TAYLOR ENGINEERING, INC.

SWAN+ADCIRC Storm Event Modeling for Broward County, FL

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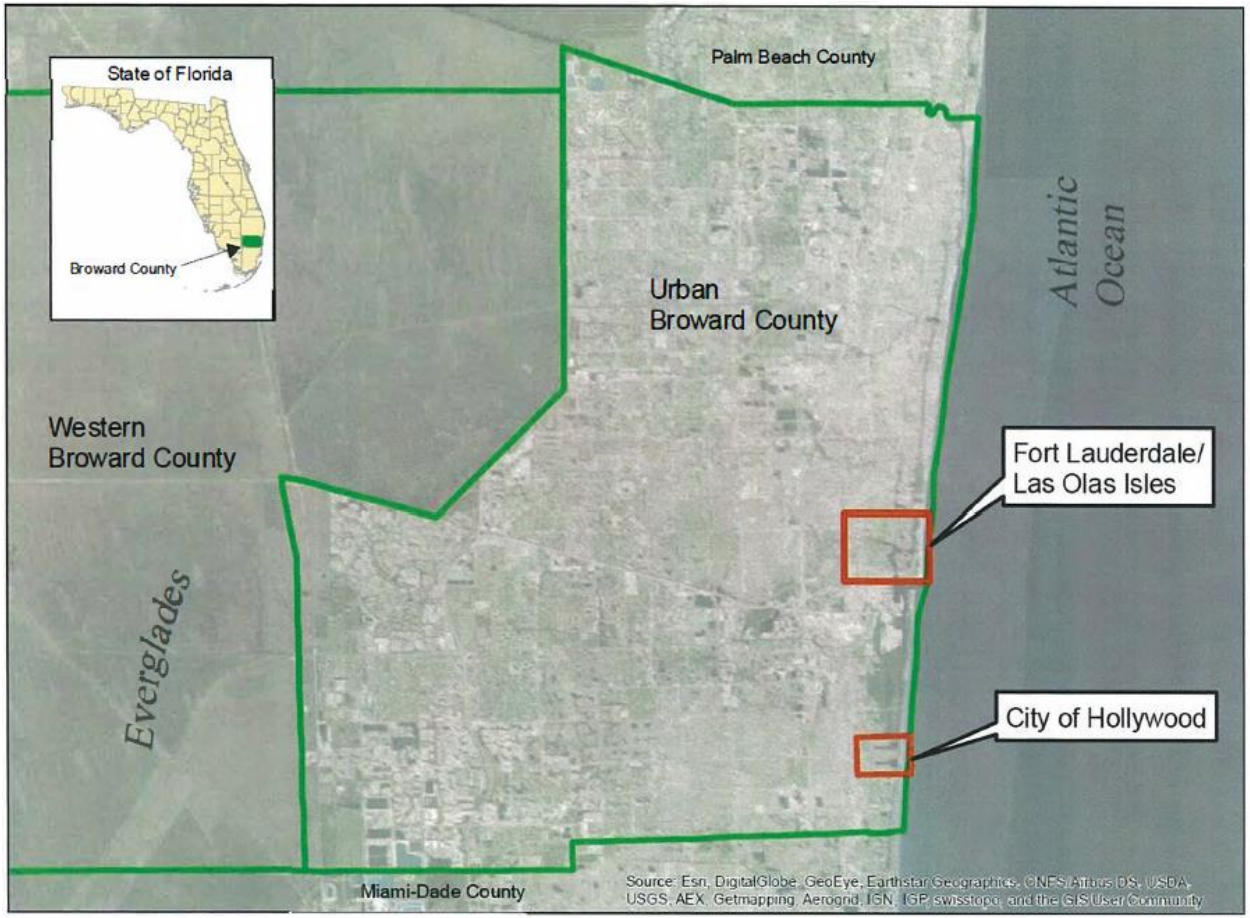
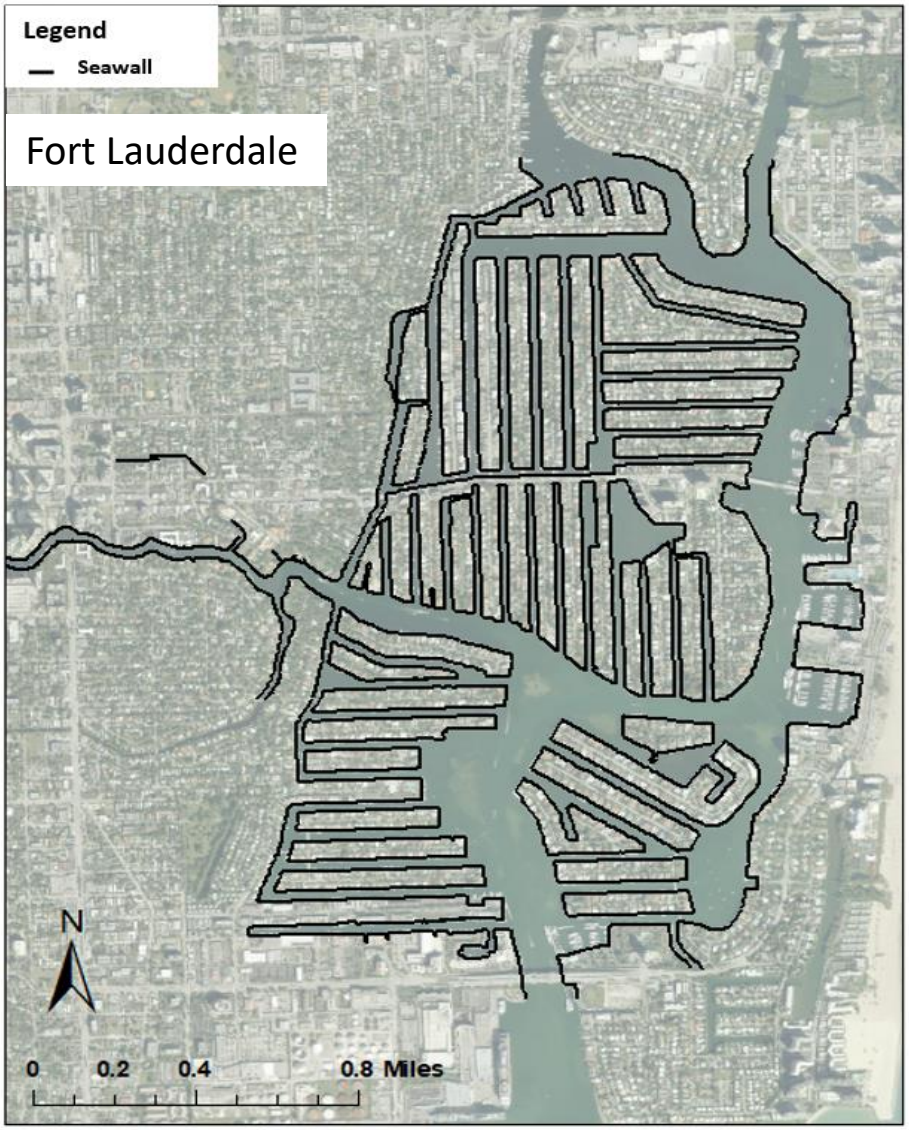
Outline

