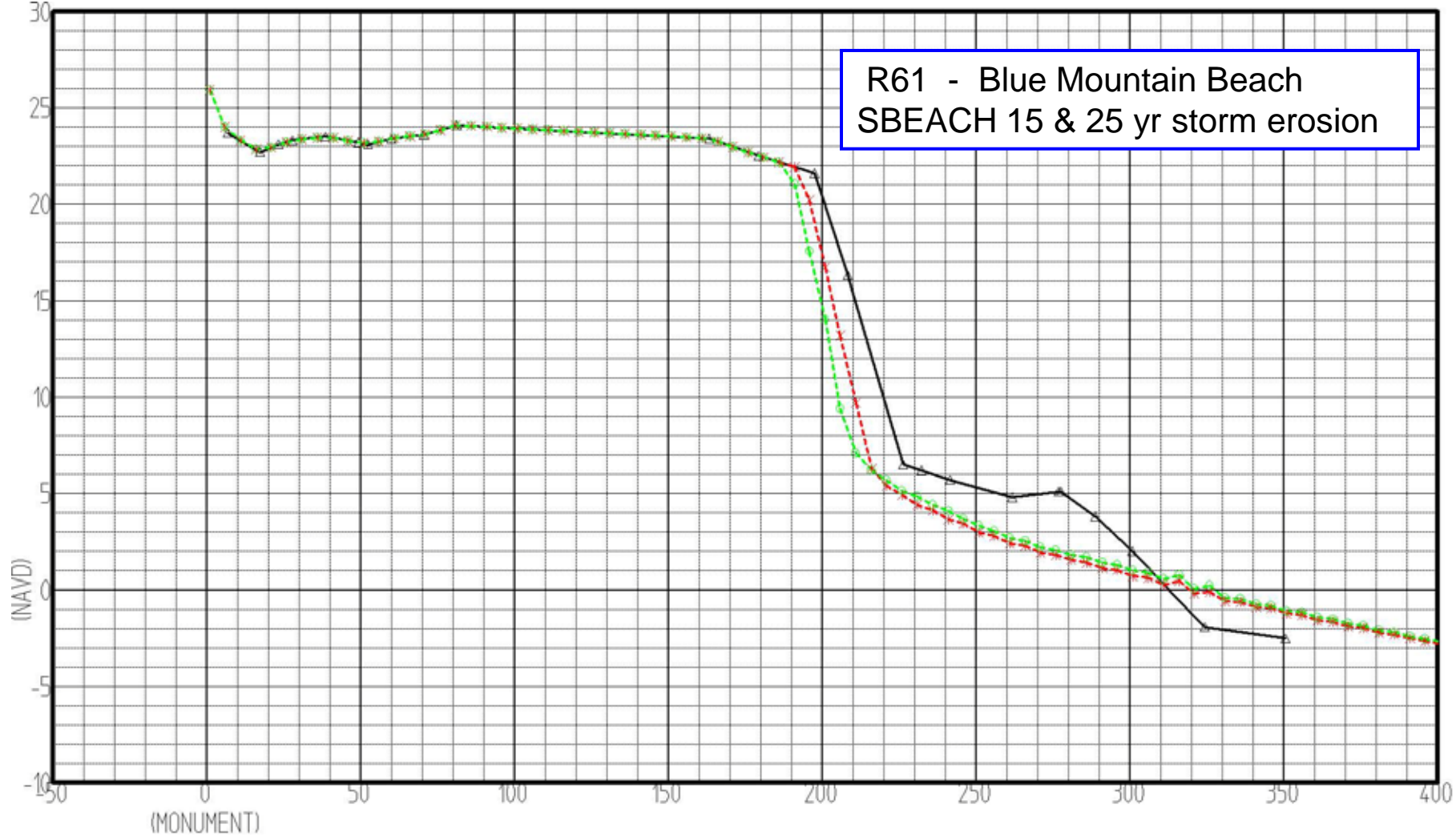
R31 - Western Walton County  
SBEACH 15 & 25 yr storm erosion



BEACH PROFILE  
 —△—△— WALTON JULY 2007 PRF  
 - - \* - - \* - - SBEACH 15-YR ERODED PRF  
 - - o - - o - - SBEACH 25-YR ERODED PRF

WALTON  
 BUREAU OF BEACHES & COASTAL SYSTEMS  
 FLA. DEPT OF ENVIRONMENTAL PROTECTION

Range: R-31 1/1  
 BEARING: 190.00



R61 - Blue Mountain Beach  
SBEACH 15 & 25 yr storm erosion

BEACH PROFILE

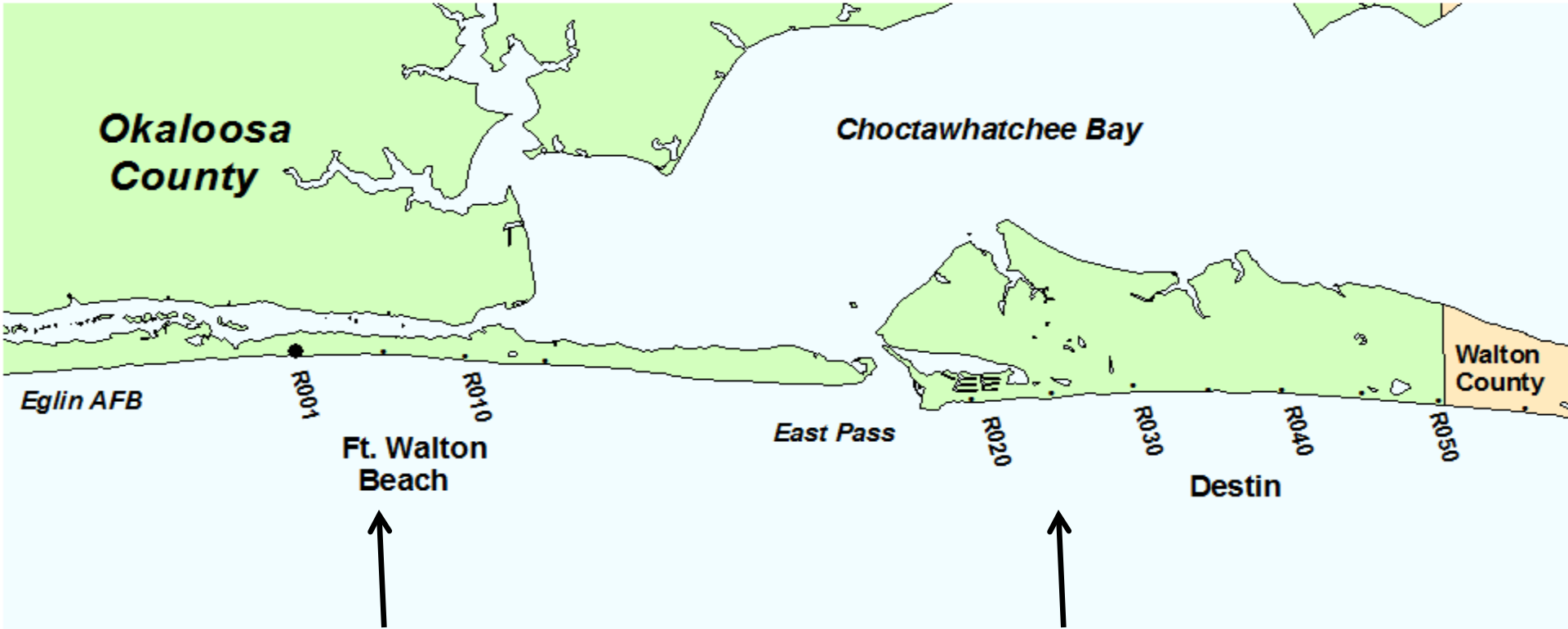
- △—△— WALTON JULY 2007 PRF
- - - \* - - - SBEACH 15-YR ERODED PRF
- - - o - - - SBEACH 25-YR ERODED PRF

WALTON

BUREAU OF BEACHES & COASTAL SYSTEMS  
FLA. DEPT OF ENVIRONMENTAL PROTECTION

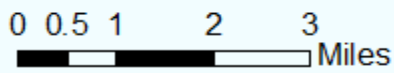
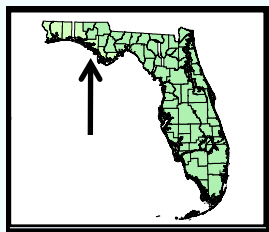
Range: R-61 1/2

