TAYLOR ENGINEERING, INC.

Jupiter Inlet Longshore Transport Modeling

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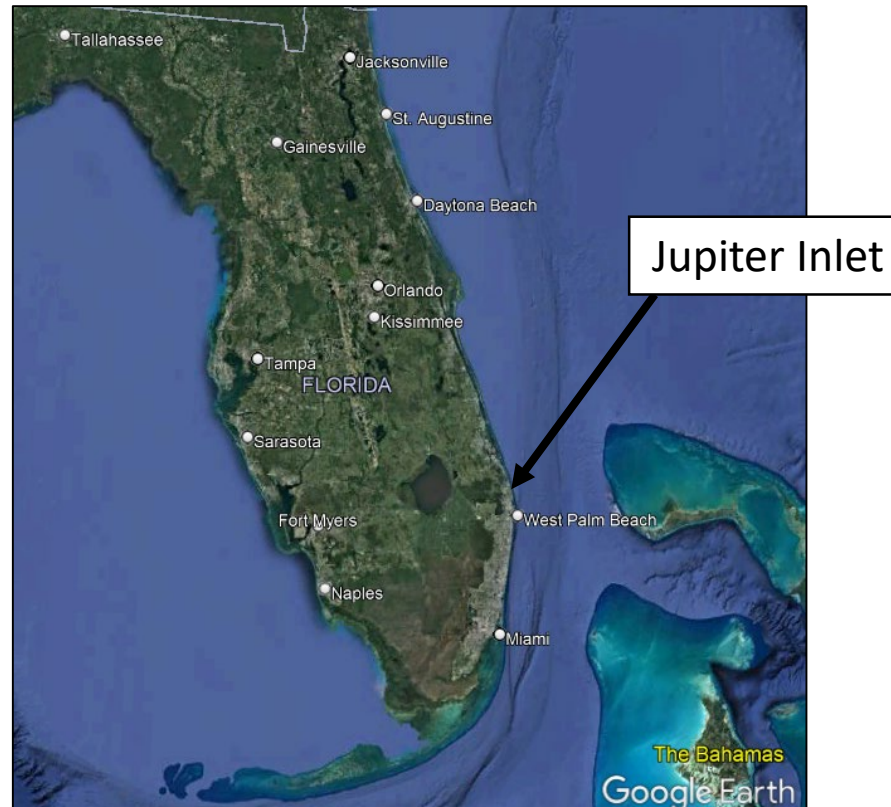
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Overview

- Background & Project Goals

- Model Setup

- Sensitivity Testing

- Validation

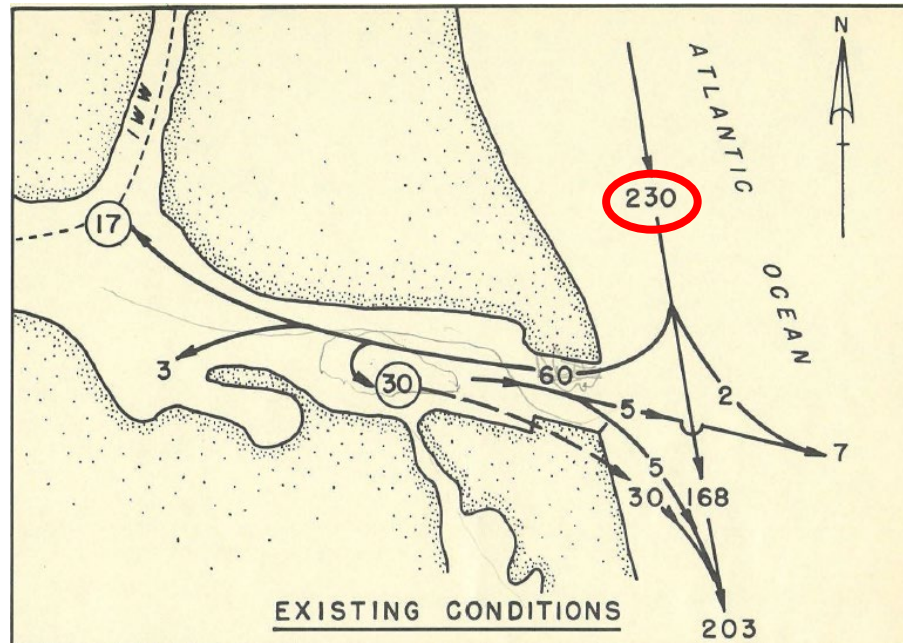- Production Run Results

- Sediment Budget

Background

- Update sediment budget at Jupiter Inlet
- Sediment budget supports Inlet Management Plan