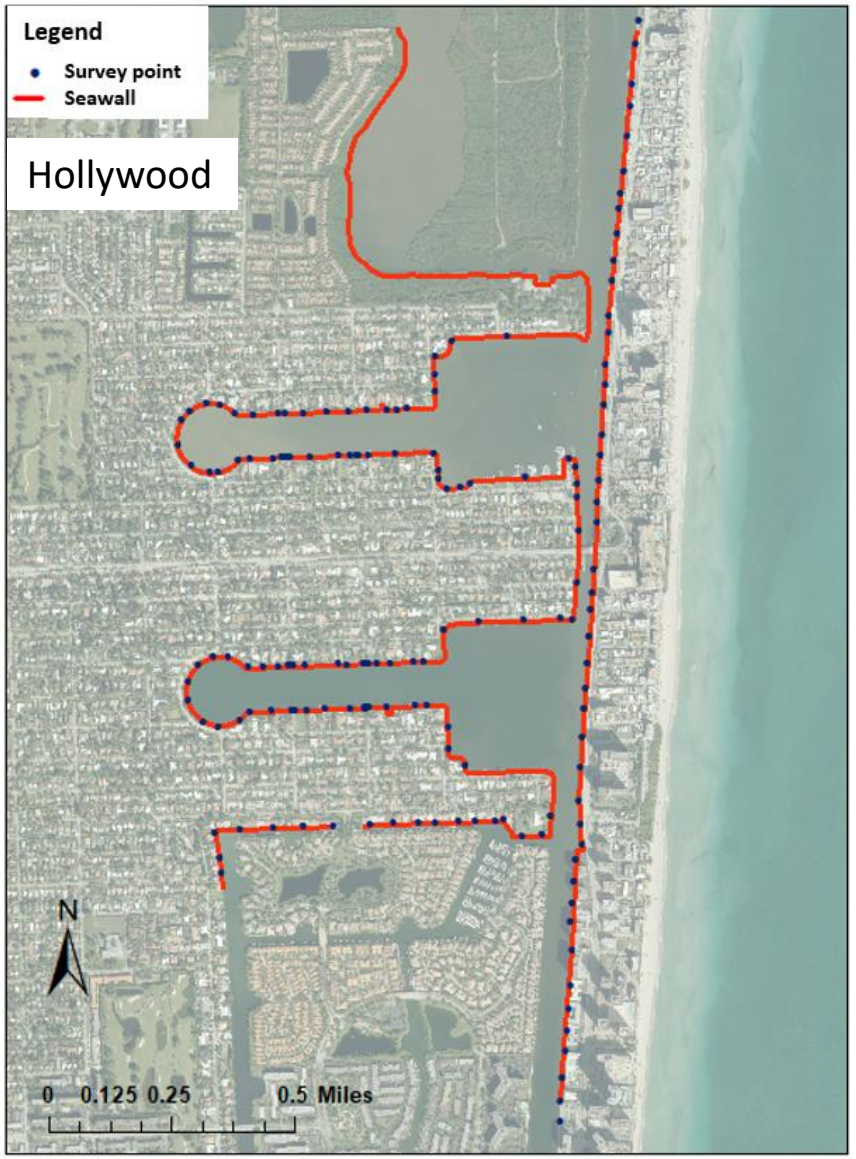
- Project area
- Study goals
- Methodology
- Results
- Conclusions

Project area



Project area





Project area

https://www.browardpalmbeach.com/news/during-king-tide-two-feet-of-seawater-flooded-hollywoods-streets-8162258

Study goals

- Nuisance flooding occurs in areas near ICWW
  - Damaging to buildings and other infrastructure
  - Compounded by storm surge, extreme rainfall events, SLR, groundwater table elevation, etc.
- USACE in partnership with Broward County, FL conducted the Flood Risk Management (FRM) Study
  - Hydrodynamic and wave modeling to evaluate contributions of storm surge and seawall elevations on nuisance flooding