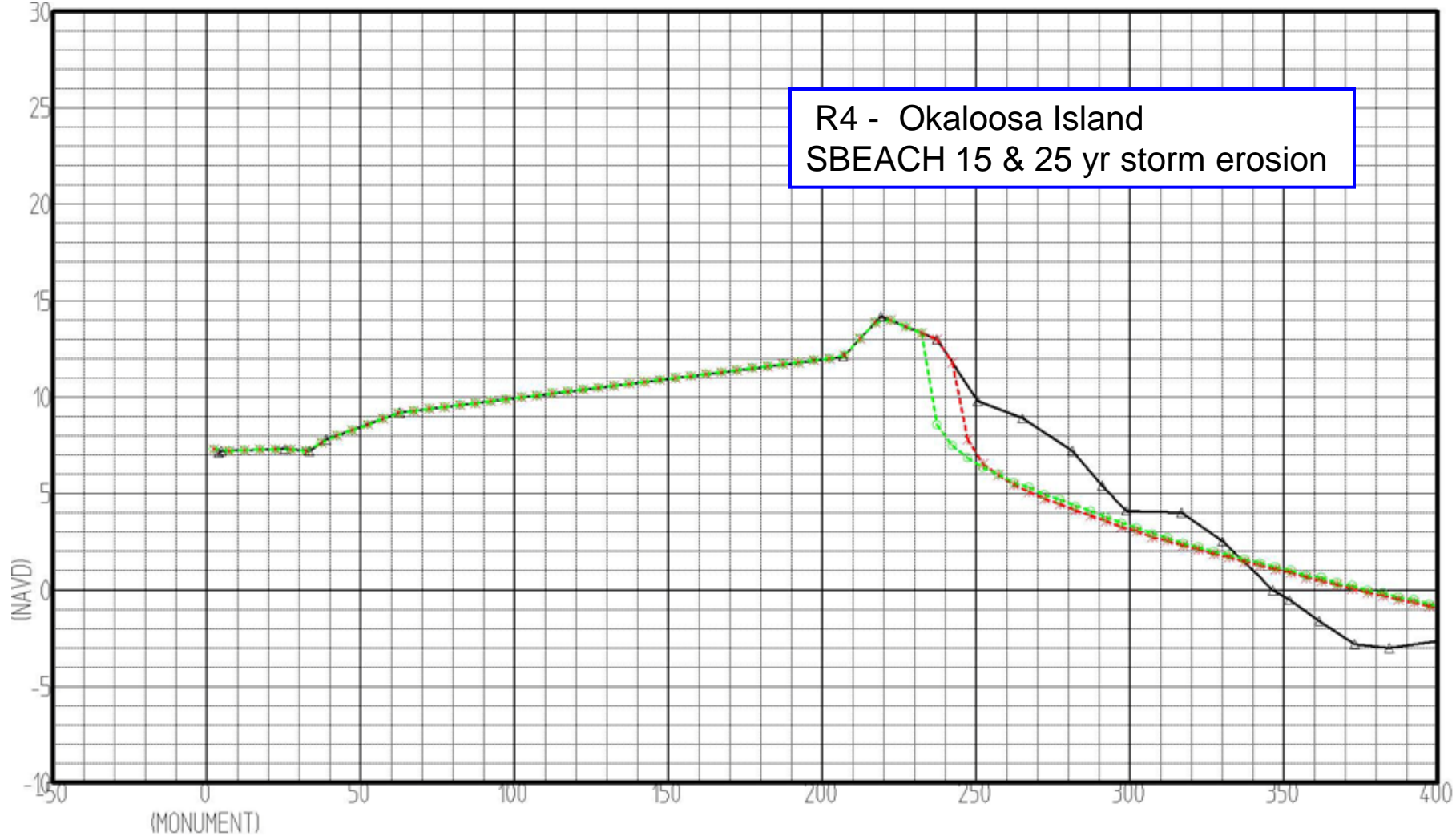
BEARING: 200.00



**SBEACH Erosion Profiles  
for Okaloosa County  
15 & 25 yr. storms – R1 - R50**

**Gulf of Mexico**





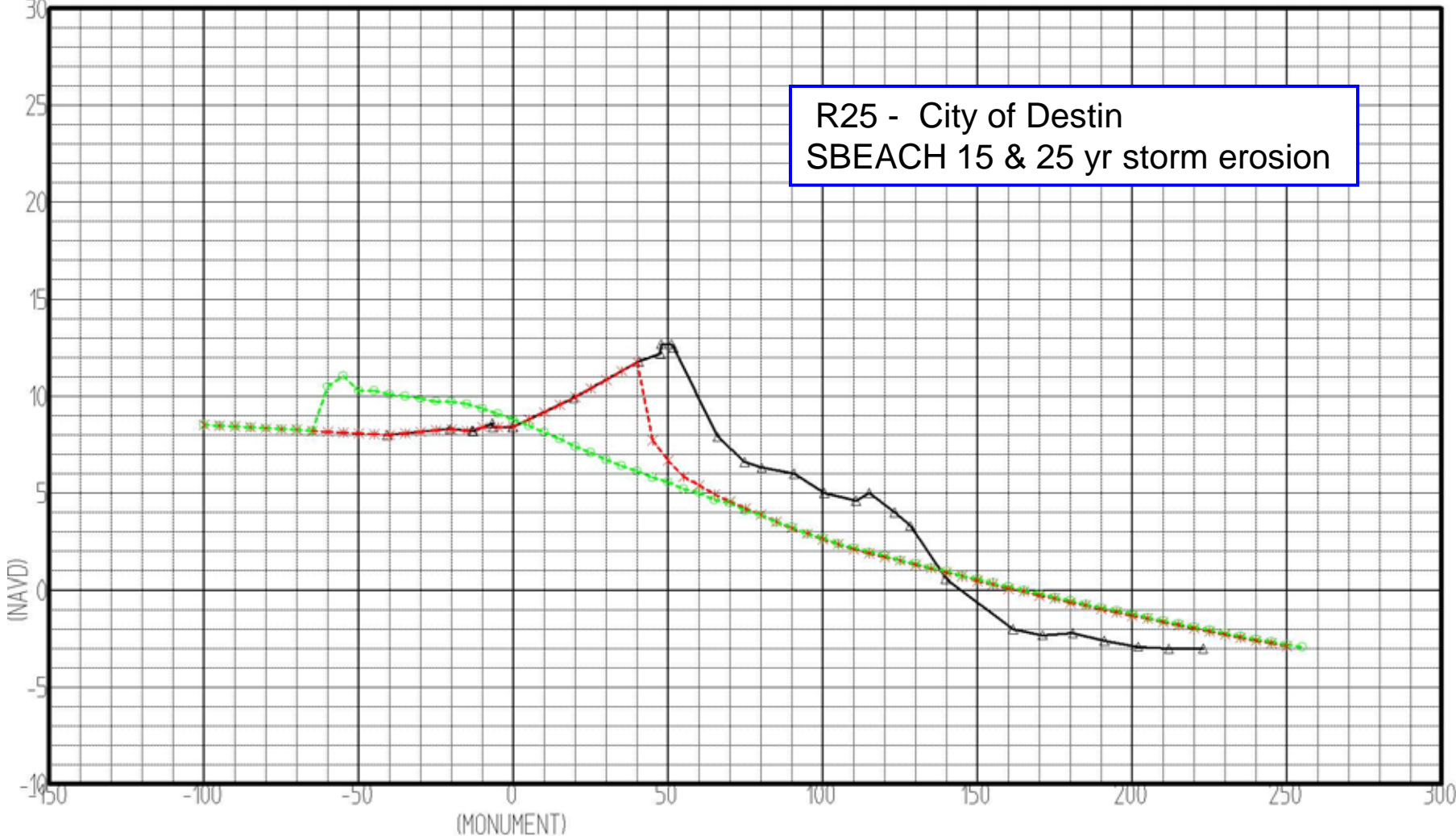
OKALOOSA

BUREAU OF BEACHES & COASTAL SYSTEMS  
FLA. DEPT OF ENVIRONMENTAL PROTECTION

Range: R-4 1/2

BEARING: 180.00

R25 - City of Destin  
 SBEACH 15 & 25 yr storm erosion

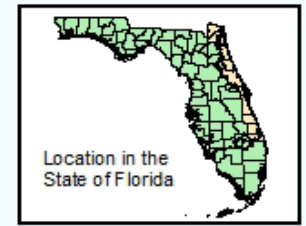


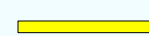
BEACH PROFILE  
 —△—△— OKALOOSA JUNE 2007 PRF  
 - - \* - - SBEACH 15-YR ERODED PRF  
 - - o - - SBEACH 25-YR ERODED PRF