Project Goals

- Develop longshore transport (LST) model for sediment budget update

- Previous studies applied USACE 1966 LST estimate
  - ➢ 230,000 cy/year

- Revisit LST with more recent wave conditions

Project Goals

- Sediment budget input terms:
  - Q = sediment transport
  - P = placement (nourishment)
  - R = removal (dredging)
  - ΔV = volume change

- Measured:
  - P, R, ΔV

- Estimated or modeled:
  - Q
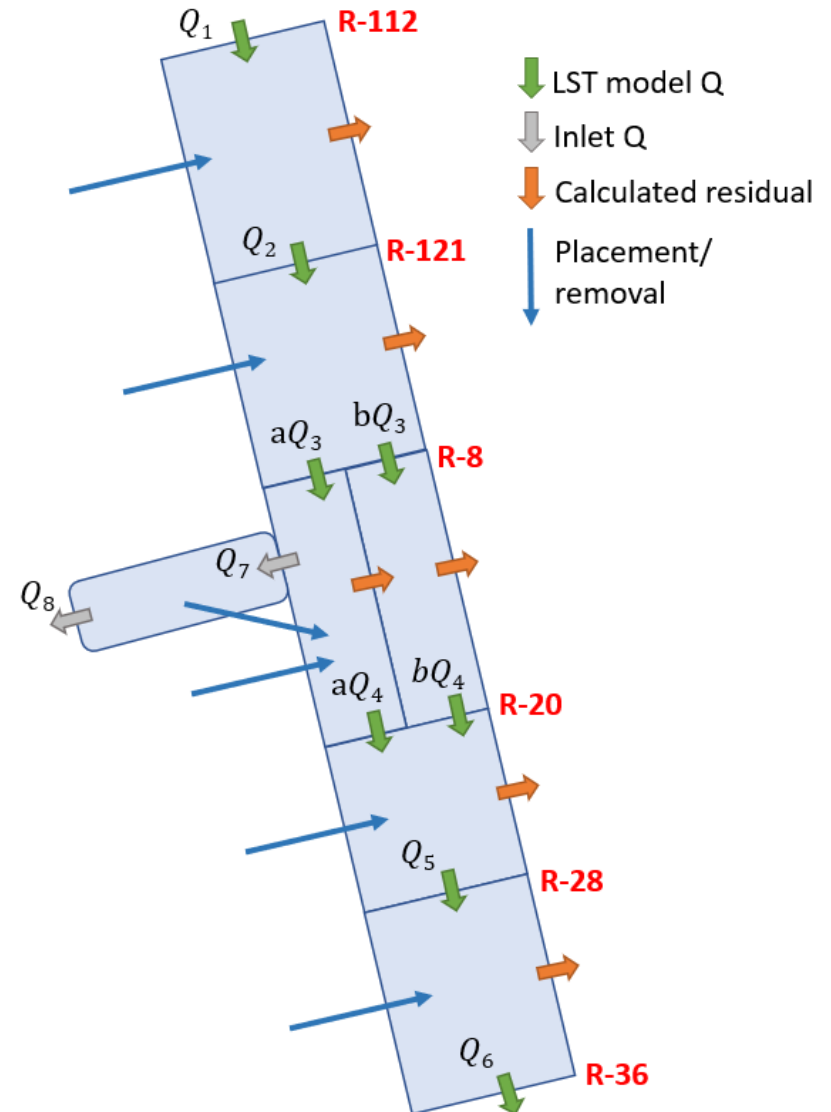
Project Goals

- MIKE LP (Littoral Processes) model

- Transect-based 1D model
  - No cross-shore transport, hardbottom, or morphodynamics
  - Study focuses on background longshore transport rates