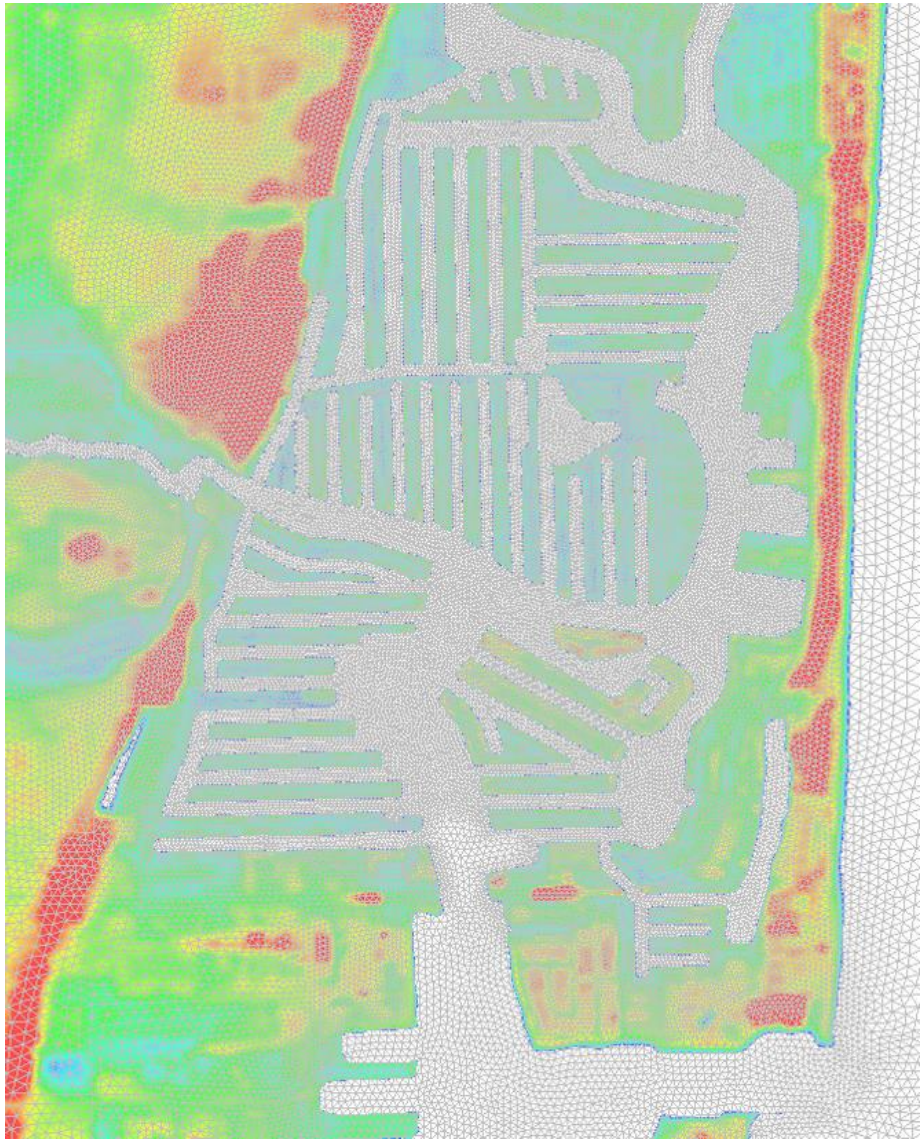
Study goals

- Identify inundation patterns and flood depths produced by four synthetic tropical storm events
  - 10 – 100 year return period
- Peak surge of synthetic storms to coincide with fall high tide
- Seawall configurations:
  - Existing conditions
  - Elevate all seawalls to 4 ft-NAVD
  - Elevate all seawalls to 6 ft-NAVD

Methodology

- SWAN+ADCIRC
  - Hydrodynamics and waves
  - Tightly coupled
  - Meteorological and astronomical tidal forcing
- Apply modified version of FEMA's South Florida Flood Insurance Study model mesh
  - > 2 million nodes
  - Validated
  - 50 ft (15 m) resolution in area of interest

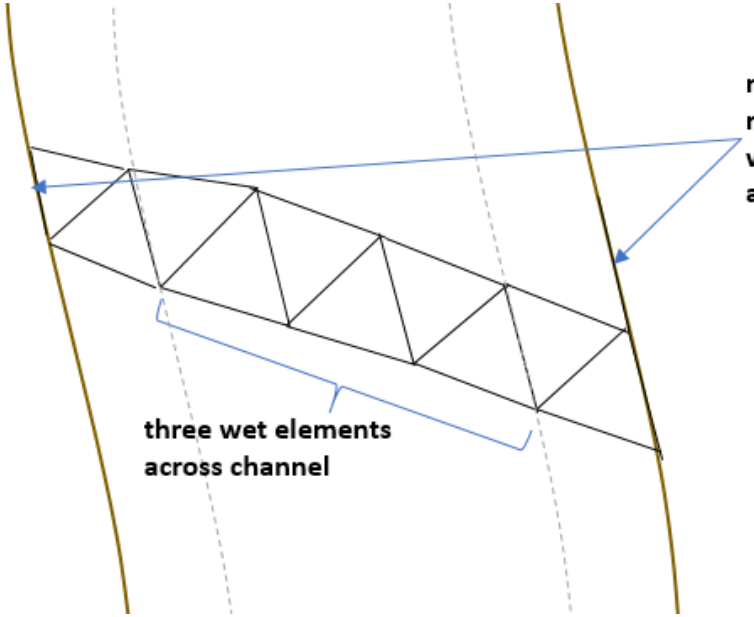
Methodology

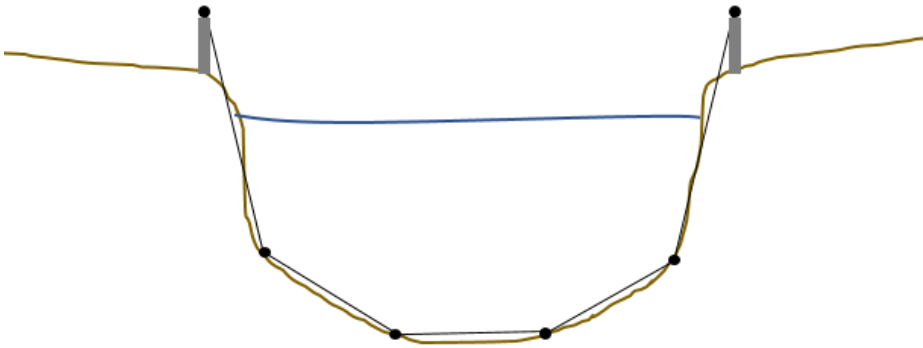


Methodology

- Update mesh geometry to incorporate canals down to 35 ft (10 m)
  - Apply 2015 LIDAR
  - Apply 2018 mean sea level
- Stability challenges
  - Low-lying, oscillatory topography does not drain well by gravity
  - Steep seawall slope
  - Wetting and drying
    - Elements that dry out during MLLW cause unrealistic hydraulic disruptions

