

Functional Resiliency at the Castillo de San Marcos: Integrating Statistical Flood Risk Analysis with Historic Preservation Design



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Introductions & Project Approach





Project Purpose & Need

- Purpose: To repair and rehabilitate the seawall's historical functionality to protect and preserve the NPS historic and cultural resources.
- Need: To address structural integrity issues at the seawall, including effects of aging, erosion, storm damage and flooding, as well as mitigate the impacts of sea level rise by raising the seawalls.



PURPOSE AND NEED

Purpose is to repair and rehabilitate the seawall along the shoreline

Address deteriorating structural integrity issues and improve seawall's resilience

Mitigate risks and preserve historical significance

Need to protect seawalls from continued degradation

Need to raise the elevation of the seawalls to provide protection to the site



Coastal Hazards

- The seawall elevations at the Fort result in overtopping and flooding during high water level and storm events.
- This allows flood waters to inundate the Historic District of St. Augustine, as seen during several recent storm events.
- The low elevation and deterioration of the aged seawalls will be addressed as part of this project.





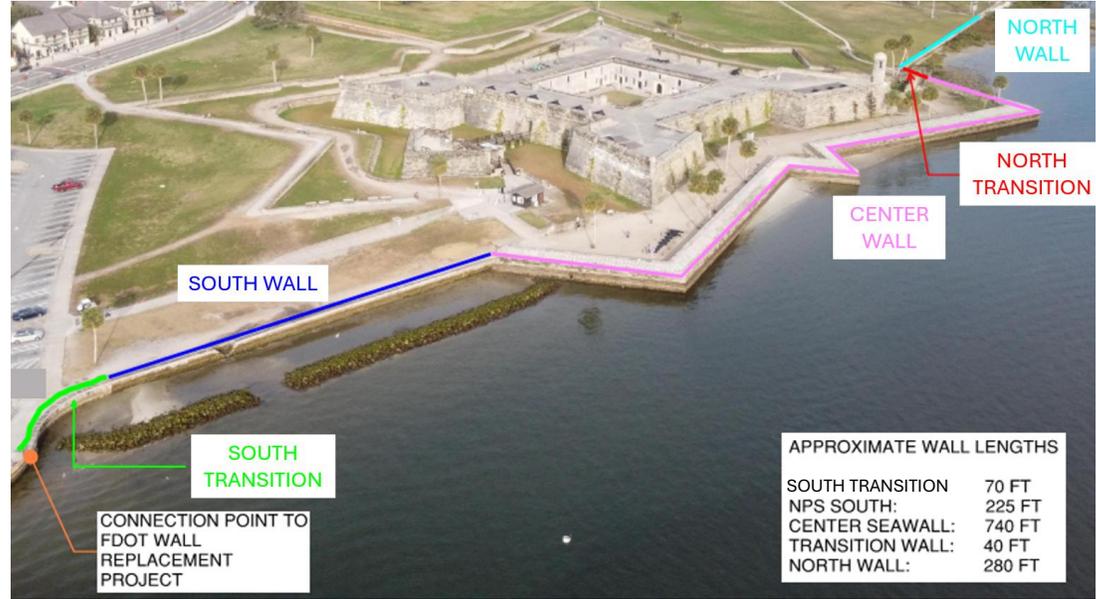
Seawall Conditions & Design Approach





Project Overview – Historic Wall Sections