OKALOOSA  
 BUREAU OF BEACHES & COASTAL SYSTEMS  
 FLA. DEPT. OF ENVIRONMENTAL PROTECTION

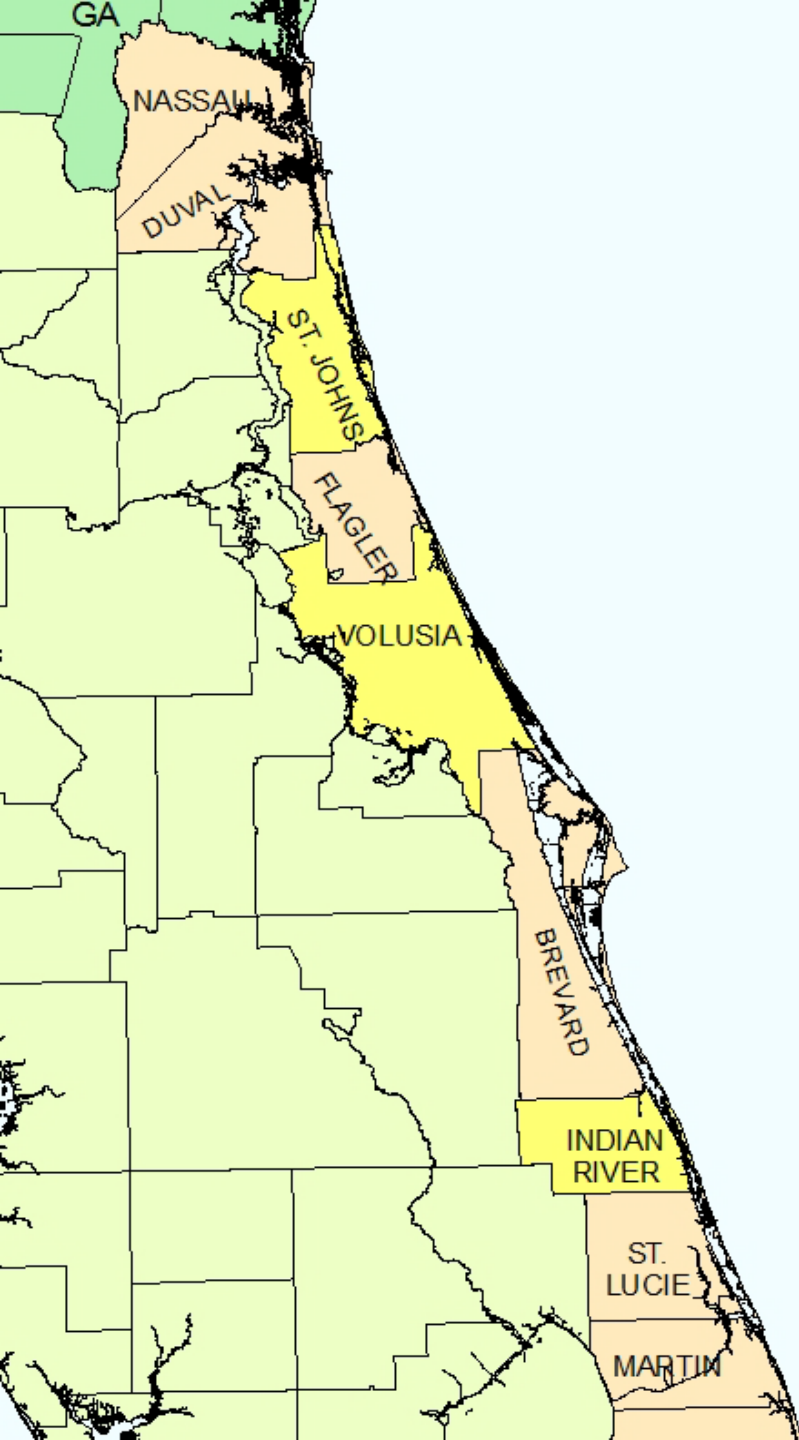
Range: R-25 1/1  
 BEARING: 175.00

# FL NE and Central Atlantic Coast

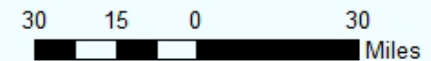


 SBEACH application areas

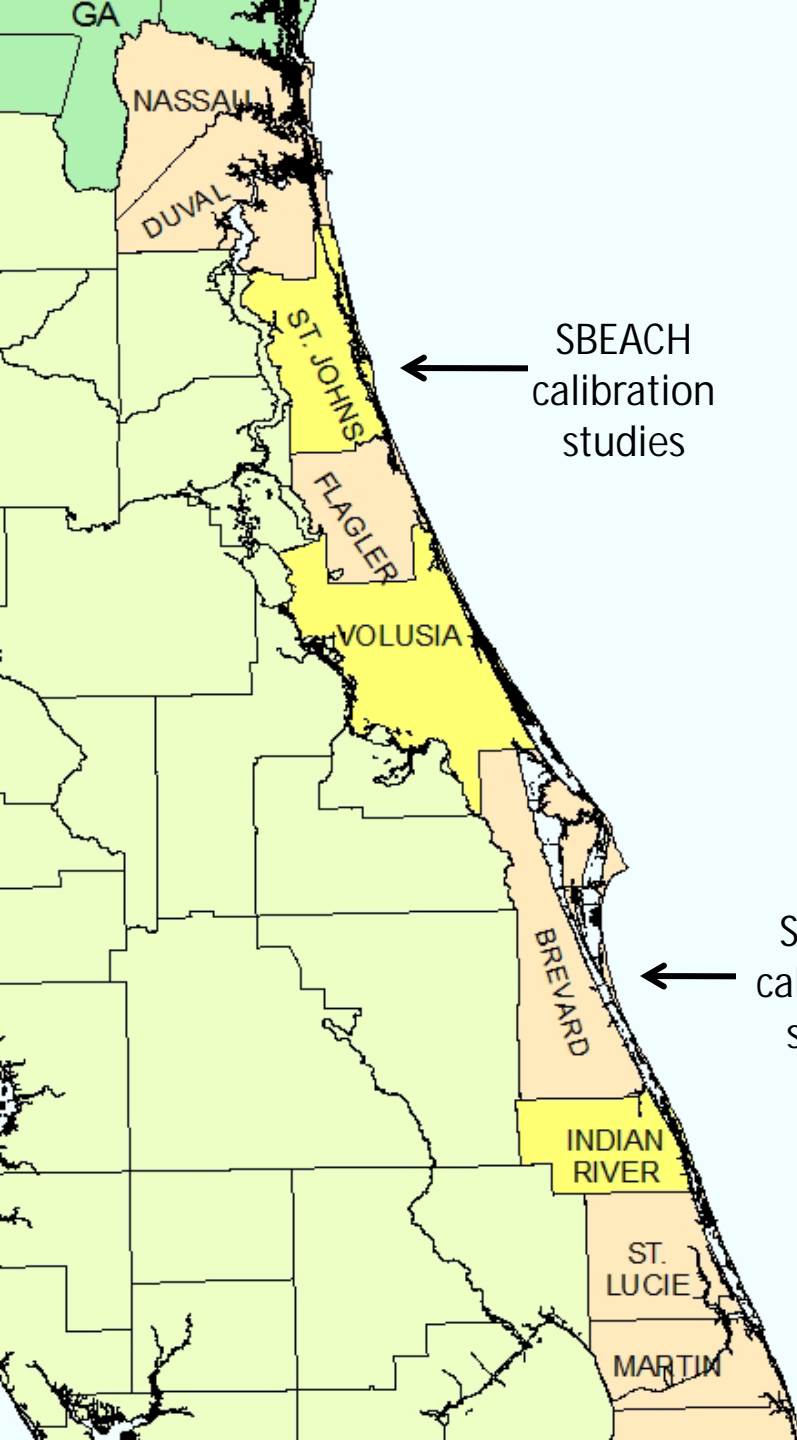
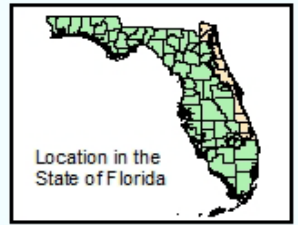
Areas for Calibrated  
SBEACH Model Simulations  
of High-Frequency Storms



ATLANTIC  
OCEAN



# FL NE and Central Atlantic Coast



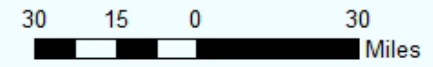
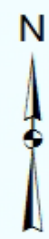
SBEACH calibration studies