Methodology





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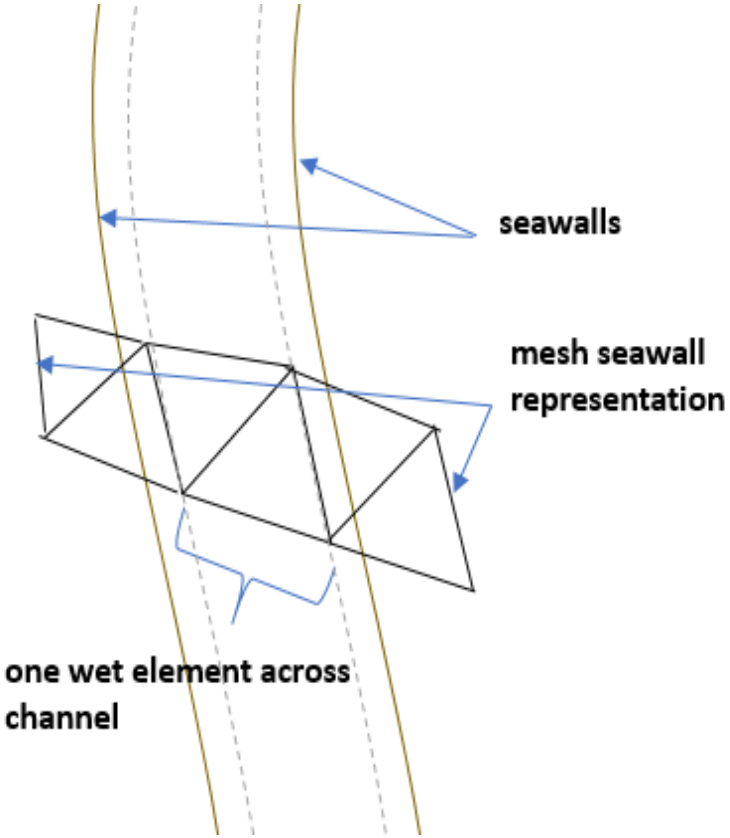
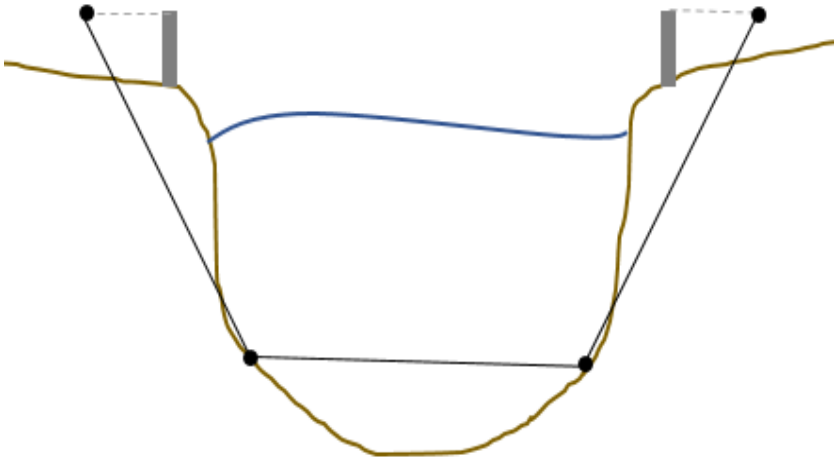
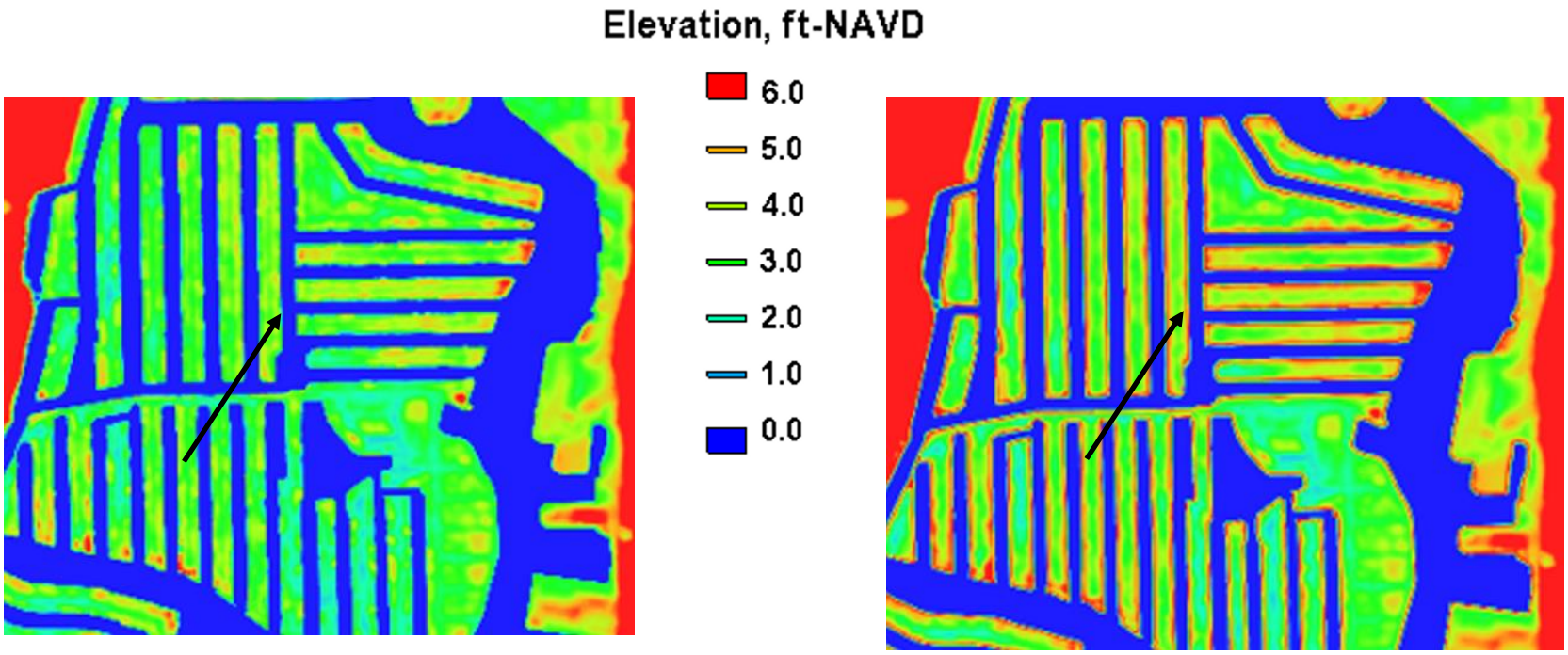