South Transition



North Wall



South Wall



Center Wall



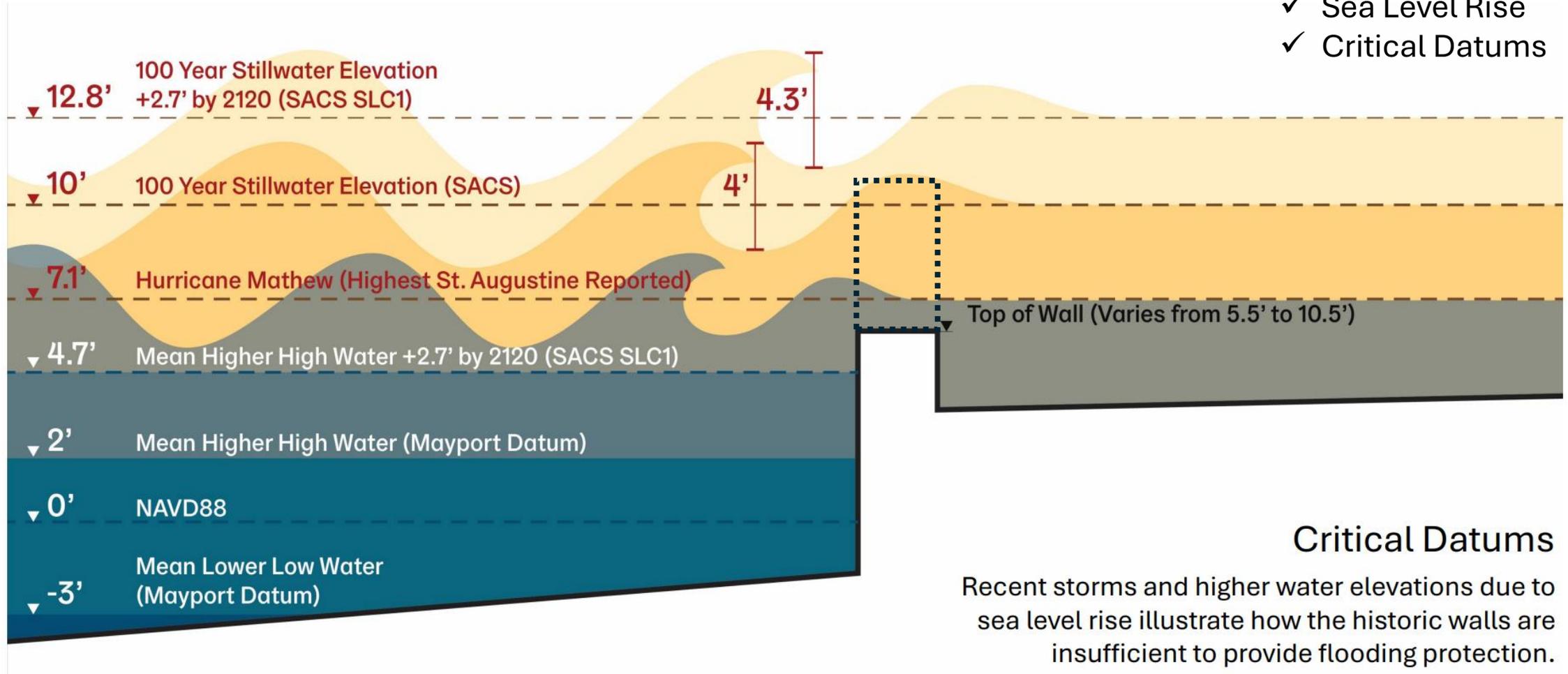
North Transition

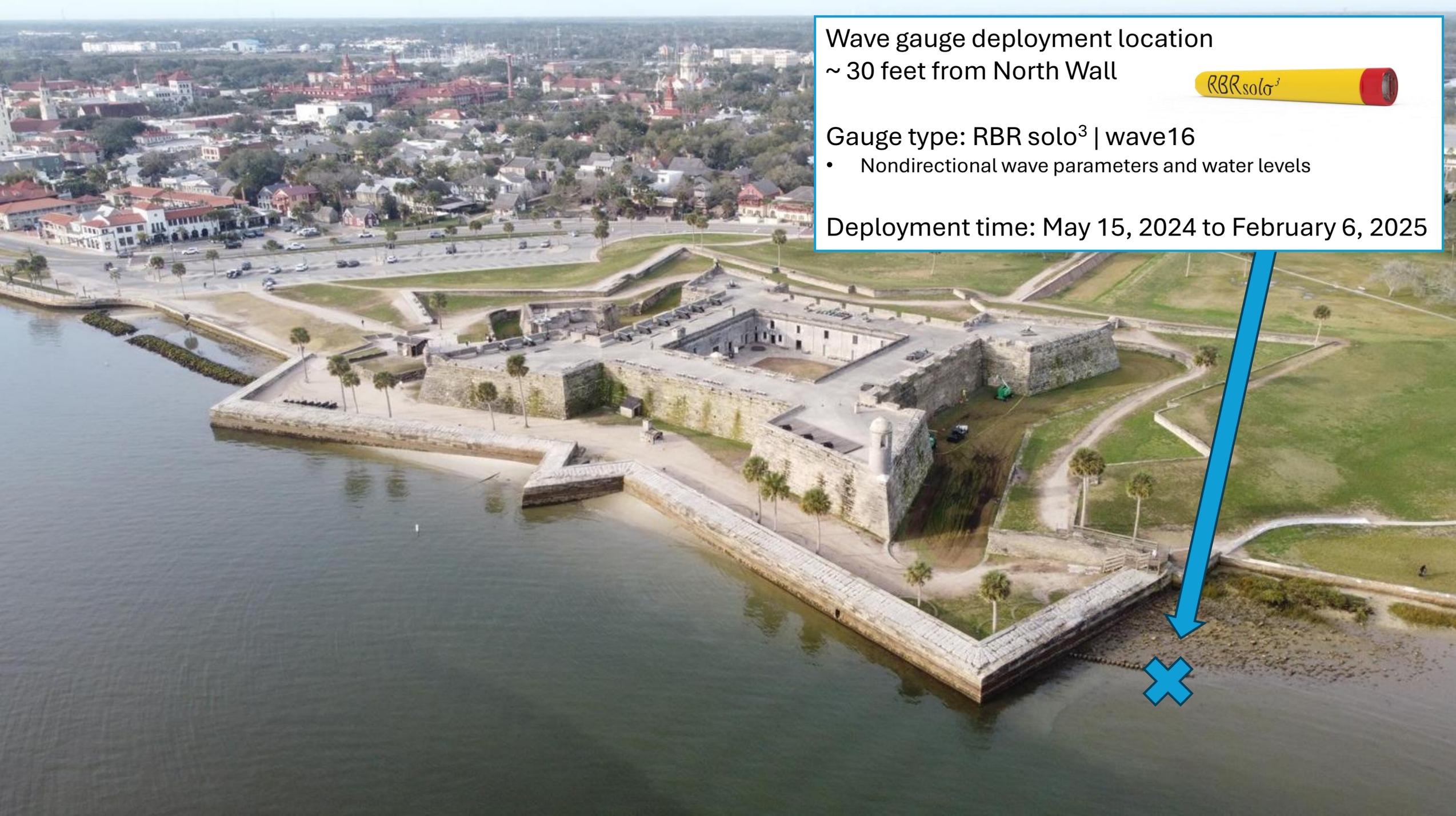




Resiliency & Rehabilitation

- ✓ Tides
- ✓ Storm Surge
- ✓ Sea Level Rise
- ✓ Critical Datums





Wave gauge deployment location

~ 30 feet from North Wall

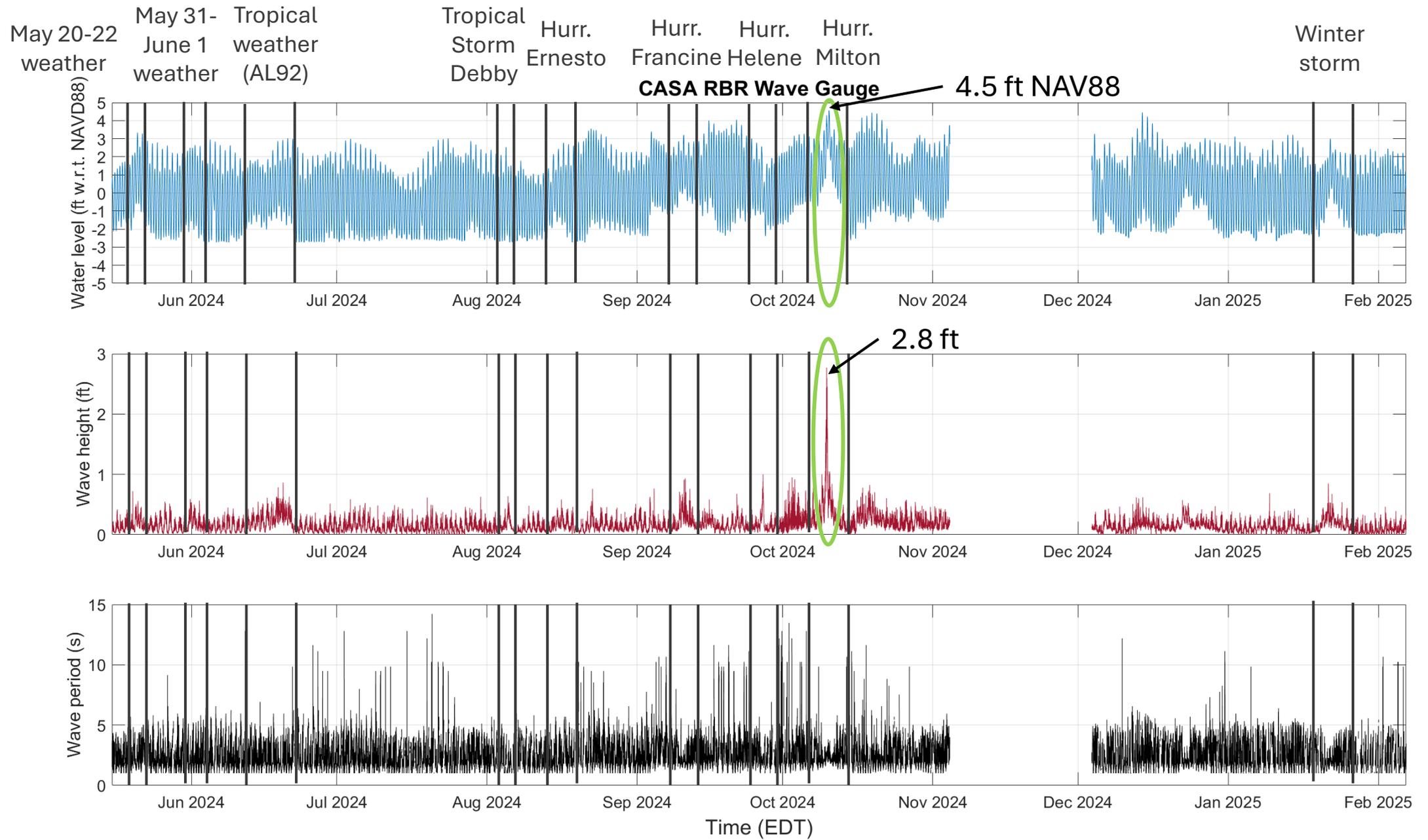


Gauge type: RBR solo³ | wave16

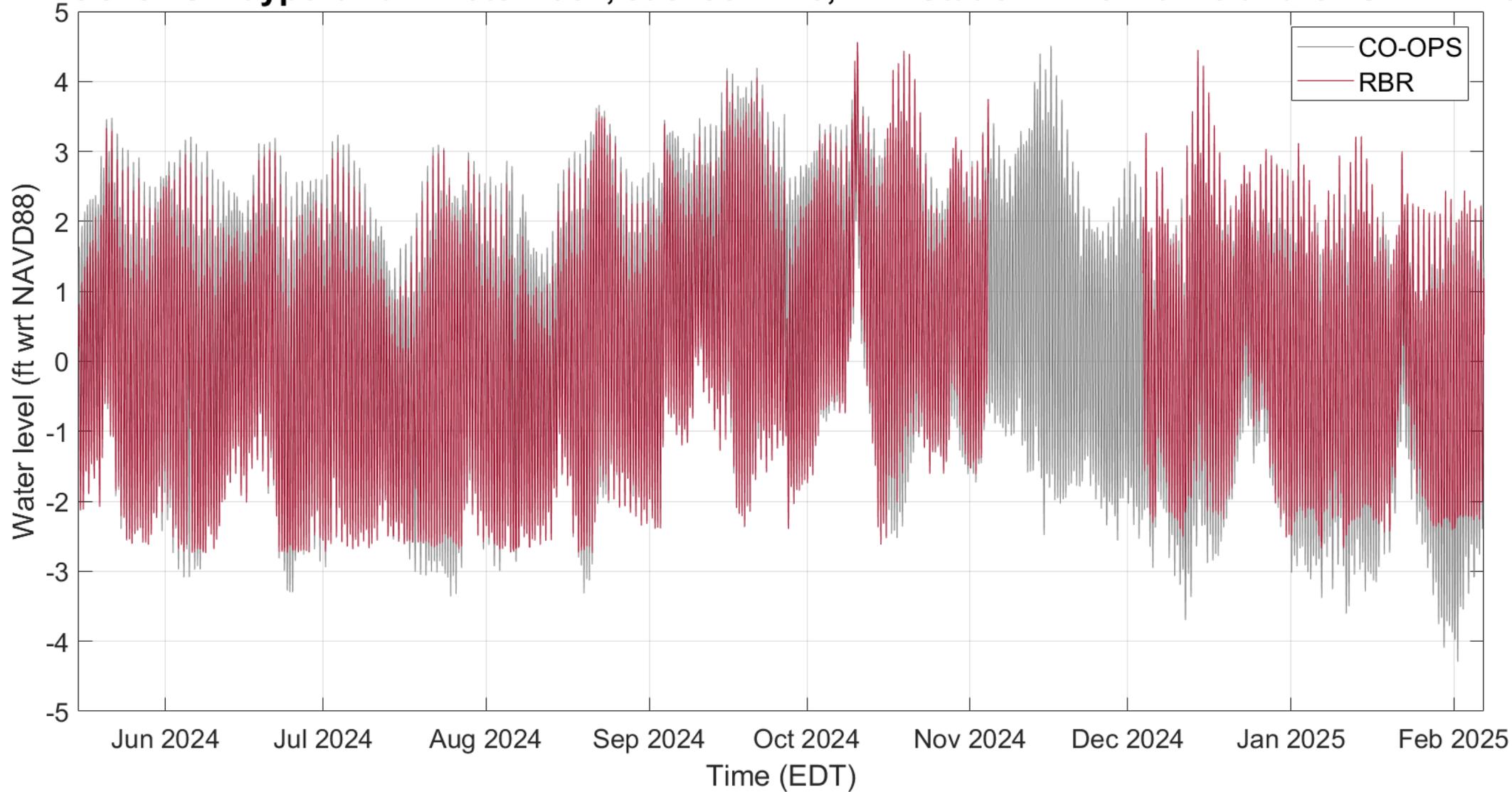
- Nondirectional wave parameters and water levels