SBEACH calibration studies

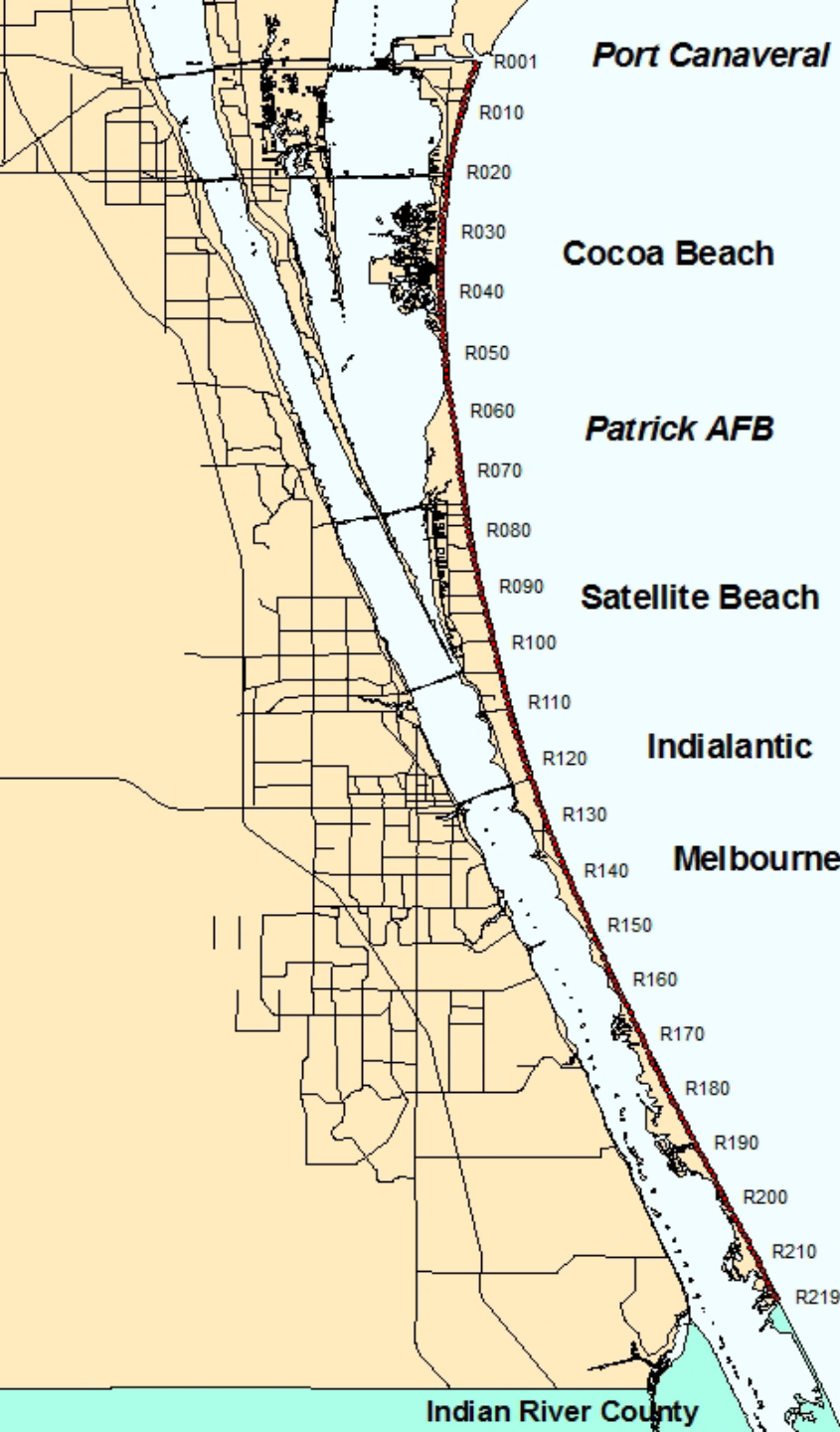
— SBEACH application areas

Areas for Calibrated SBEACH Model Simulations of High-Frequency Storms

ATLANTIC OCEAN







R001 **Port Canaveral**

R010

R020

R030

**Cocoa Beach**

R040

R050

R060

**Patrick AFB**

R070

R080

R090

**Satellite Beach**

R100

R110

R120

**Indialantic**

R130

R140

**Melbourne Beach**

R150

R160

R170

R180

R190

R200

R210

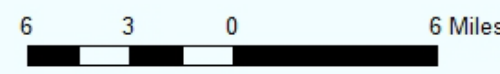
R219

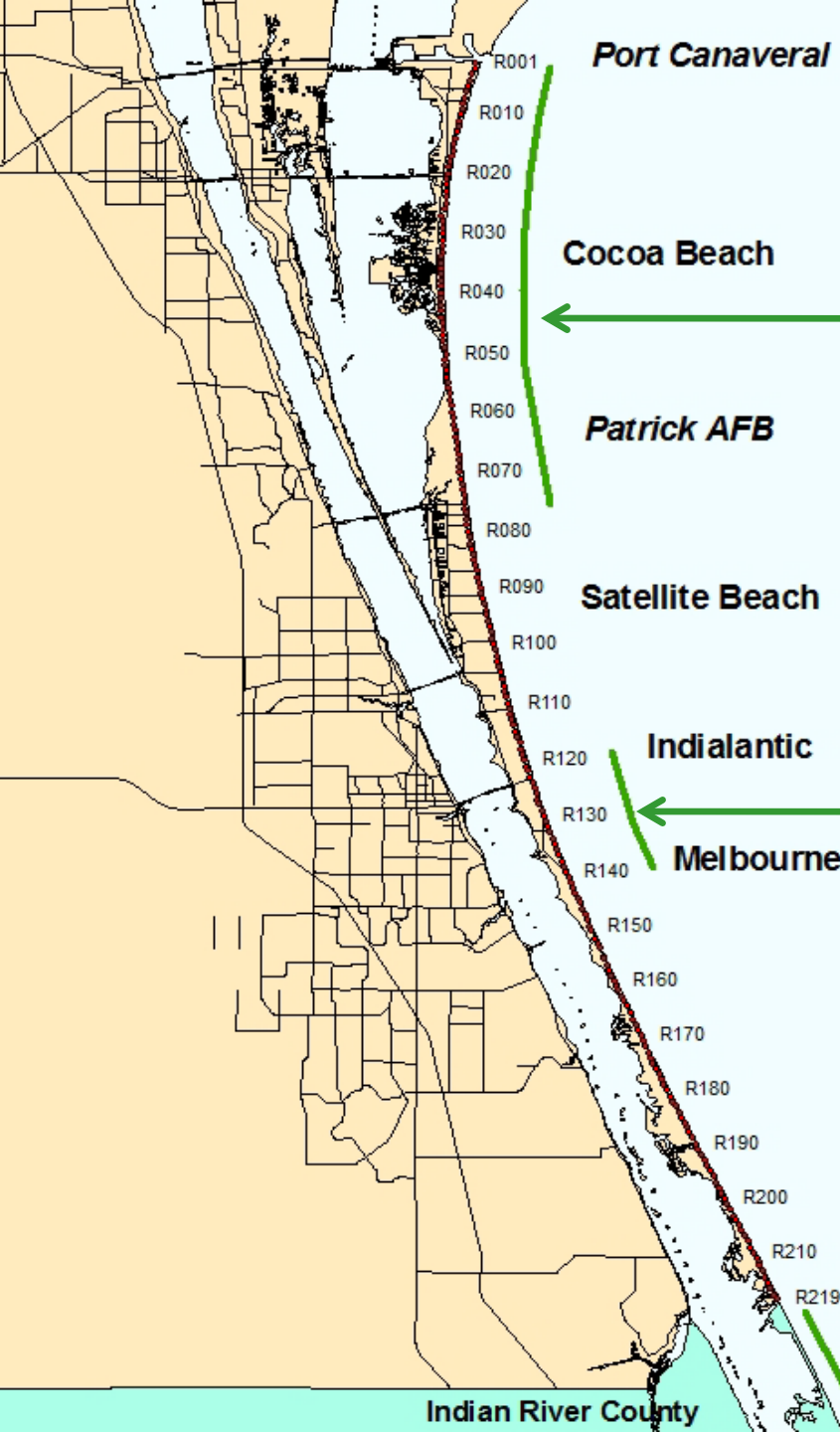
**Sebastian Inlet**

**Indian River County**

**Brevard  
County**

**Atlantic  
Ocean**





# Brevard County

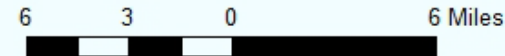
Beach Nourishment

Atlantic Ocean

South Reach Fill Area

Sebastian Inlet

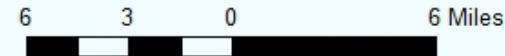
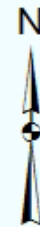
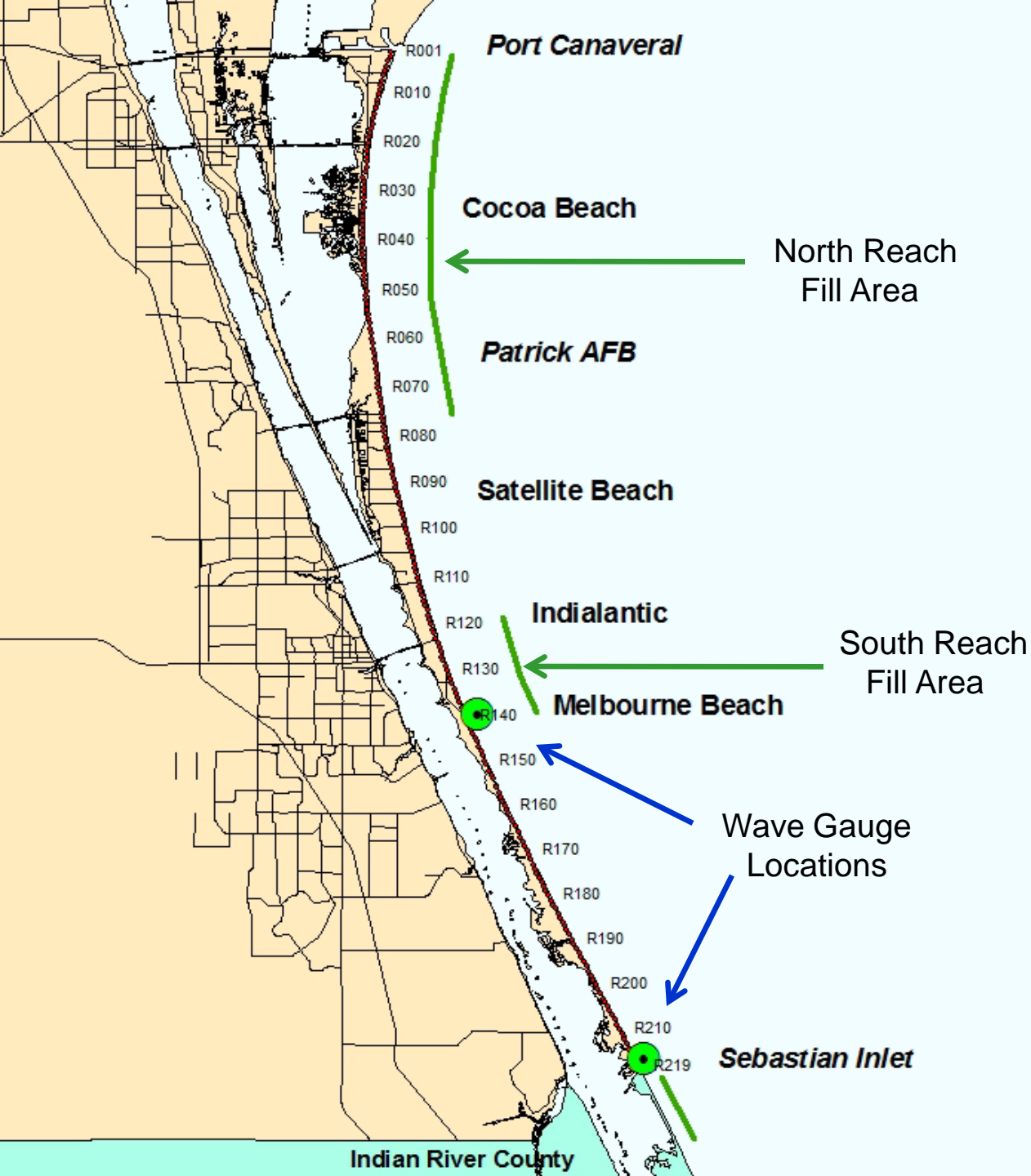
Indian River County




