

NEXT GEN U.S. INLETS ATLAS

COASTAL INLET RESILIENCE IN 3D GEOMORPHIC GIS

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1 Oct 2024

COASTAL INLETS RESEARCH PROGRAM
FY24 IN PROGRESS REVIEW



U.S. ARMY



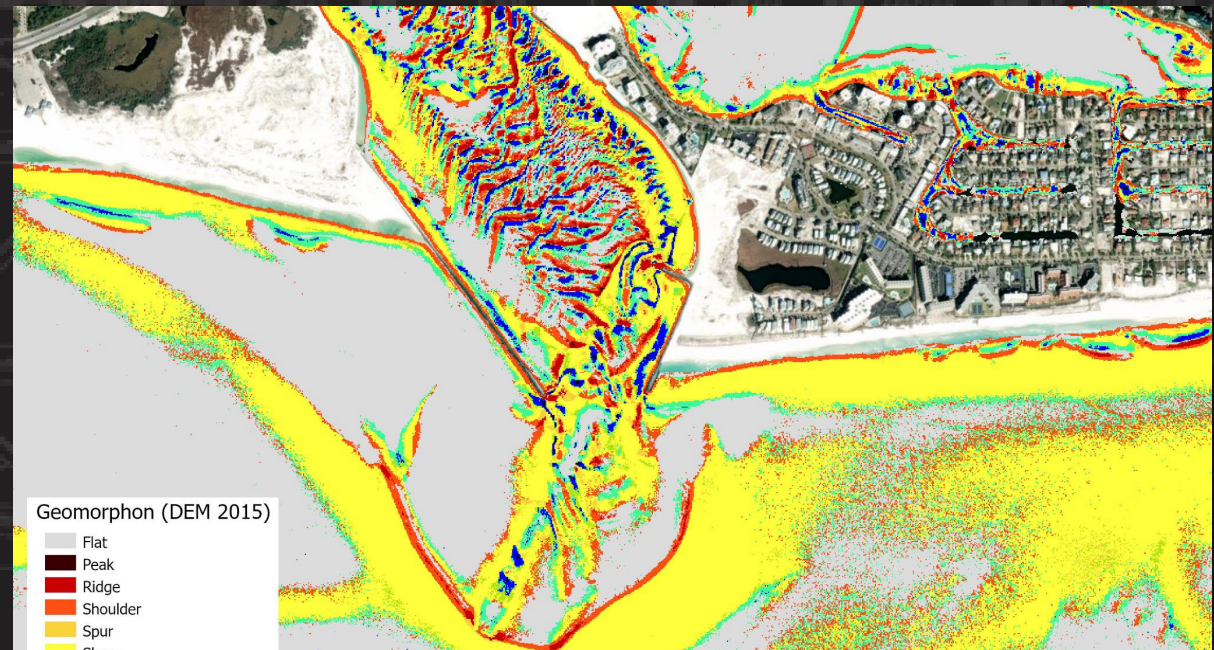
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PROBLEM STATEMENT

The U.S. Tidal Inlets Atlas provides a critical path towards the development and implementation of an **automated workflow** to provide highly detailed and accurate representations of **inlet morphology** and calculations of sediment volumes critical to sediment budget development. The research team shares a vision of a **next-generation U.S. Tidal Inlets Atlas** that is a "one stop shop" for trusted, current, and understandable inlet morphology and sediment volumes. The Atlas will promote **interoperability of information** across USACE business lines to inform ongoing initiatives in the **USACE flood risk management, regional sediment management, and navigation communities**.



Statements of Need:

- FY24 2159 - Shoal Migration and Formation: Technology for Near Real-Monitoring Predictions
- FY23 1829 – Navigation Tools Updates
- FY22 1657 – Remote Sensing of Back Bay Environments

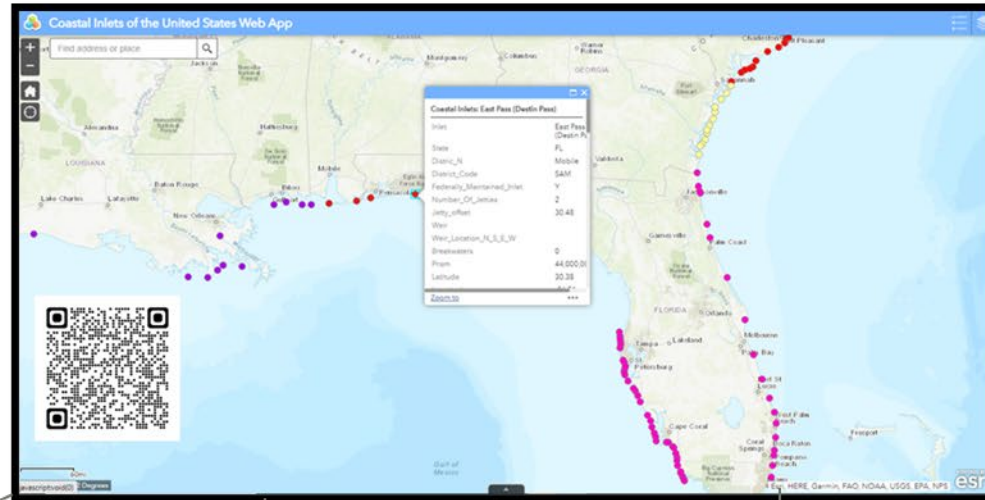
FY24 was Year 2 of 3

New workflows facilitate the rapid integration and assessment of new survey datasets in a timely manner for regional-scale updates of inlet information





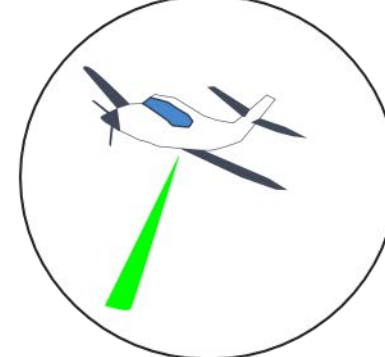
CAPABILITY AND STRATEGIC IMPACT



Beneficial Use
of Dredged Material



Save Time



Leverage USACE Data



“One Stop Shop”




MAJOR FY24 PRODUCT – TECHNICAL NOTE



Status: in EPAS, in review

Impact: Summarizes and applies new tools and techniques for inlet bathymetric analysis to aid tech transfer

Next few slides highlight those results and tools



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MONTH 202?