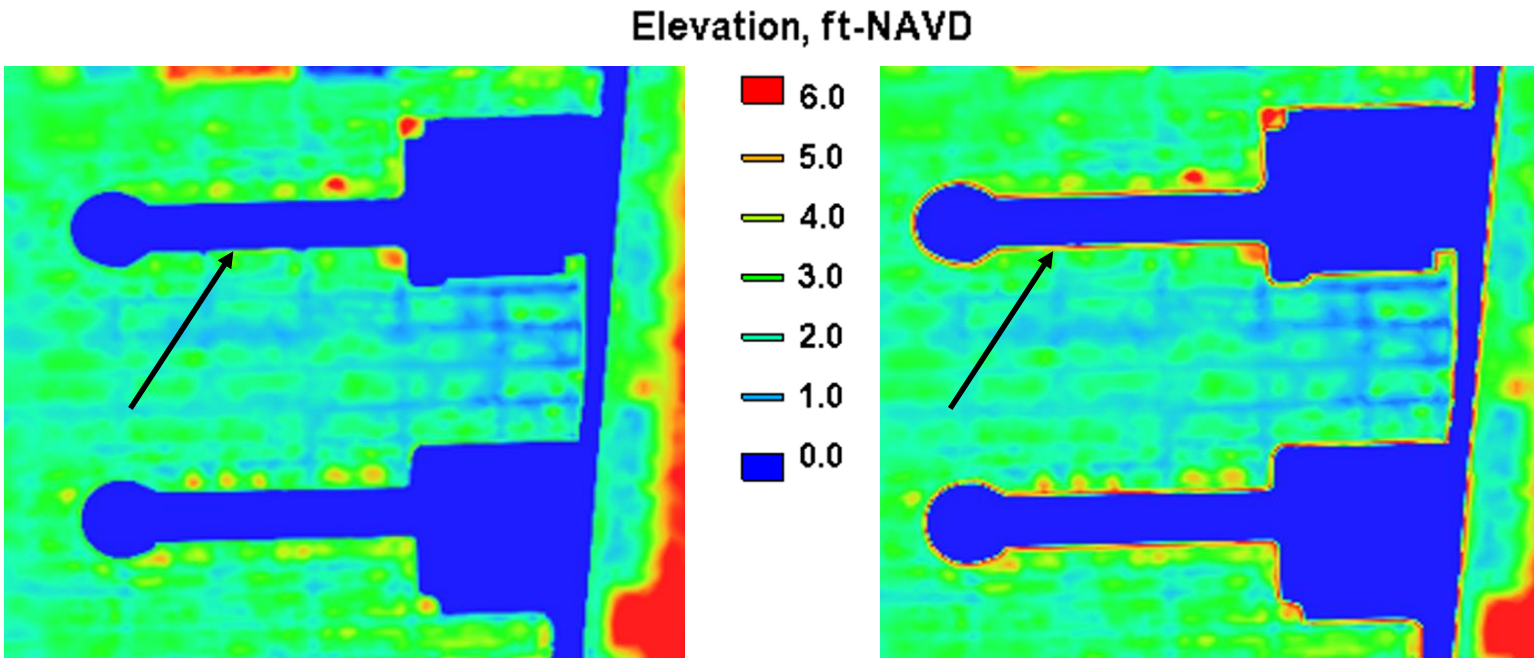
Methodology



Existing conditions

Seawalls raised to 6 ft-NAVD

Methodology



Existing conditions

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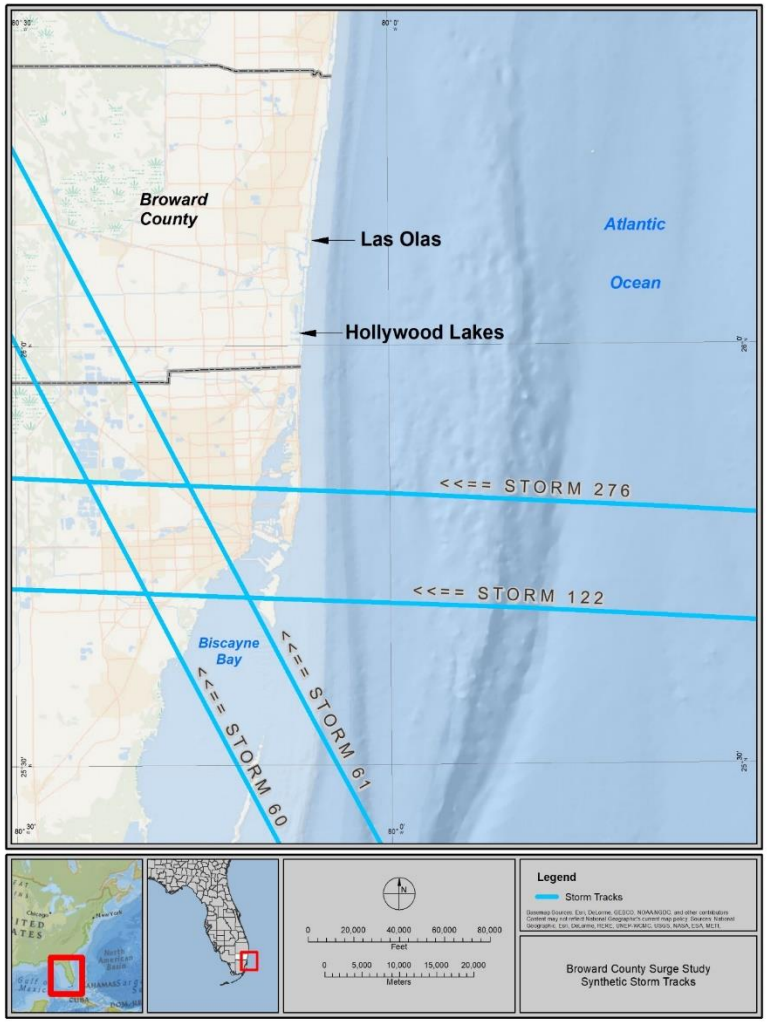