- High computational efficiency

- Capture range of regional transport rates
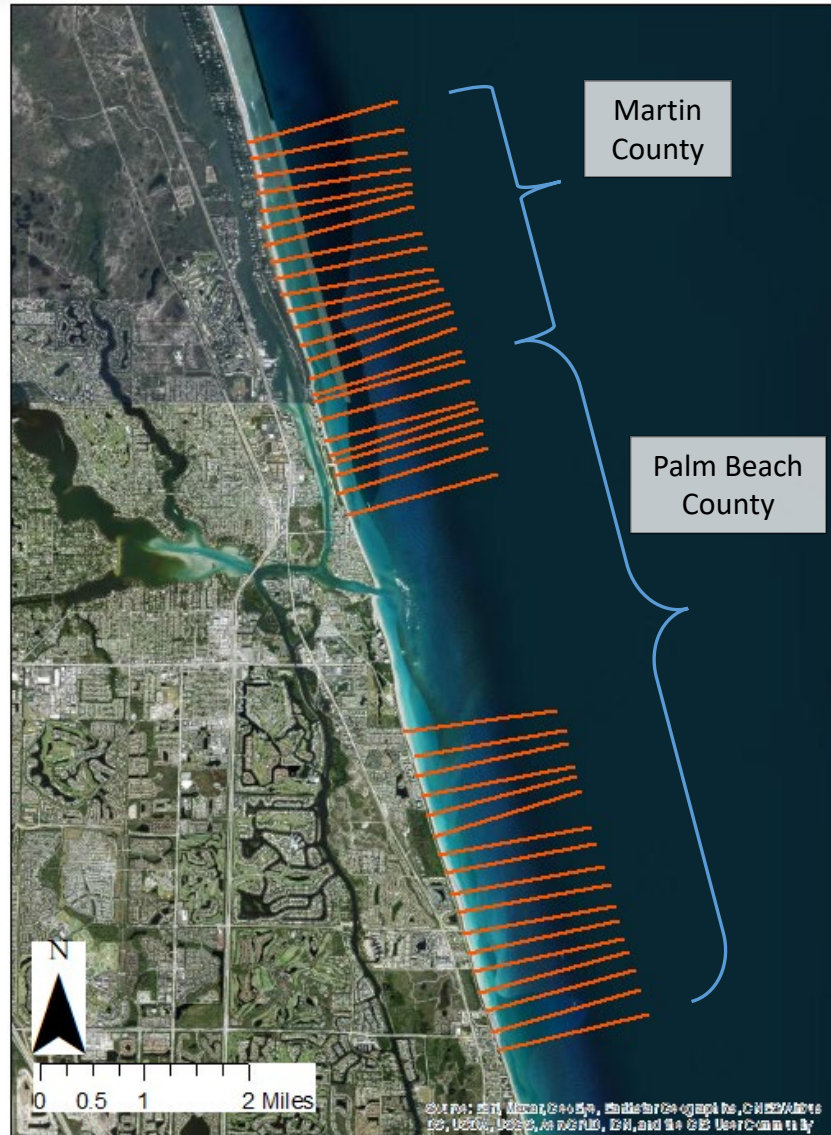 - Significant annual variability

Model setup

- Alongshore extents
  - 4.5 miles to north and 4.5 miles to south of the inlet
  - Model all R-monuments except within inlet shadow

- Cross-shore profile layout
  - 800 cells per profile
  - 10 ft spacing
  - 60 ft depth contour

- Bathymetry from beach transect surveys
  - Collected sediment samples at 8 R-monuments

Model setup

Sensitivity testing

- Azimuth shift

- D_{50}

- Bed roughness

- Wave model and parameters
  - Rayleigh vs. Battjes & Janssen (B&J)
  - B&J depth- and steepness-limited breaking