# Brevard County

- Wave Gauge Locations
- Beach Nourishment

Atlantic Ocean

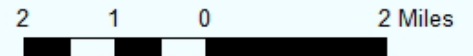
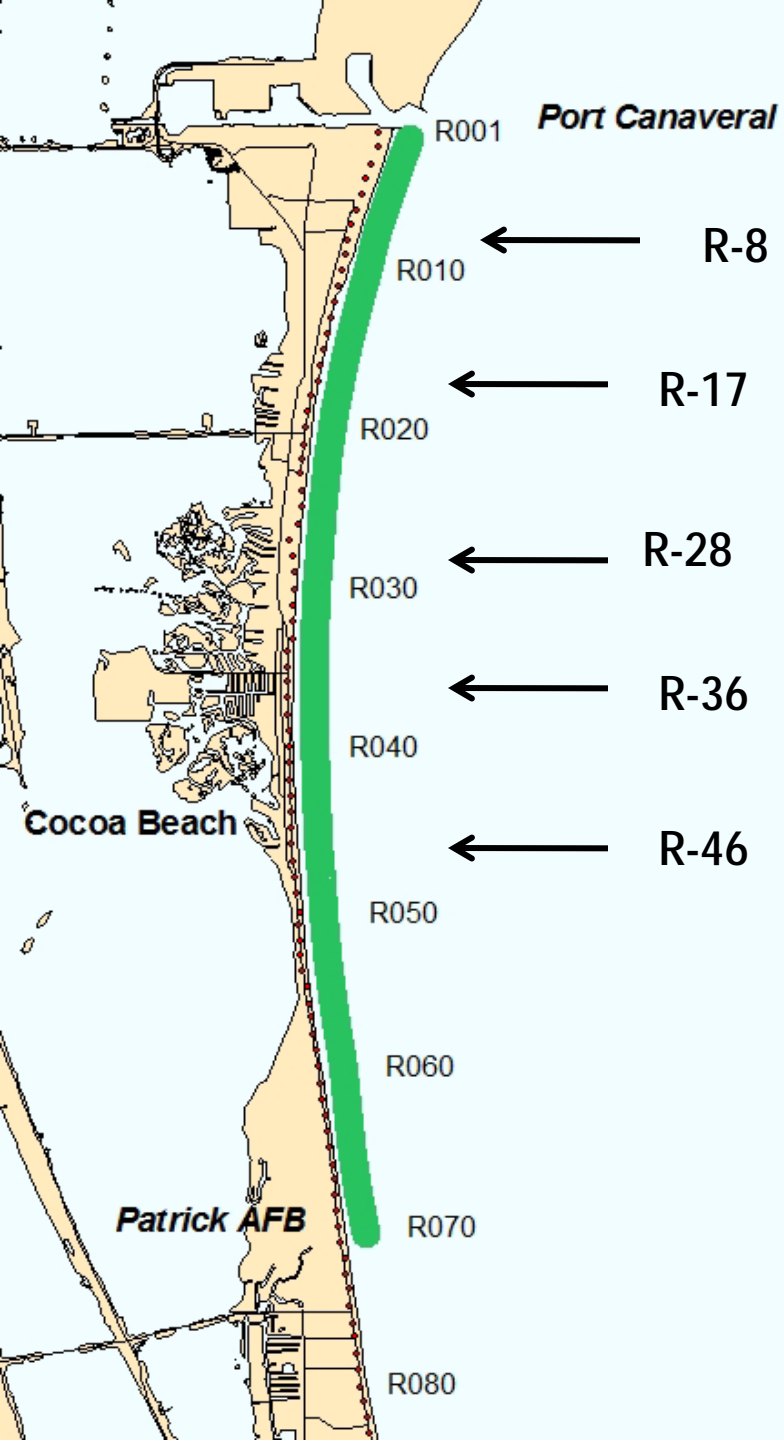