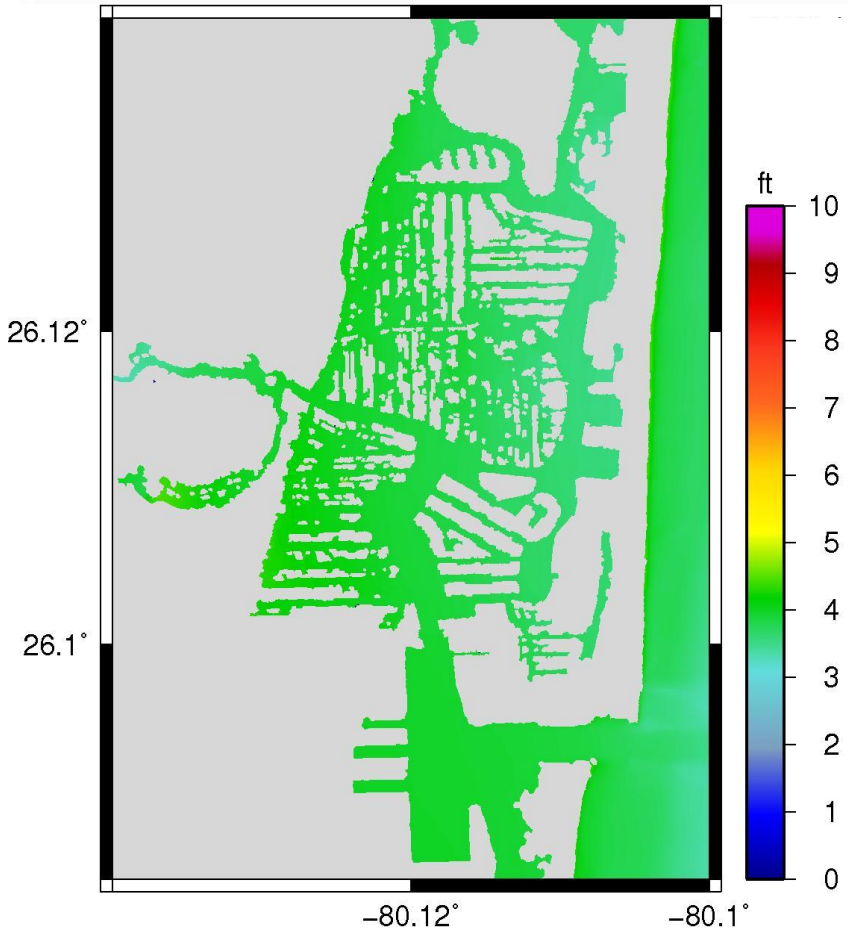
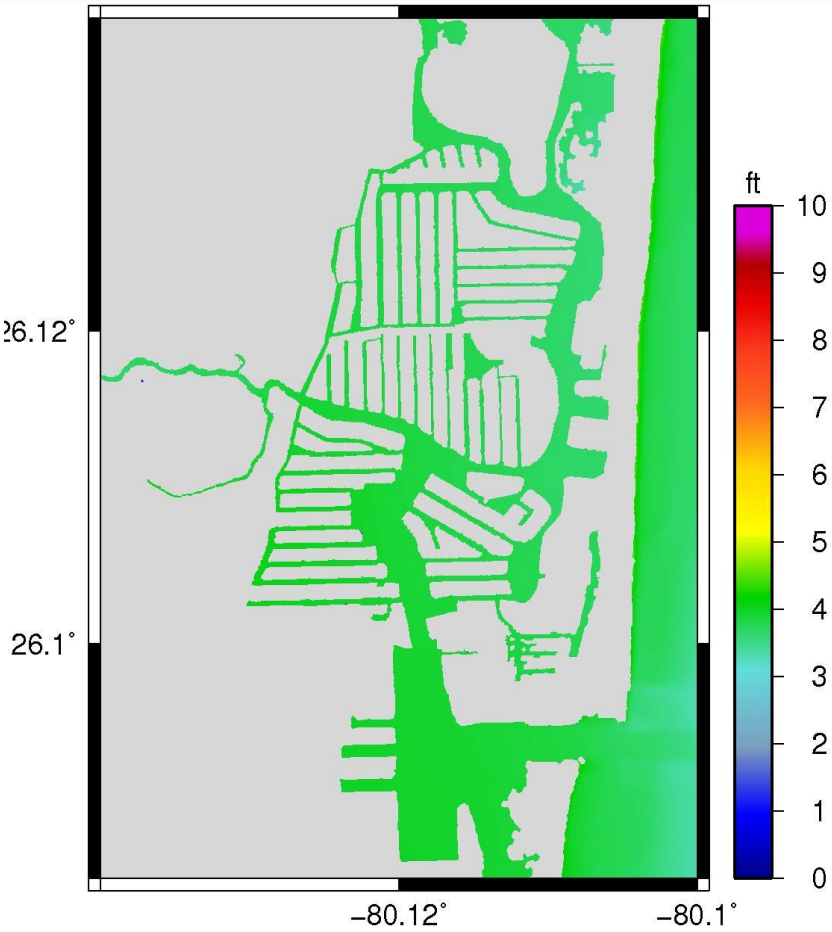


Storm	Forward Velocity (knots)	Radius to Maximum Wind (nmi)	Maximum Wind Speed (knots)
276	10	25	58
122	10	13	114
60	10	14	114
61	10	14	114