- Due to instability, applied Rayleigh waves for validation and production phases
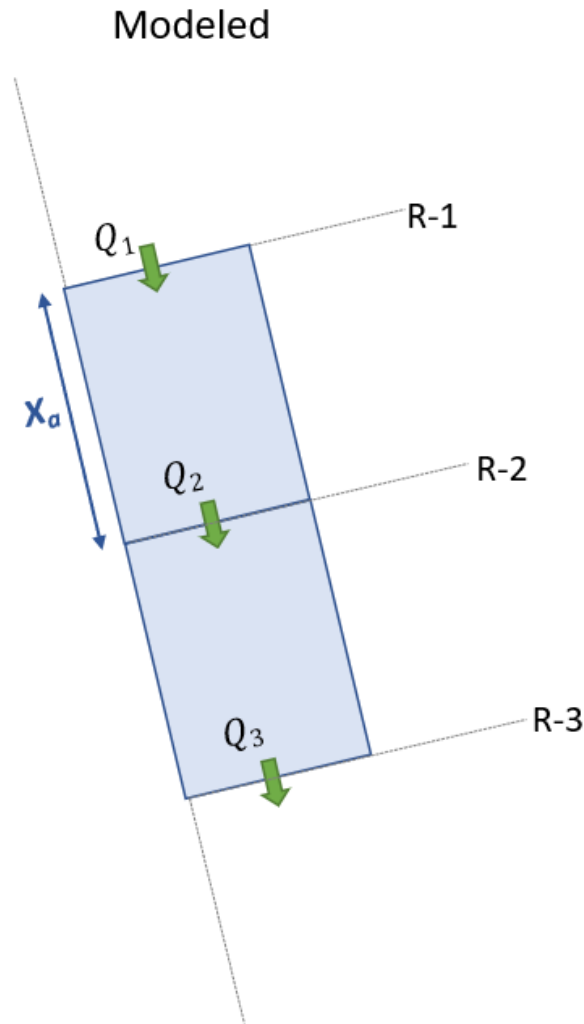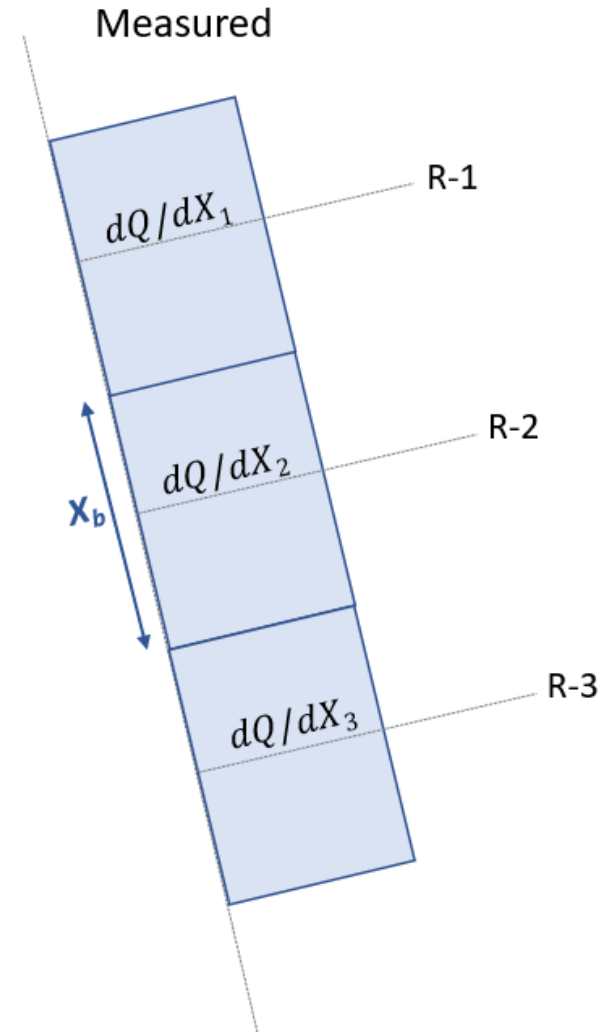
Validation

- Date selection considerations
  - ➢ Survey availability
  - ➢ Moderate wave energy