Deployment time: May 15, 2024 to February 6, 2025





NOAA CO-OPS Mayport Bar Pilots Dock, Jacksonville, FL - Station ID: 8720218 and CASA RBR Gauge



Hurricane Milton site flooding

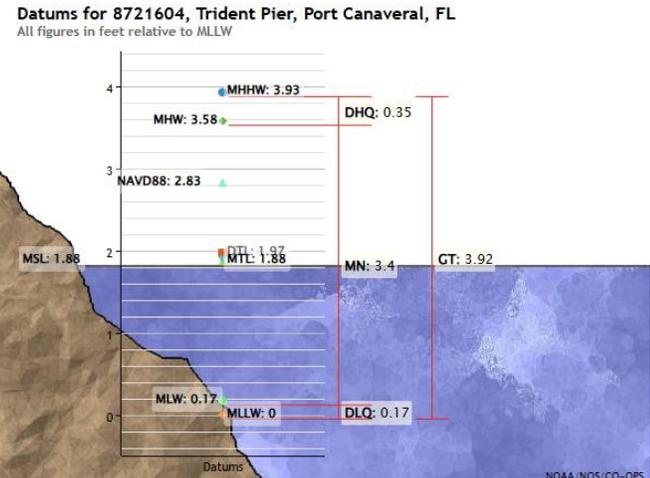
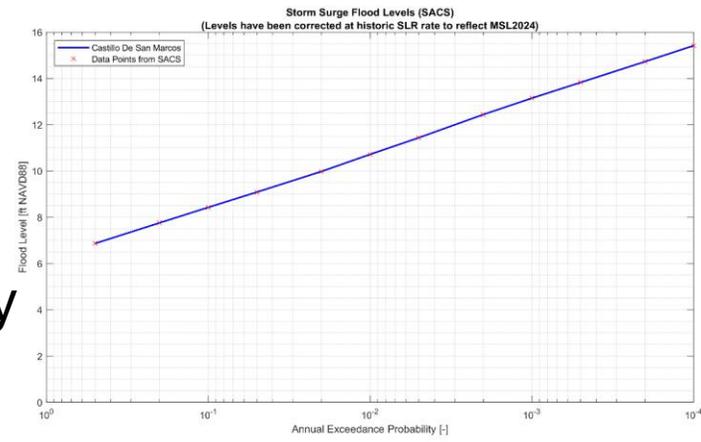
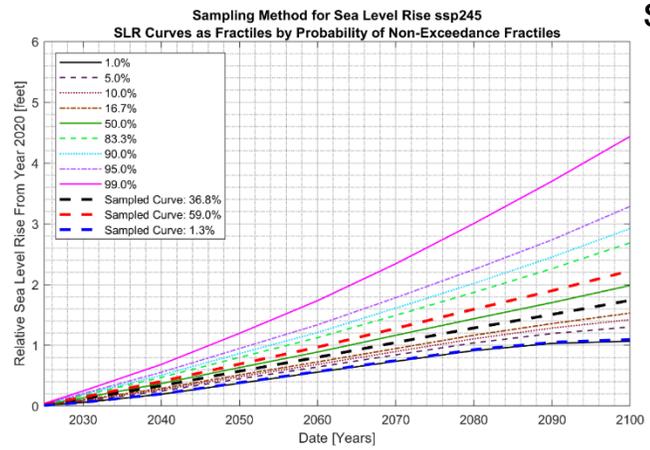


Monte Carlo
Method:

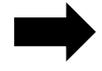
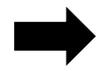
SLR
probability

Storm
Surge
probability

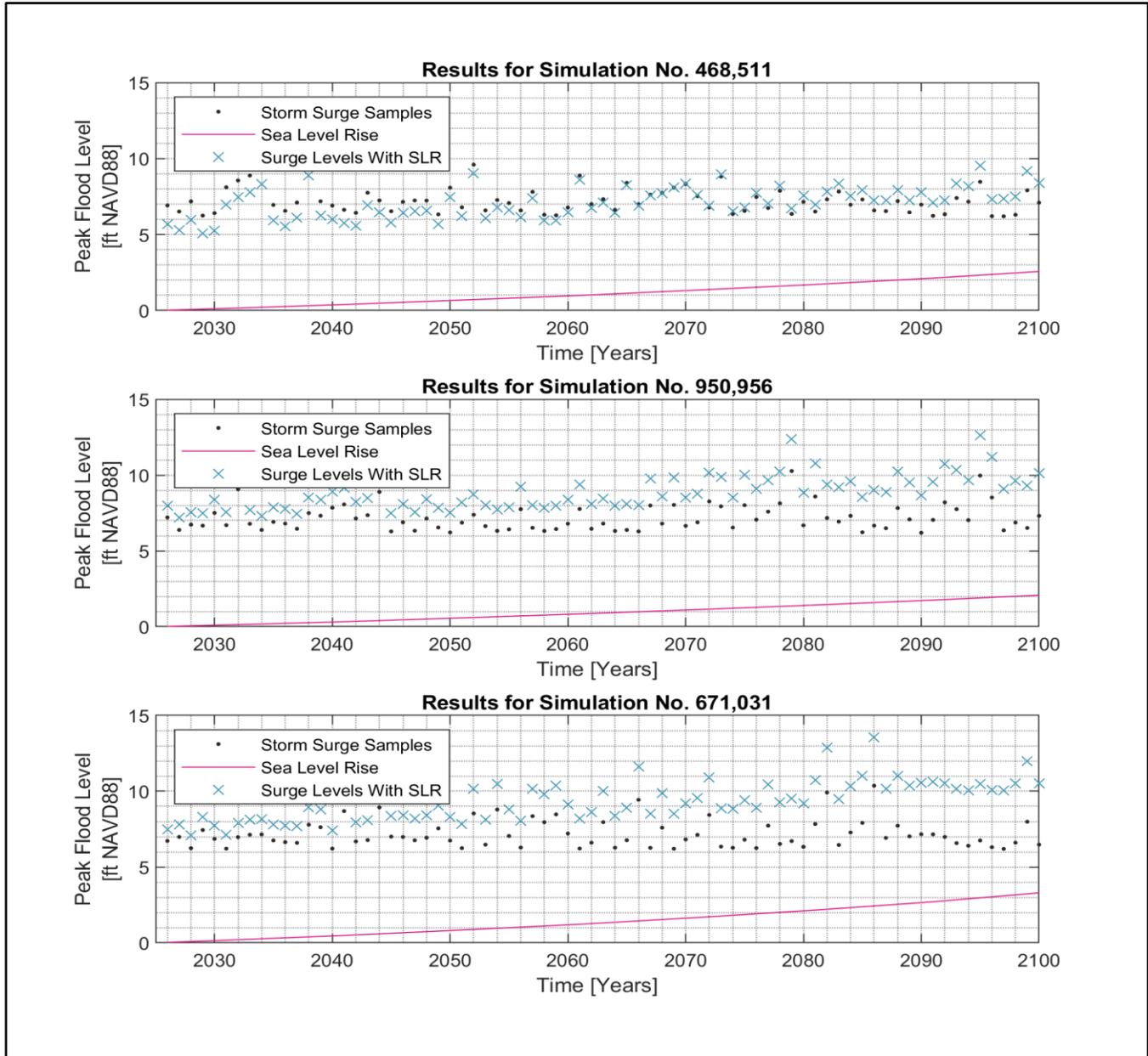
Random
Tides



sampling

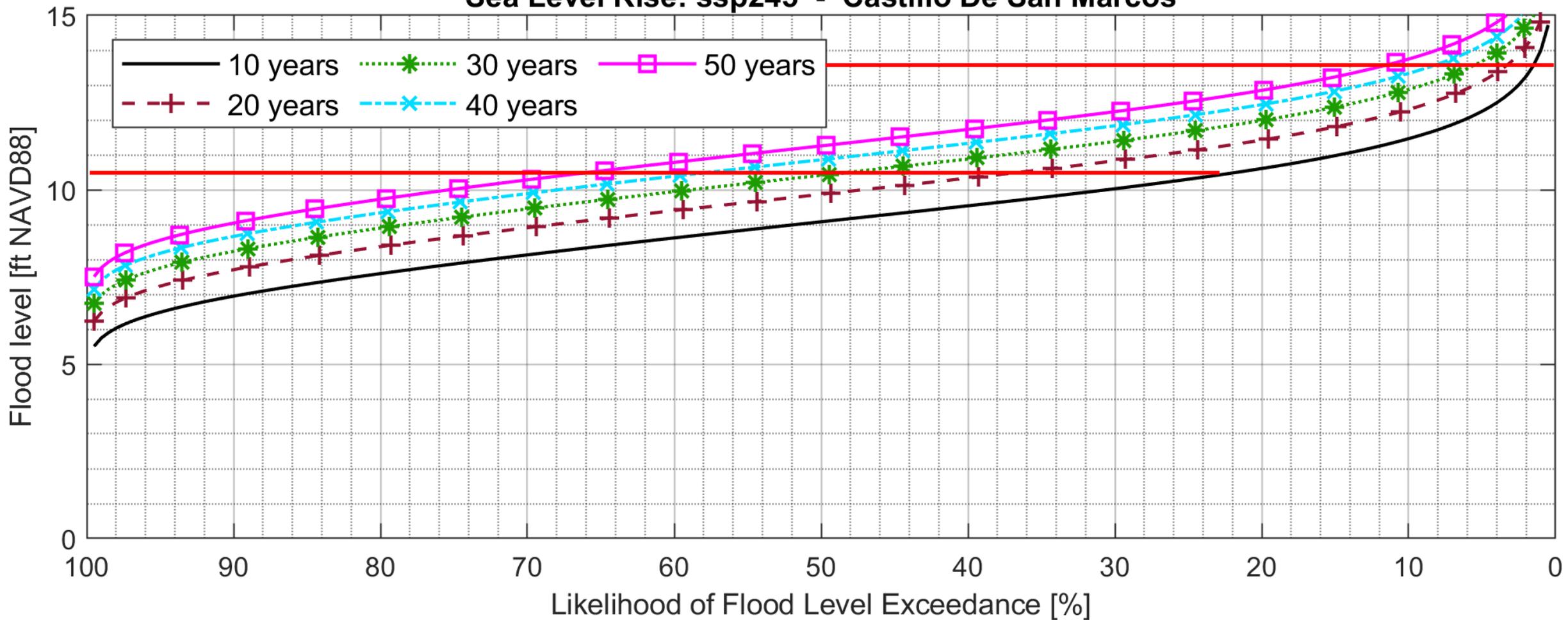


Simulation Results



Monte Carlo Analysis Results

Likelihood of Exceeding Flood Levels - By Project Life