# Brevard County

North Reach Beach Nourishment 

SBEACH Calibration Profile Locations

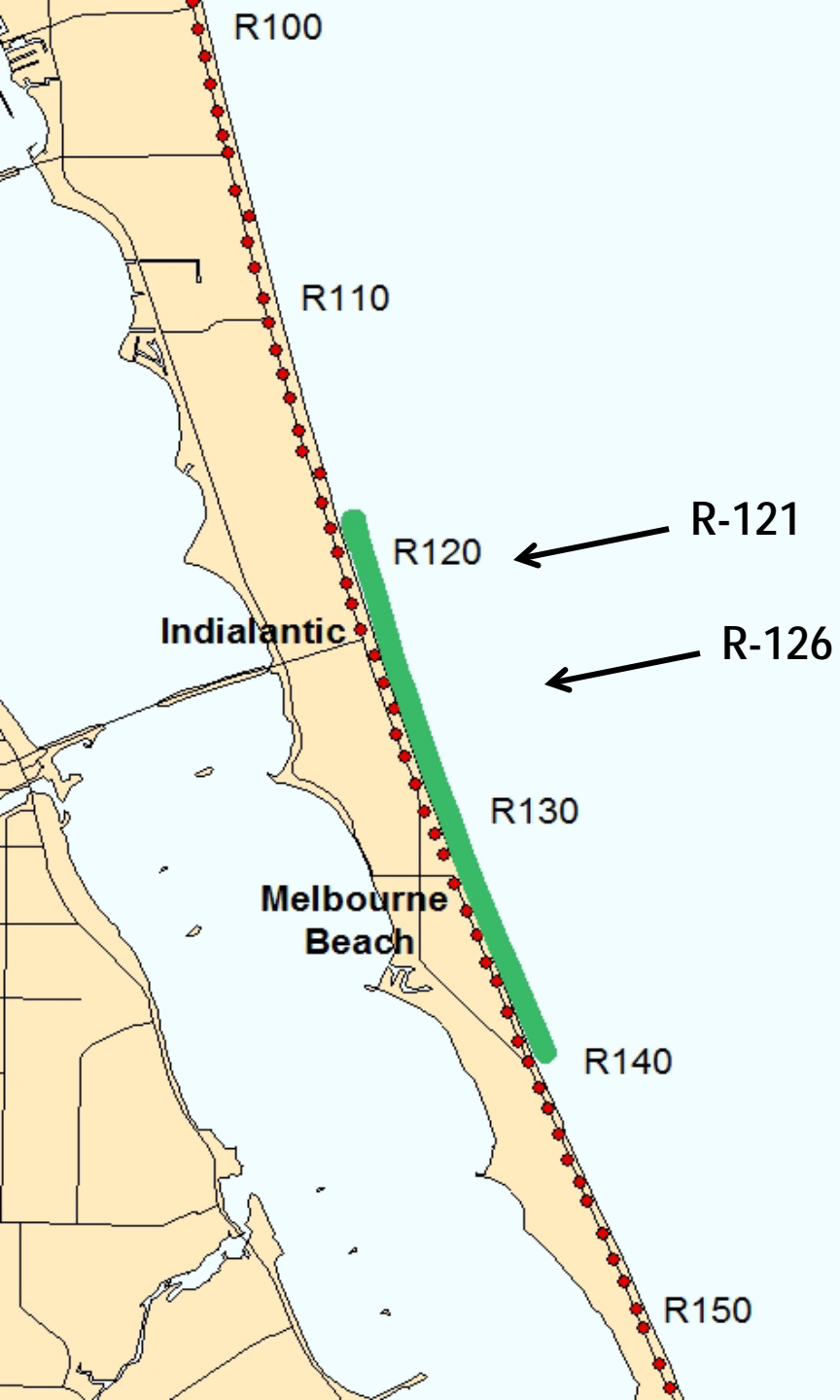
Atlantic Ocean



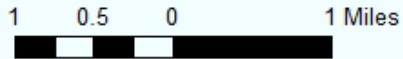
# Brevard County

South Reach  
Beach Nourishment 



SBEACH Calibration  
Profile Locations



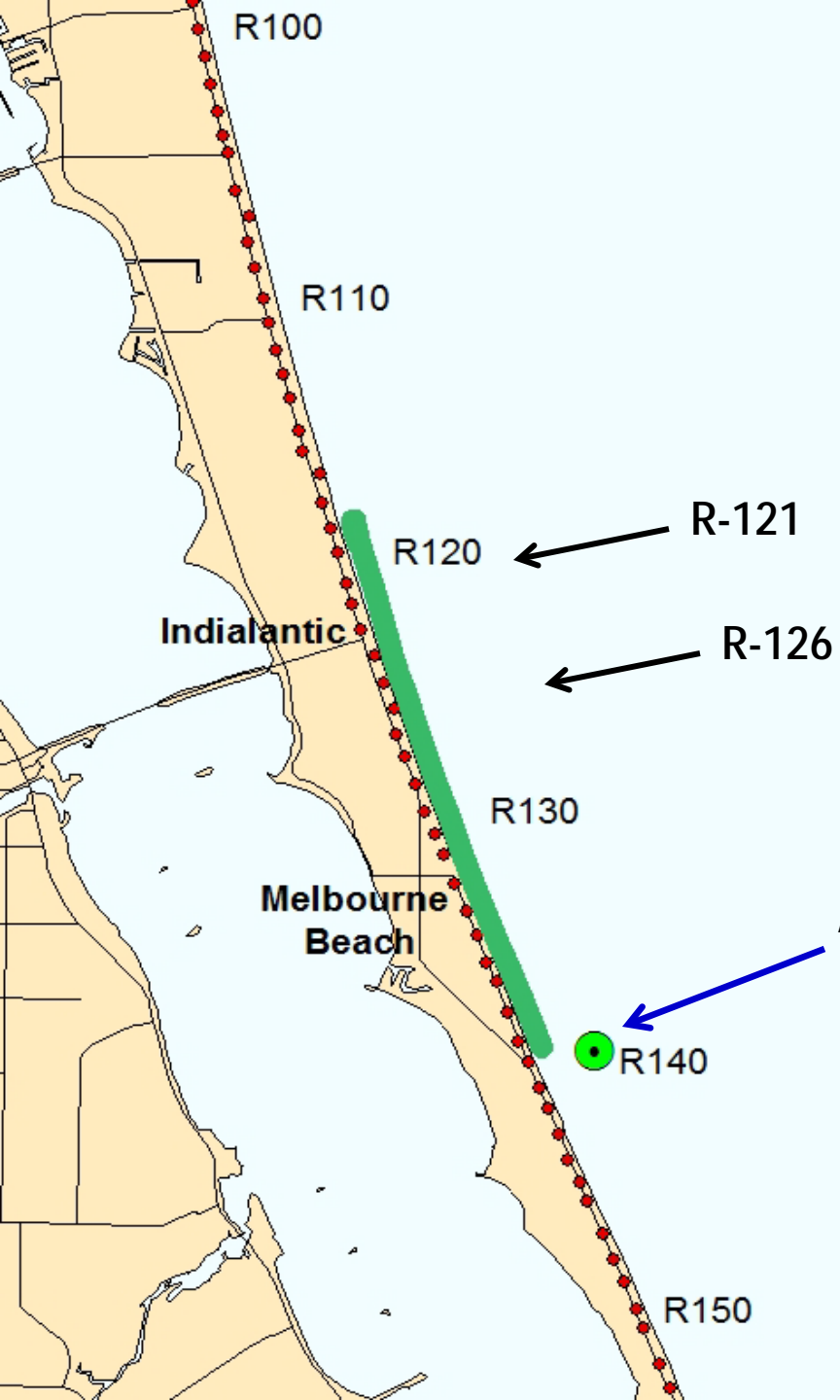
*Atlantic Ocean*



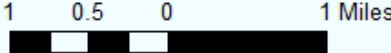
# Brevard County

-  South Reach Beach Nourishment
-  Wave Gauge

SBEACH Calibration Profile Locations



Atlantic Ocean

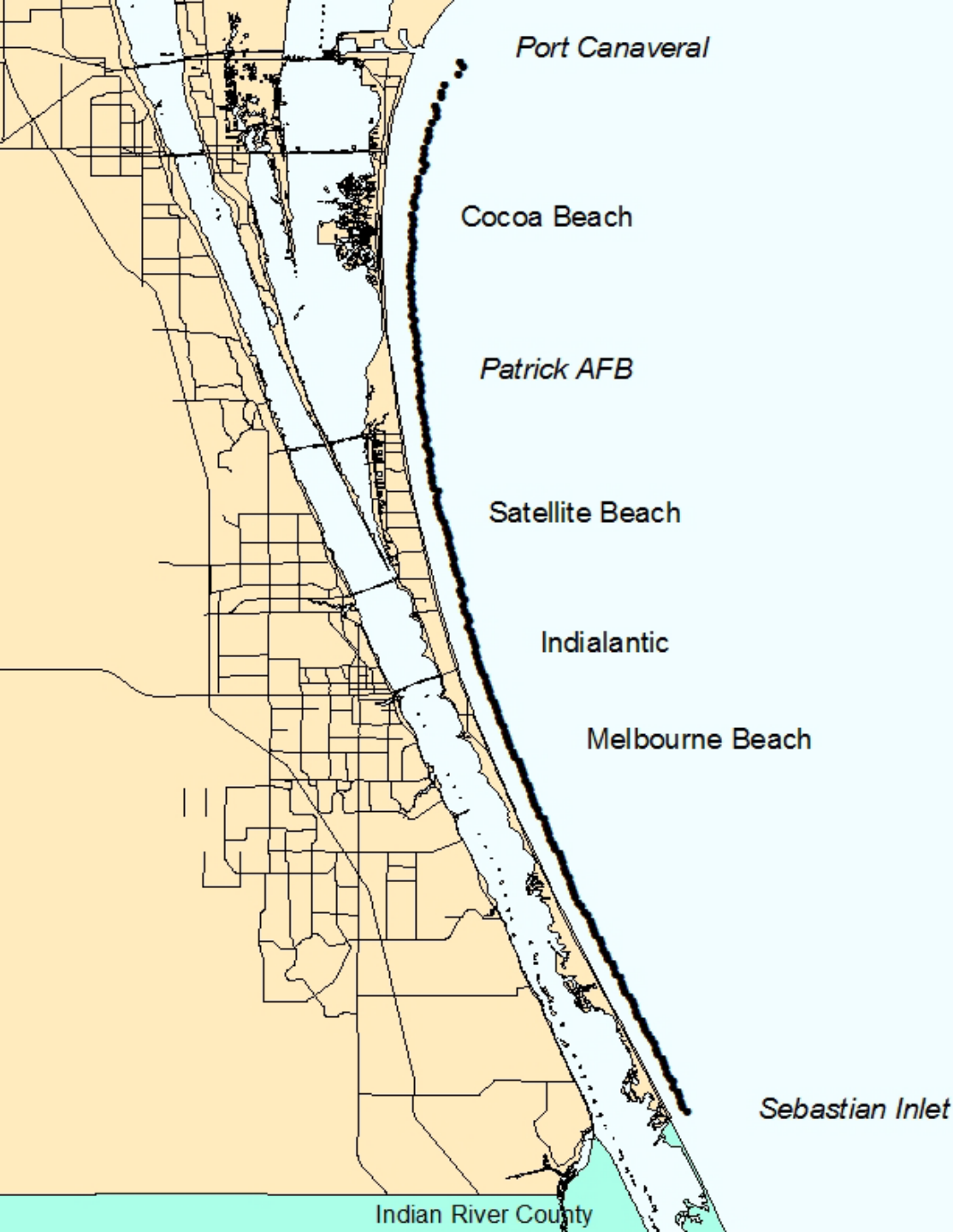
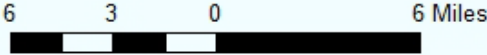


# Brevard County

● BE Co. Synthetic  
Wave Record (SWR)