  - ➢ Avoid large nourishment events
- May 2018 to May 2019
- May 2016 to November 2016
- July 2019 to December 2019

Validation

Modeled

Measured

Accretion over X_a in cy = $Q_1 - Q_2$
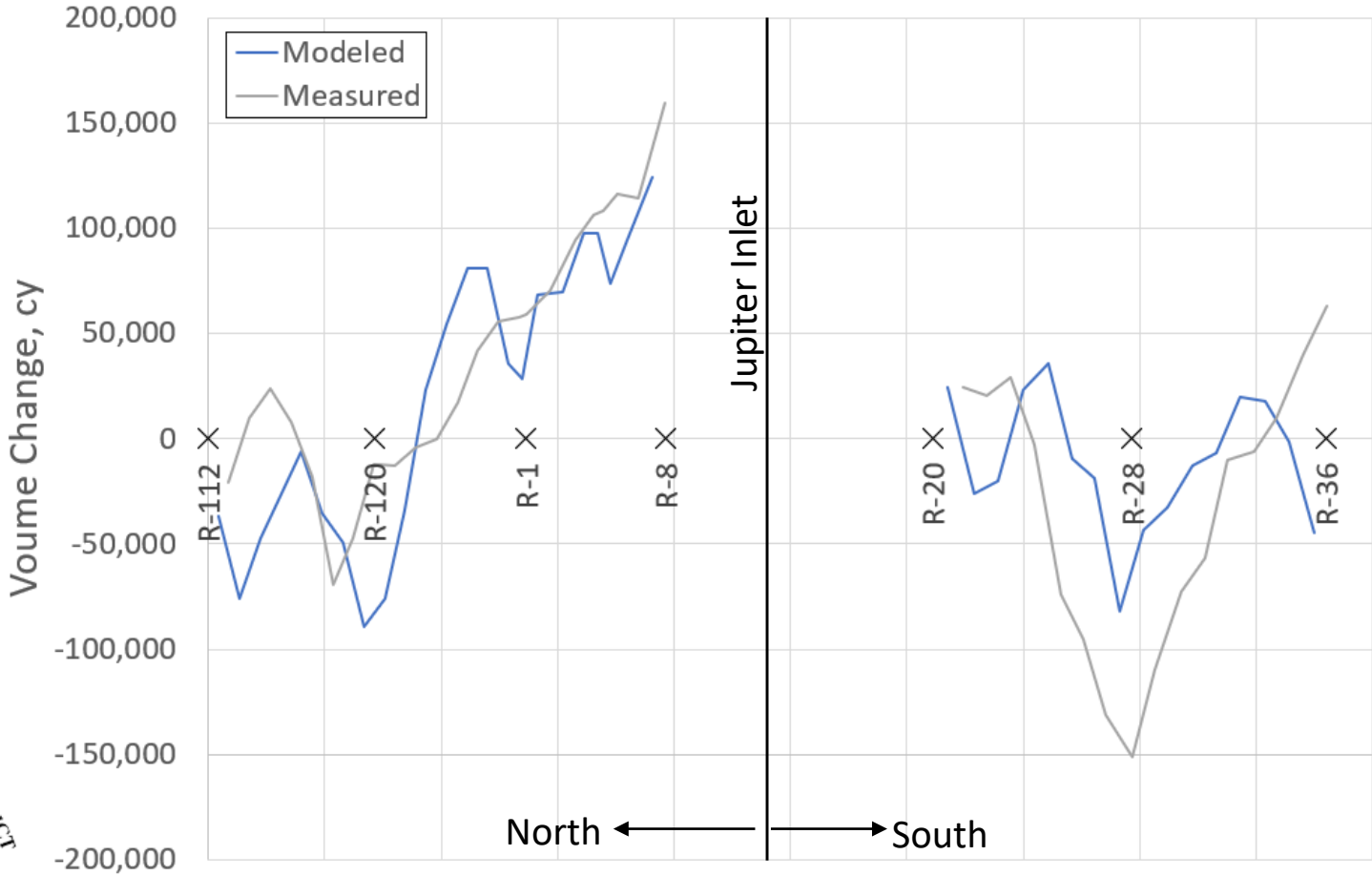
Accretion over X_b in cy = $dQ/dX_2 * X_b$