Sea Level Rise: ssp245 - Castillo De San Marcos





Proposed Project: Design Updates





Project Challenges

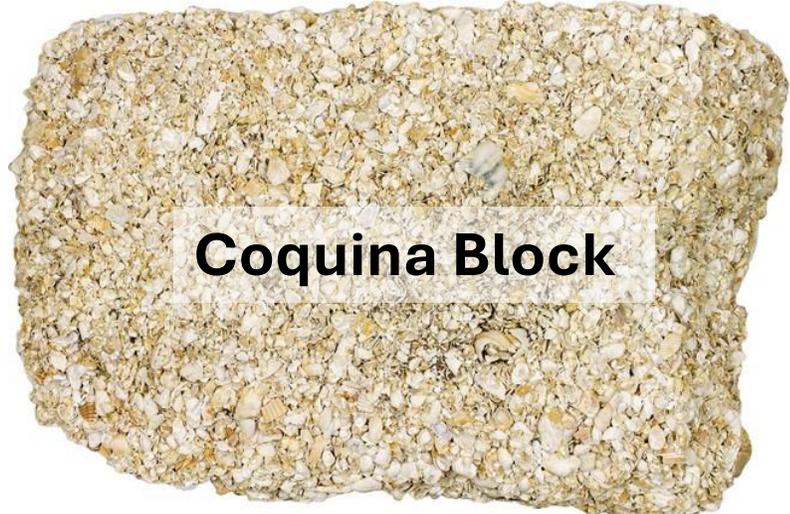
History	Preservation	Resiliency	Cultural	Structural Integrity
Materials	Archeology	Scope & Funding	Viewsheds	Constructability
Resource Impacts	Site Conditions	Operations	Guest Experience	Coastal Hazards