Synthetic Wave Record  
200 Stations in  
Brevard County

Atlantic  
Ocean

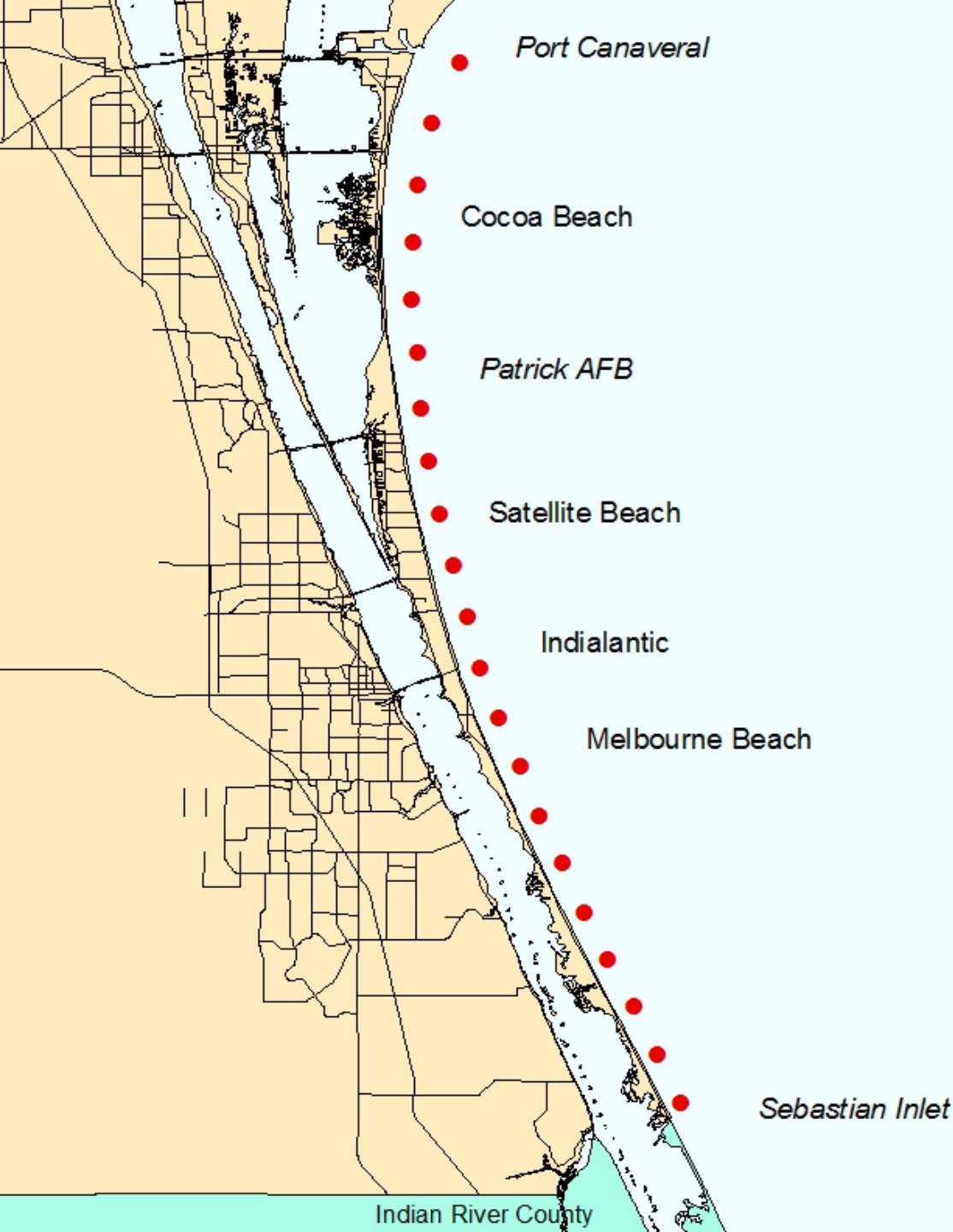
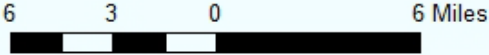


# Brevard County

● BE Co. Synthetic  
Wave Record (SWR) -  
Every 10th Station

Synthetic Wave Record  
200 Stations in  
Brevard County

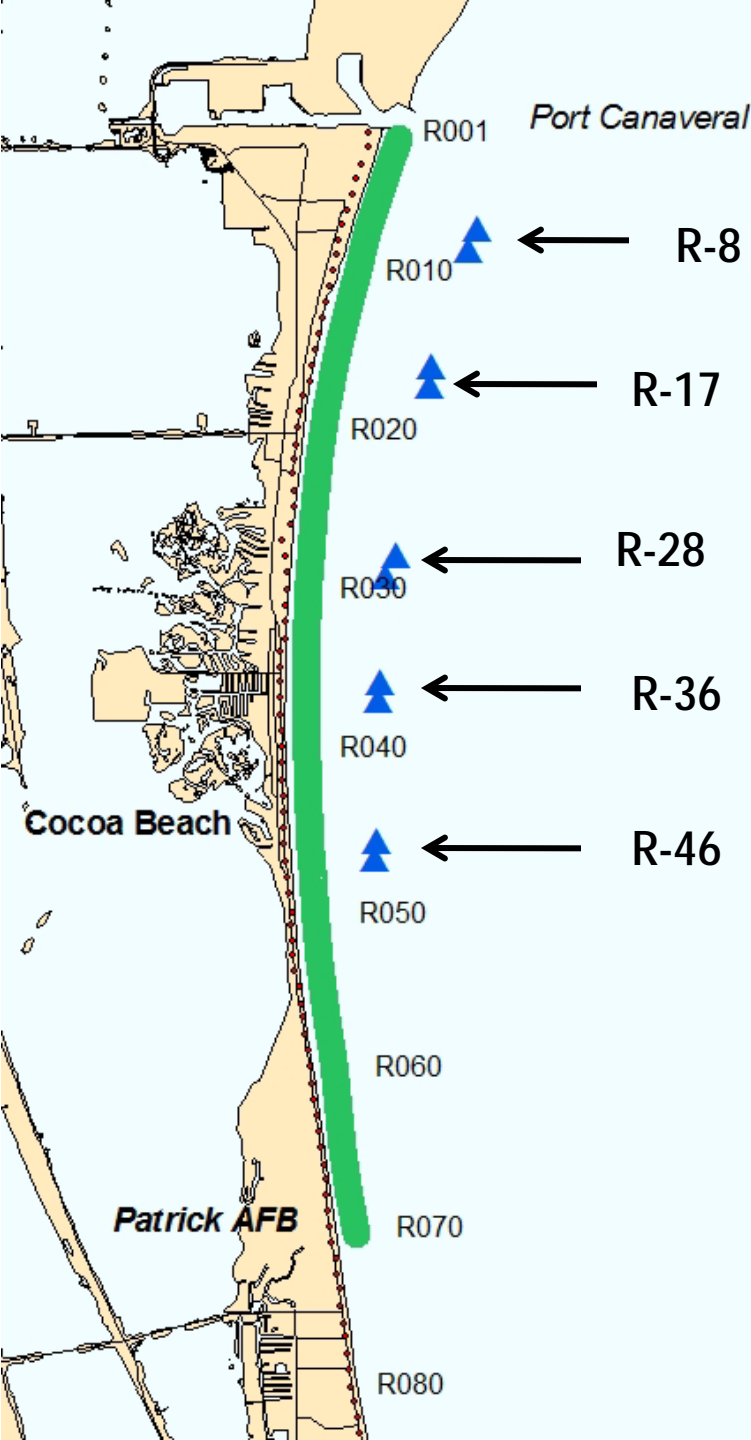
Atlantic  
Ocean



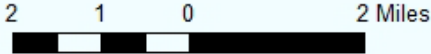
# Brevard County

- North Reach Beach Nourishment
- BE Co. Synthetic Wave Record (SWR)