Validation Results – May to Nov 2016
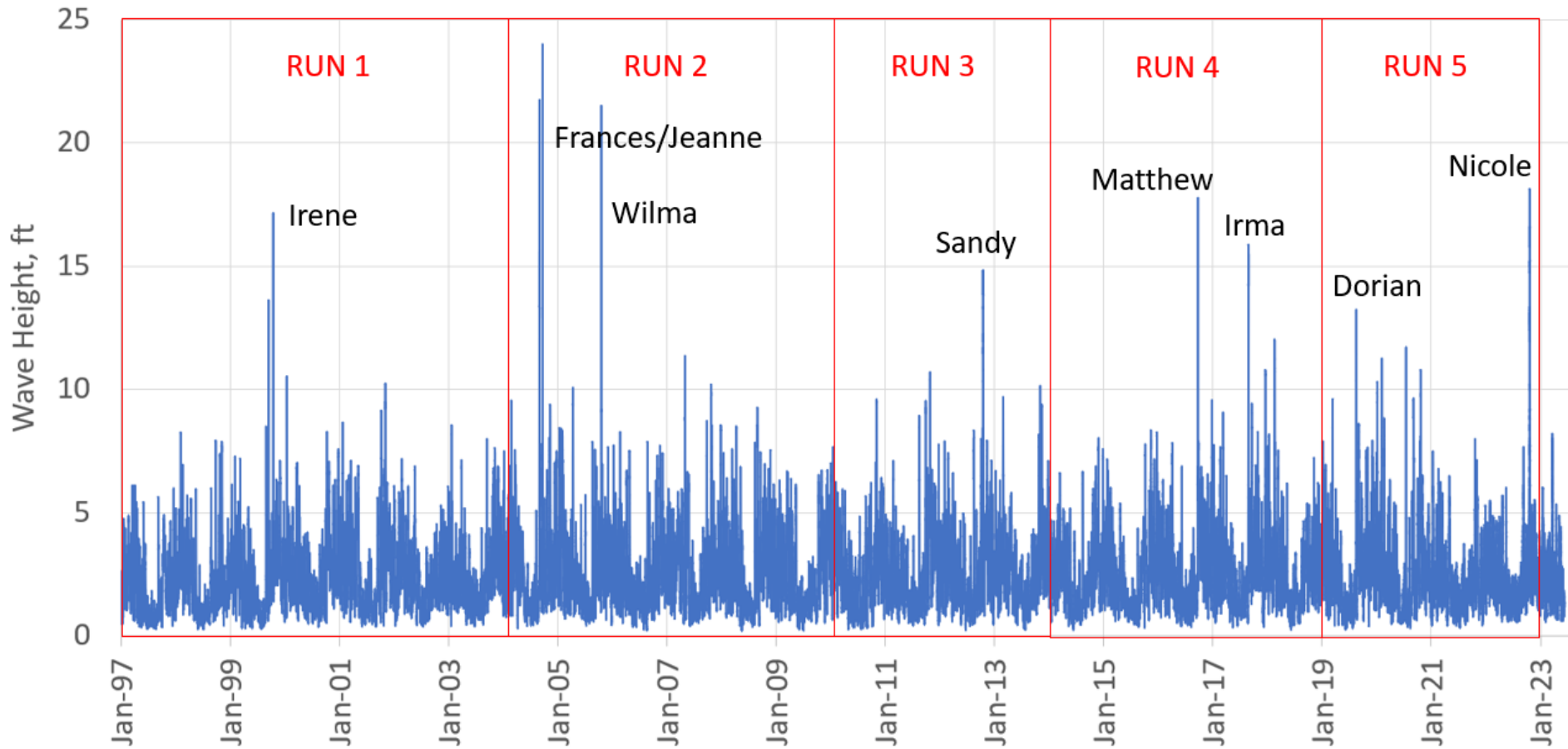

Cumulative Alongshore Volume Change

Production Runs

- Model net littoral drift Q from 1997-2022
  - Jetty extension work completed in 1997

- Update bathymetry every ~5 years
  - Exact dates dependent on data availability