Results



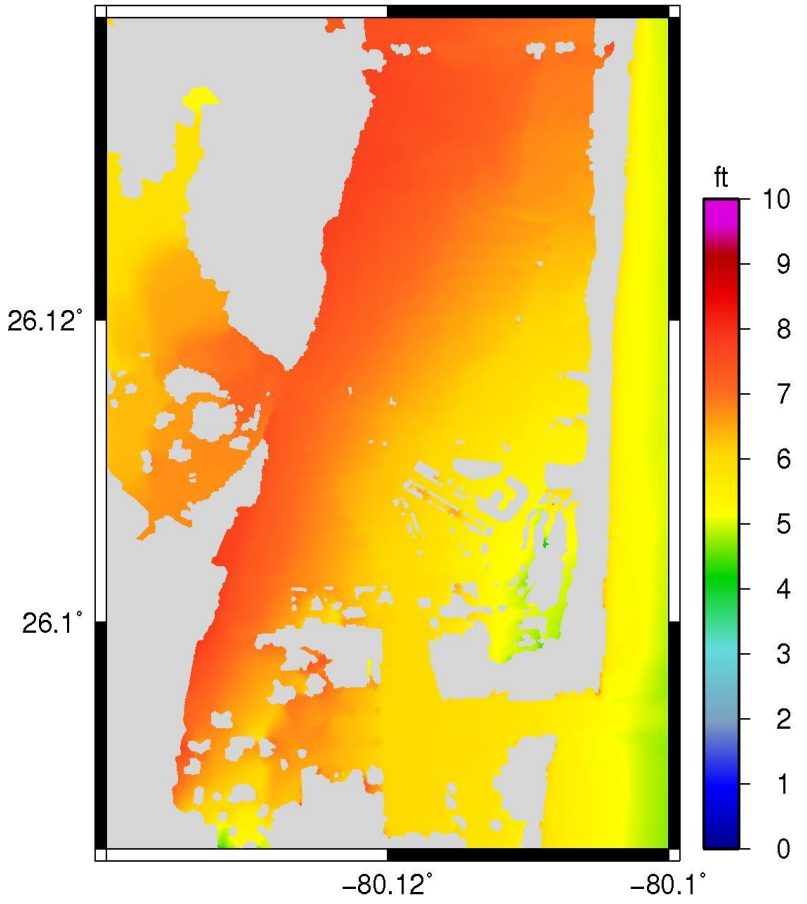
Existing conditions



Seawalls raised to 4 ft-NAVD

Storm 276, Maximum Water Surface Elevation (ft-NAVD), Las Olas

Results



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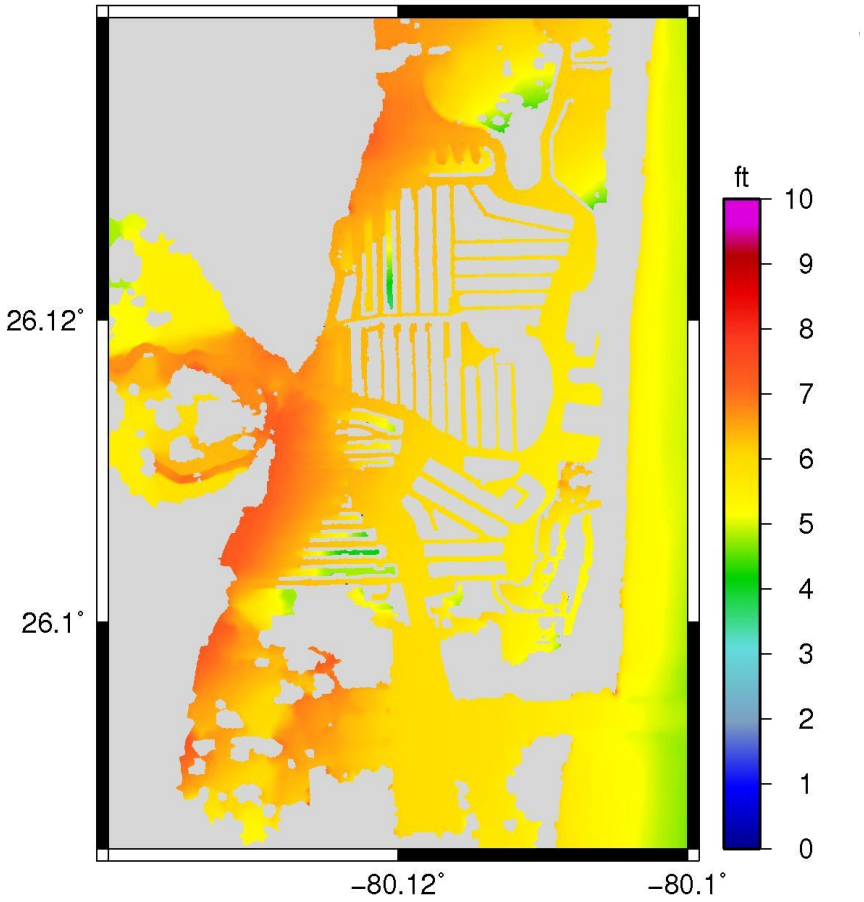
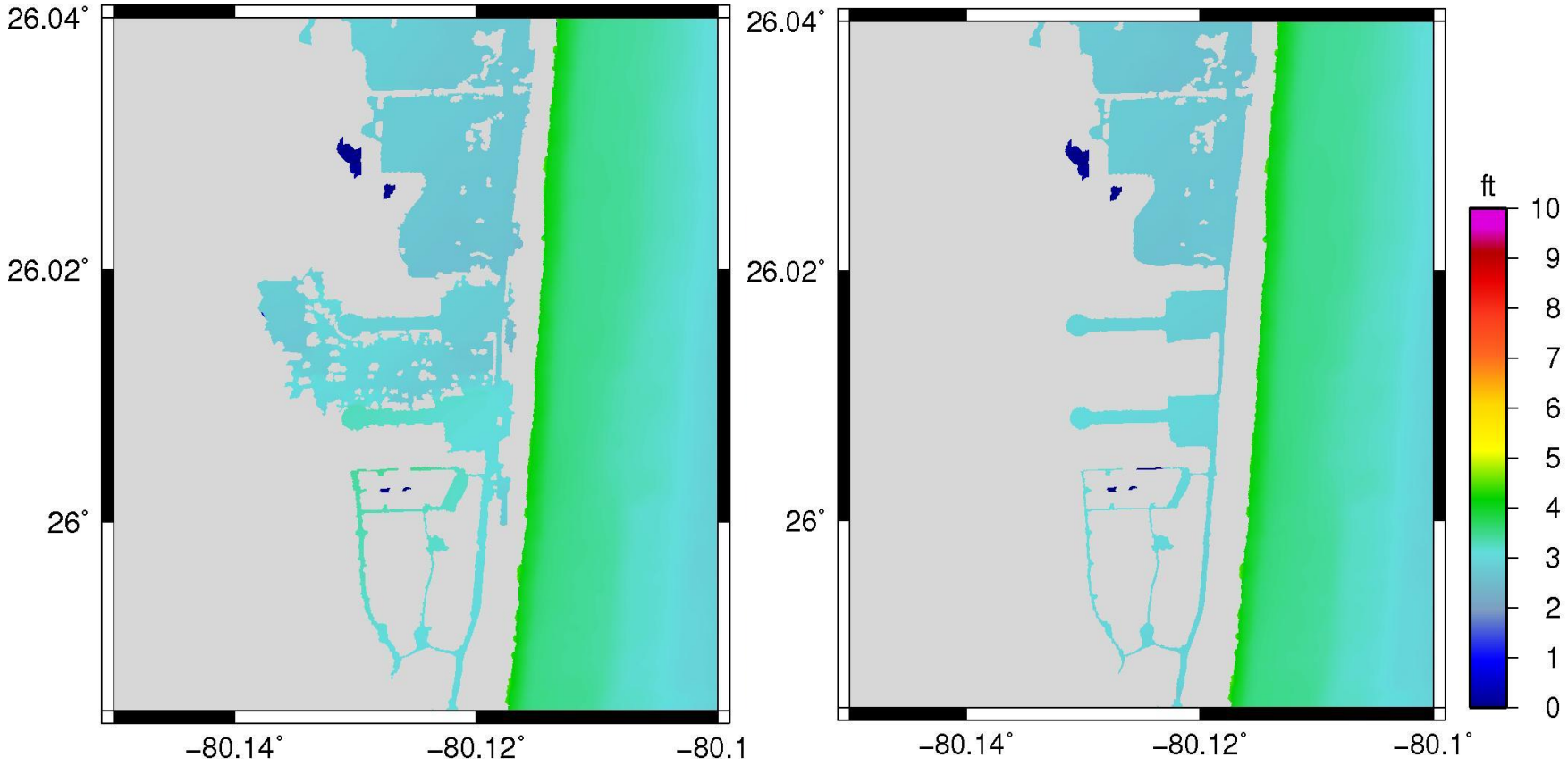