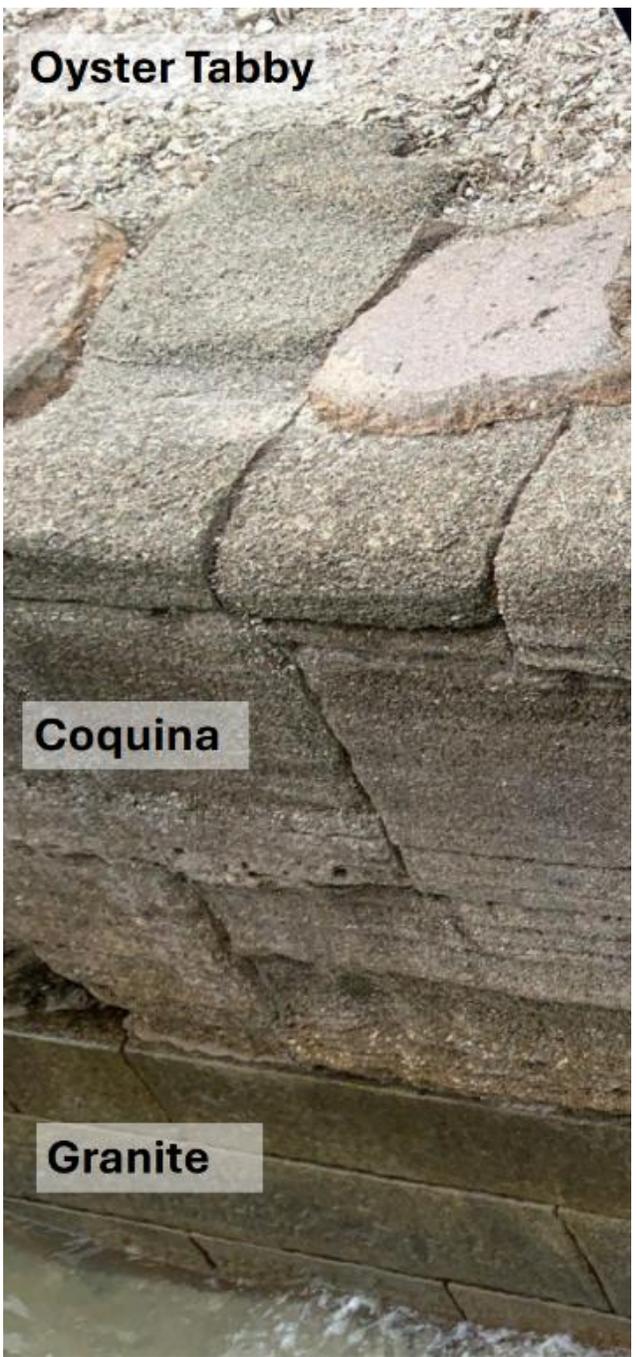
Materials

Historical Materials

- Coquina (*limitations*)
- Poured Concrete with Coquina Shell Aggregate
- Tabby
- Granite



Coquina Block



Oyster Tabby

Coquina

Granite

Typical Modern Materials

- Steel Sheet Pile (SSP)
- Concrete Cast-In-Place (CIP)
- Concrete Fascia and Cap





North Wall

+ 4.5'

North Transition Wall

+ 2.5'

Center Wall

Spot Repairs

South Wall

+ 5'

South Transition Wall

+ Varies



North Wall View – Existing





Extent of Proposed
Grade Changes

4' (+0')

5' (+1')

6' (+2')

7' (+3')

8' (+4')

2.5'

Proposed Top Elevation 10.5'
(Wall Increase + 4.5')

Proposed Top Elevation 10.5'
(Wall Increase + 2.5')



South Wall View – Existing





Proposed Top Elevation 10.5'
(Wall Increase + 5')

Proposed Grade Changes

1.5'

1.5'

2.5'

5.5'

9' (+0'-5')

8' (+0'-4')

7' (+0'-3')

6' (+0'-1.5')

5' (+0'-0.5')



Fort Approach View – Existing





Proposed Grade Changes

Proposed Top Elevation 10.5'
(Wall Increase + 5')

9' (+0'-5')

8' (+0'-4')

7' (+0'-3')

6' (+0'-1.5')

5' (+0'-0.5')

1.5'

2.5'

3.5'

4.5'

5.5'





Thank you!
Questions?