SBEACH Calibration Profile Locations



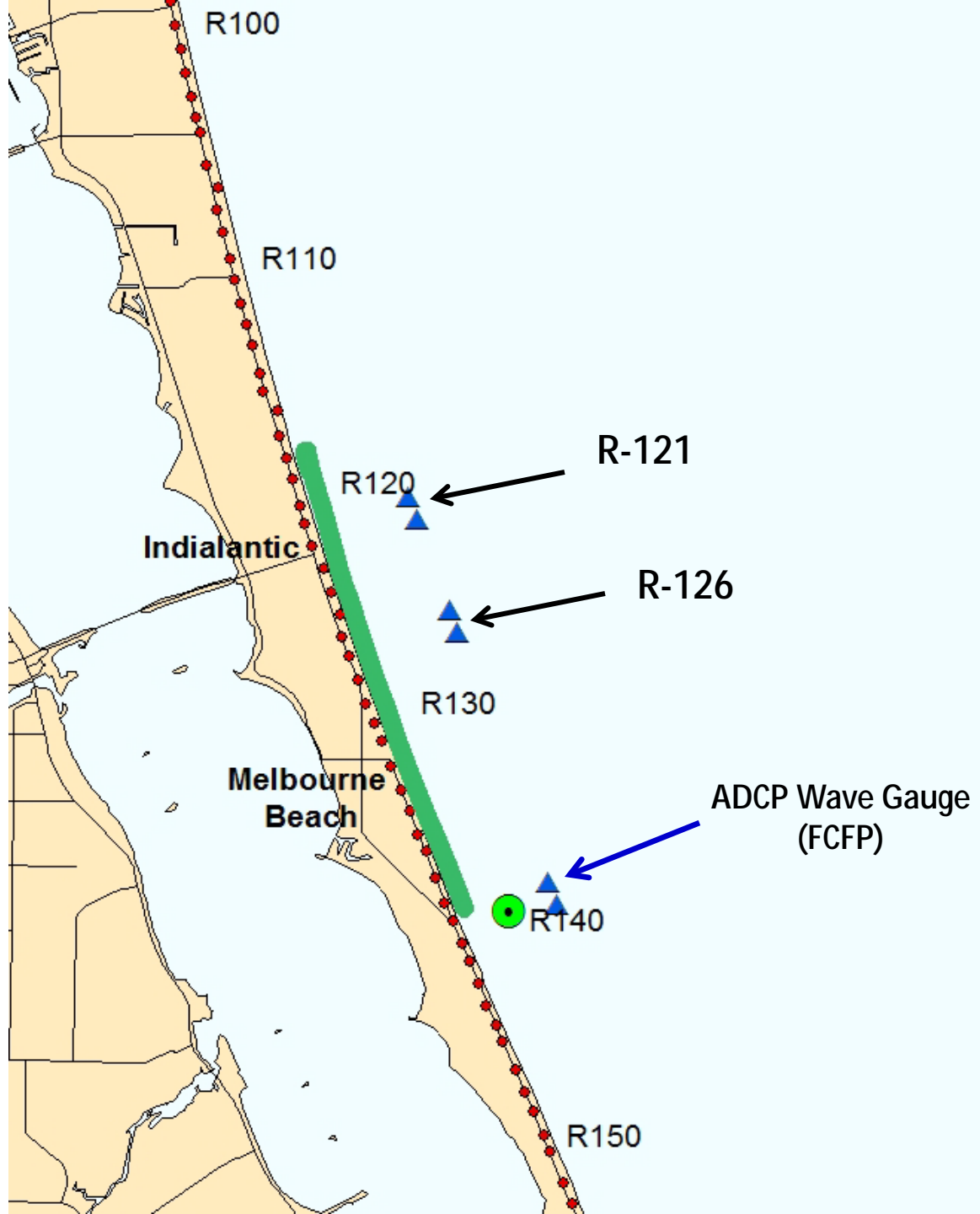
Atlantic Ocean



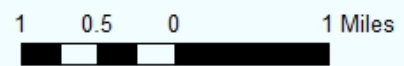
# Brevard County

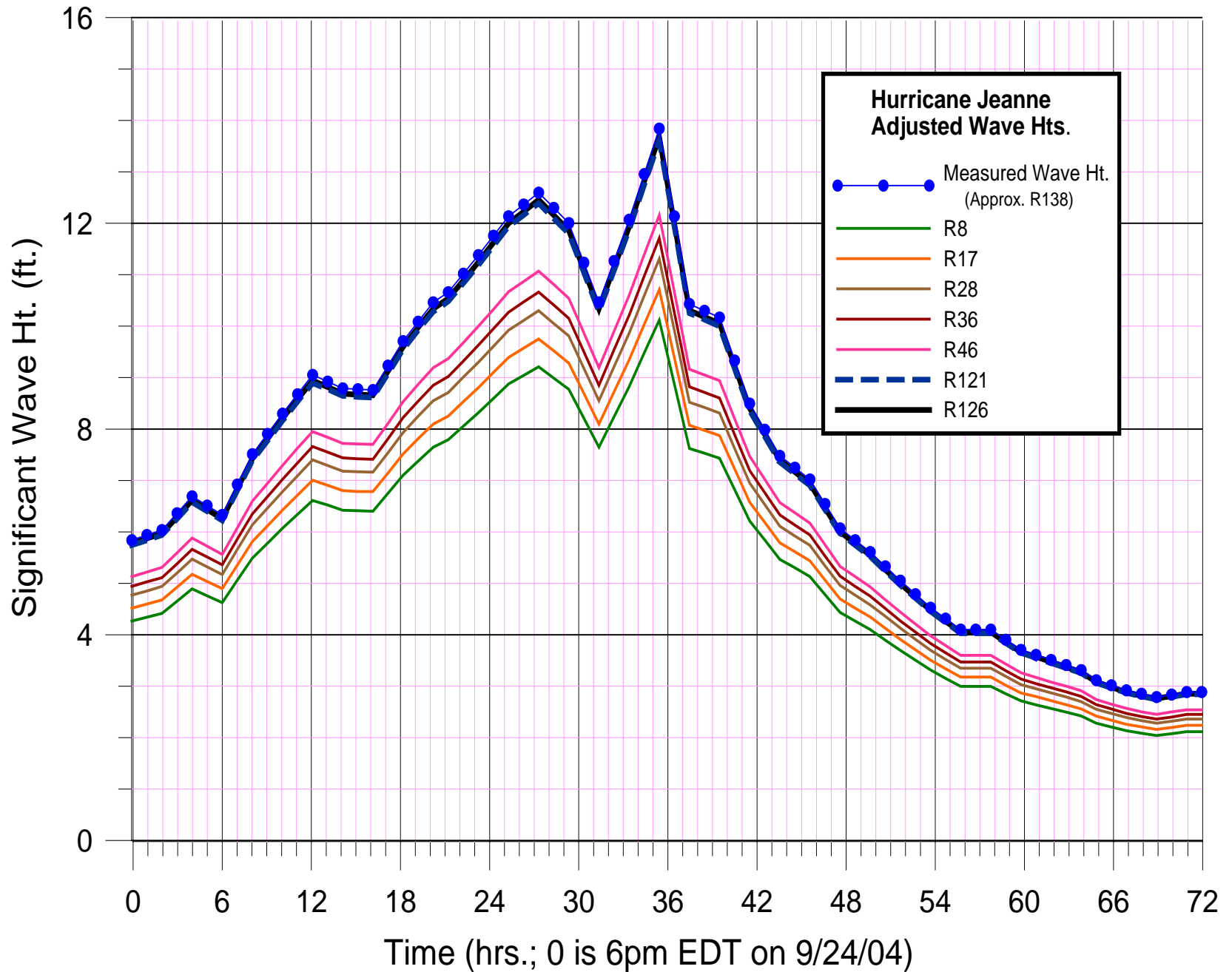
- South Reach Beach Nourishment
- Wave Gauge
- BE Co. Synthetic Wave Record (SWR)

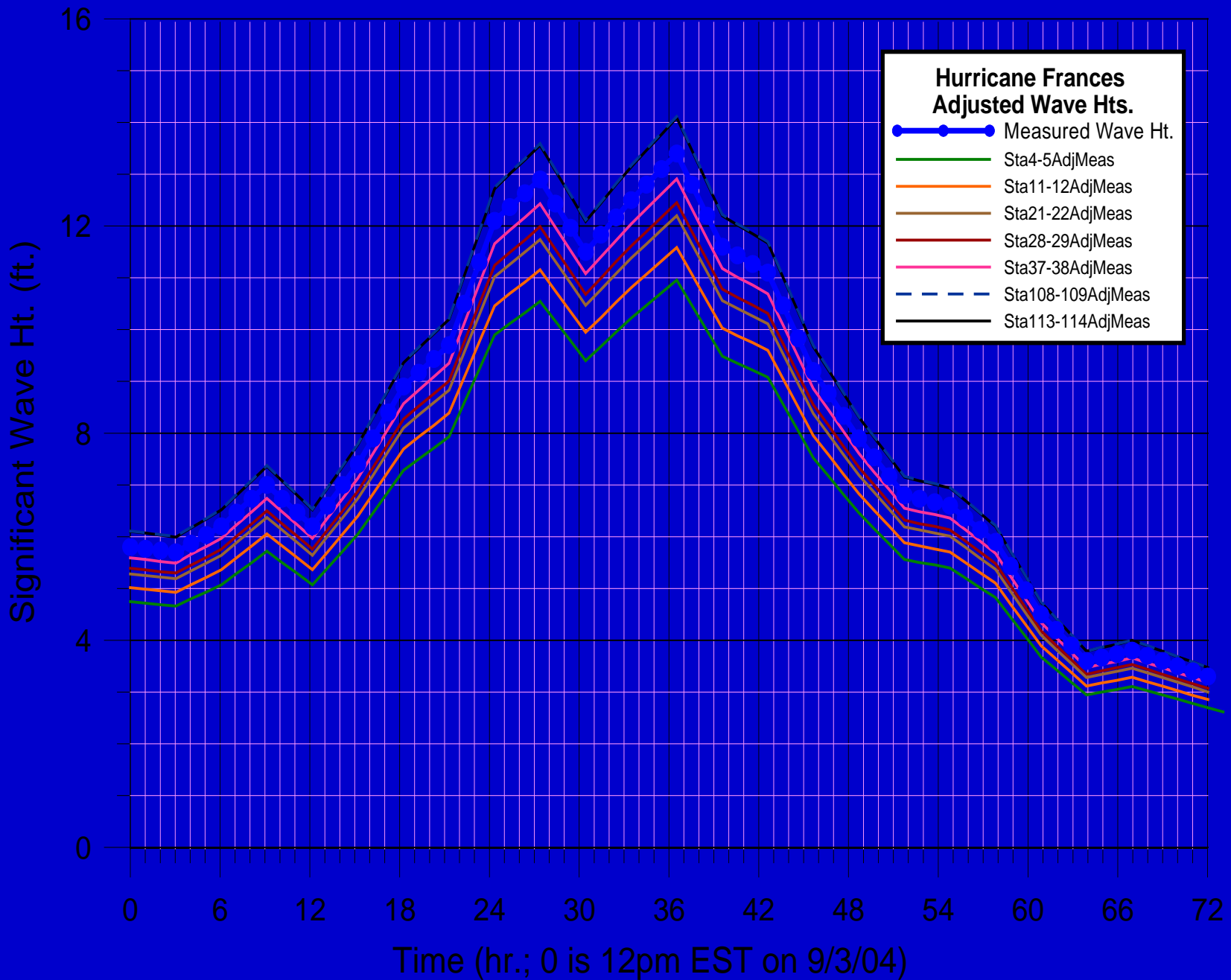
SBEACH Calibration Profile Locations



Atlantic Ocean







# Summary and Conclusions

## Phase I work:

- Ø SBEACH calibration work completed in western Bay County for Hurricanes Ivan and Opal
- Ø Calibration results for SBEACH for Hurricane Ivan support use of SBEACH for HF storm erosion in WL, OK, and BA counties
- Ø Recommended SBEACH input parameters identified for SBEACH model erosion simulation for Walton and Okaloosa counties for HF storm events
- Ø SBEACH output and erosion profiles for 15 and 25-yr storm events completed for Walton and Okaloosa counties

## Phase II work:

- Ø SBEACH calibration work completed in Brevard County for Hurricanes Frances and Jeanne
- Ø SBEACH calibration for HF storm erosion in BE Co. looks favorable

A tropical beach scene with turquoise water, a white sailboat on the horizon, and a sandy shore in the foreground. The sky is a deep blue with scattered white clouds. The word "End" is written in white text in the center of the image.

End