- Input data
  - NOAA tide gages
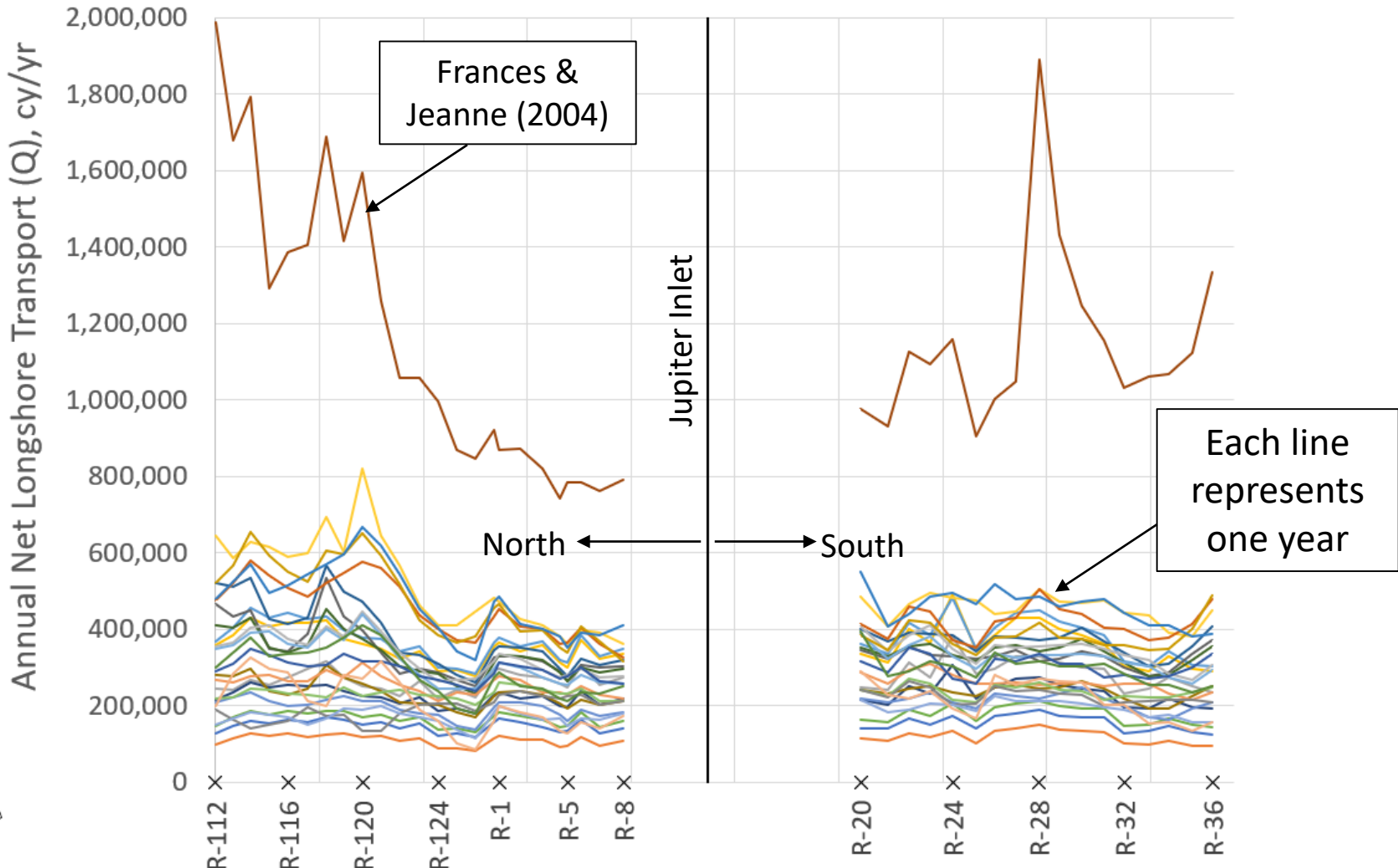 - WIS hindcast stations
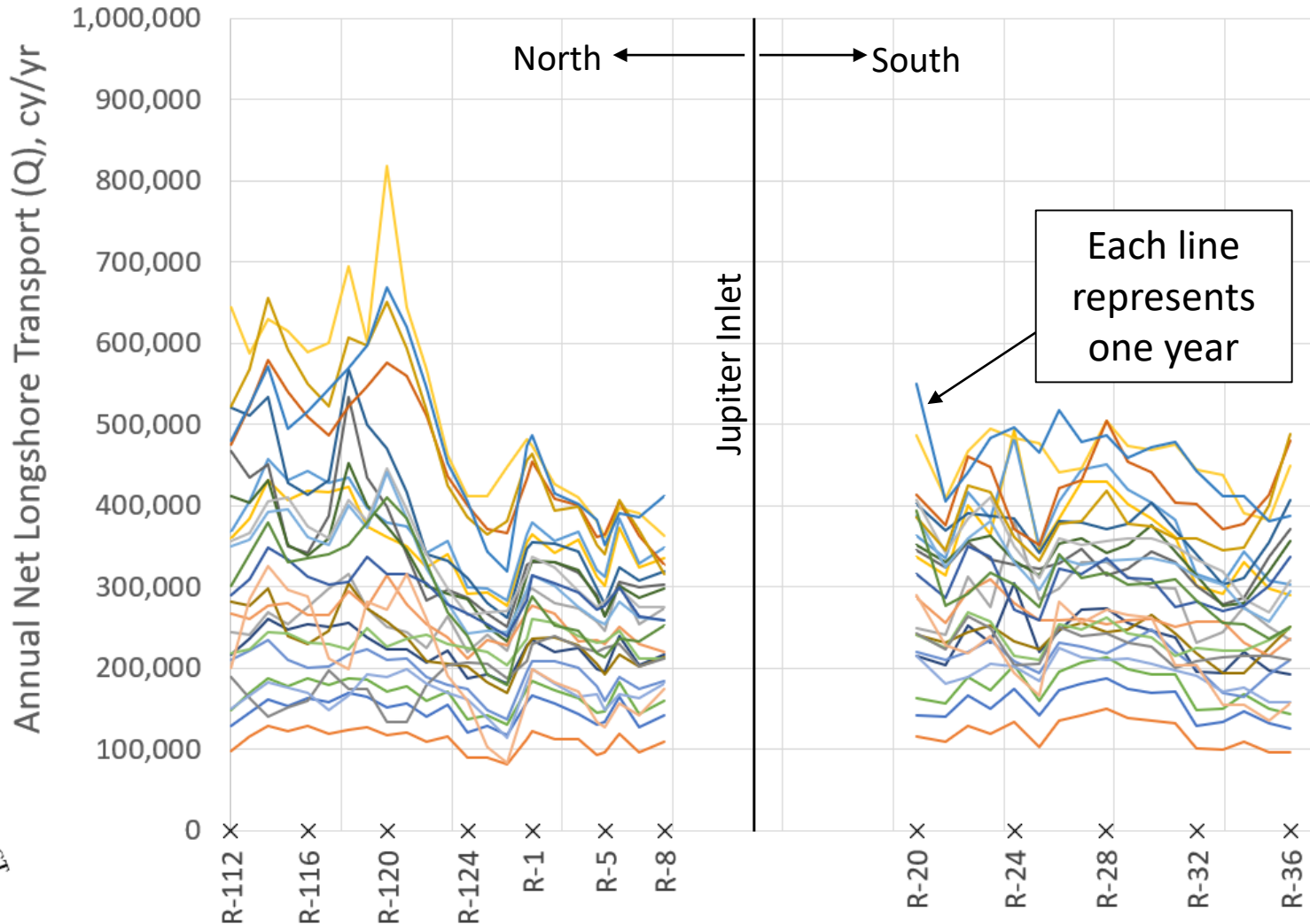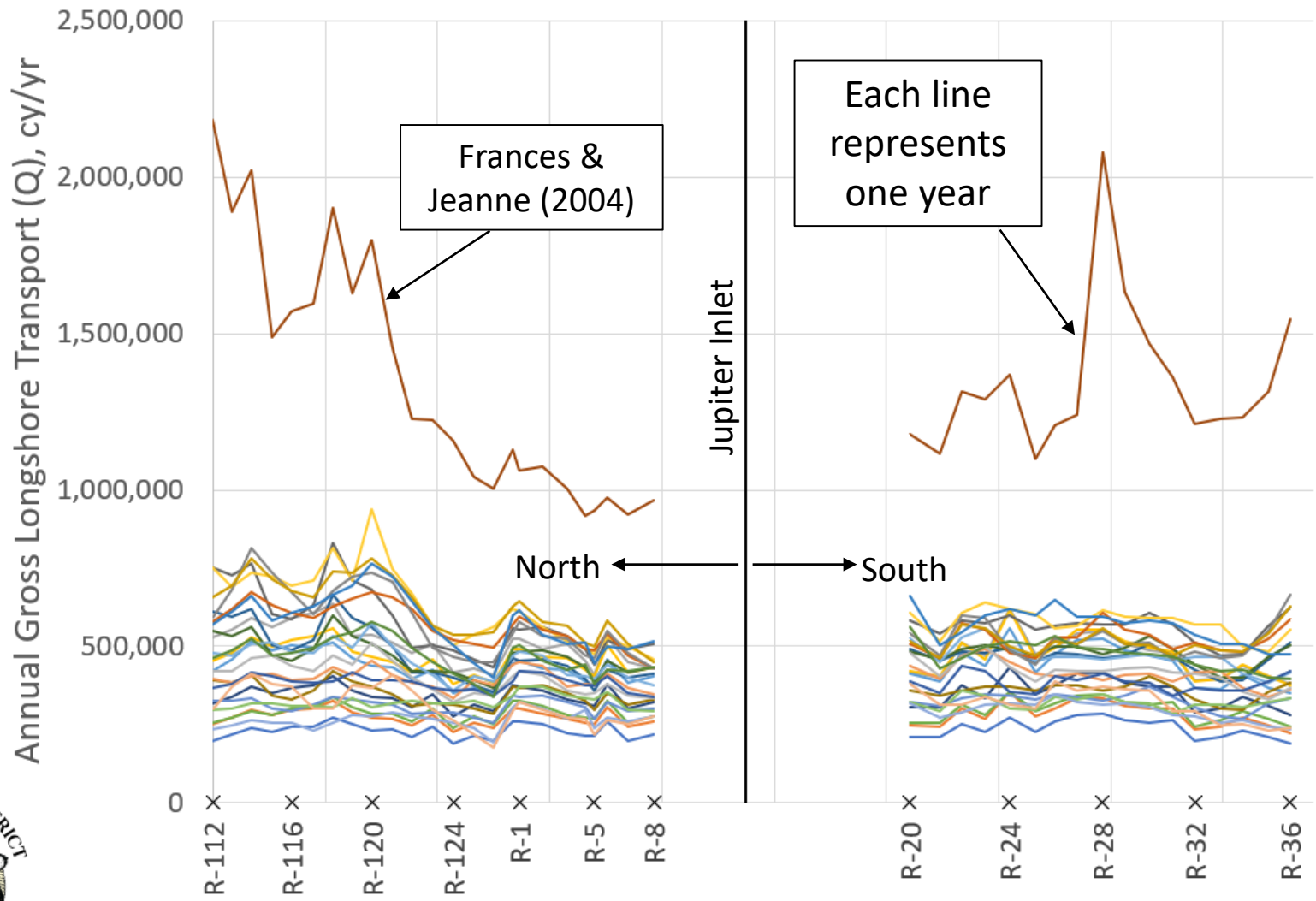 - NDBC buoys

Production Run Dates

Production Run Results

Production Run Results (no 2004)

Production Run Results

Production Run Results

Palm Beach County R-8	Transport	Annual Littoral Drift (Q), cy/yr	
		Average	Standard Deviation
USACE 1966	Net	230,000	90,000
MIKE LP Model, 1997-2022	Net	276,000	129,000
MIKE LP Model, 1997-2022	Gross	394,000	141,000

Sediment Budget

- *Modeled results relatively close to 1966 estimate!*

- Two timeframes:
  - ➢ Post-jetty extension to present
  - ➢ Last 10 years

- Apply modeled longshore transport
  - ➢ Calculate offshore losses
  - ➢ Compare to conflicting previous findings

- Assess bypassing goals

THANK YOU
Questions?