Seawalls raised to 6 ft-NAVD

Storm 61, Maximum Water Surface Elevation (ft-NAVD), Las Olas

Results

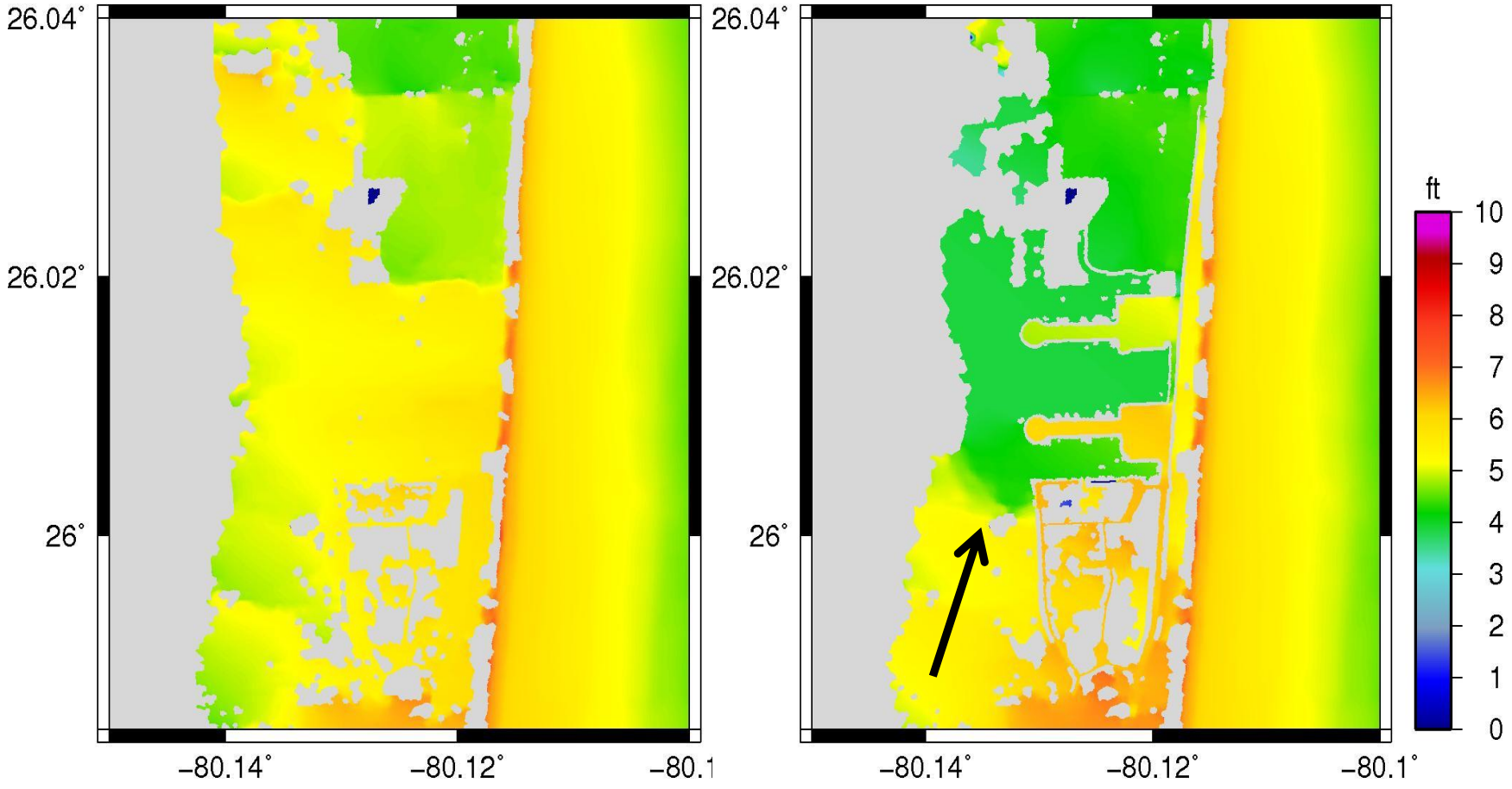


Existing conditions

Seawalls raised to 4 ft-NAVD

Storm 276, Maximum Water Surface Elevation (ft-NAVD), Hollywood

Results



Existing conditions

Seawalls raised to 6 ft-NAVD

Storm 61, Maximum Water Surface Elevation (ft-NAVD), Hollywood

Conclusions

- Seawalls raised to 4 ft eliminated overtopping in weaker storms
- Seawalls raised to 6 ft eliminated or reduced overtopping, hence overland flooding
- Inundation can occur from “backside” of seawalls in Hollywood Lakes area
- Inundation patterns from storm events may influence new requirements for seawall heights

Thank you!

- Co-authors
  - Chris Bender, PhD, PE
  - Hunter Bredesen, EI
- USACE-SAJ
  - Steve Bratos, PE
  - Glenn Landers, PE
- Broward County
  - Samantha Danchuk, PhD, PE
  - Jennifer Jurado, PhD