**Tools for Inlet Geomorphic Mapping: An
Overview and Application at East Pass, FL
and Fire Island Inlet, NY**

*by Justin L. Shawler, Charlene S. Sylvester, Kaitlyn A. McPherran, Matheus de Assis Bose
and Rekea Williams*

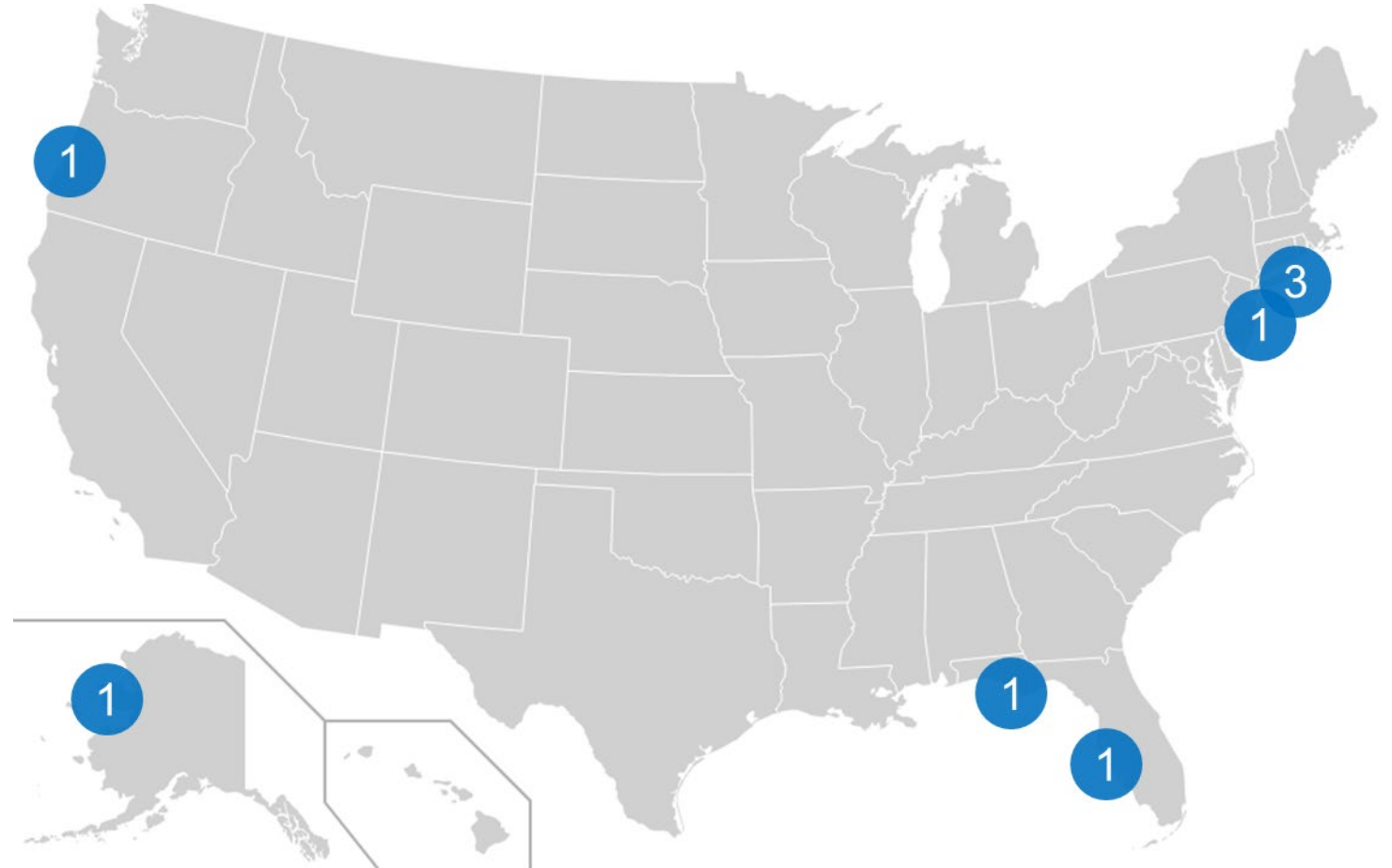
PURPOSE: The purpose of this Coastal and Hydraulics Engineering Technical Note (CHETN) is to highlight new and emerging tools for inlet geomorphic mapping and describe the workflows used to implement the tools and techniques. The Coastal Inlets Research Program (CIRP) manages and maintains the US Coastal Inlets Atlas, which houses technical information on tidal inlets. Future expansion of the Atlas should include ready-made products and workflows that address a call from coastal inlet managers and practitioners to more accurately map inlet geomorphic change and features. The methods and workflows demonstrated in this document represent the first step towards expanding the US Coastal Inlets Atlas.



MAJOR FY24 ADVANCEMENT – MORE INLETS



- Coos Bay, OR
- East Pass, FL (Panhandle)
- New Pass, FL (West Coast)
- Barnegat Inlet, NJ
- Nome, AK
- Moriches Inlet, NY
- Fire Island Inlet, NY
- Wilderness Breach, NY

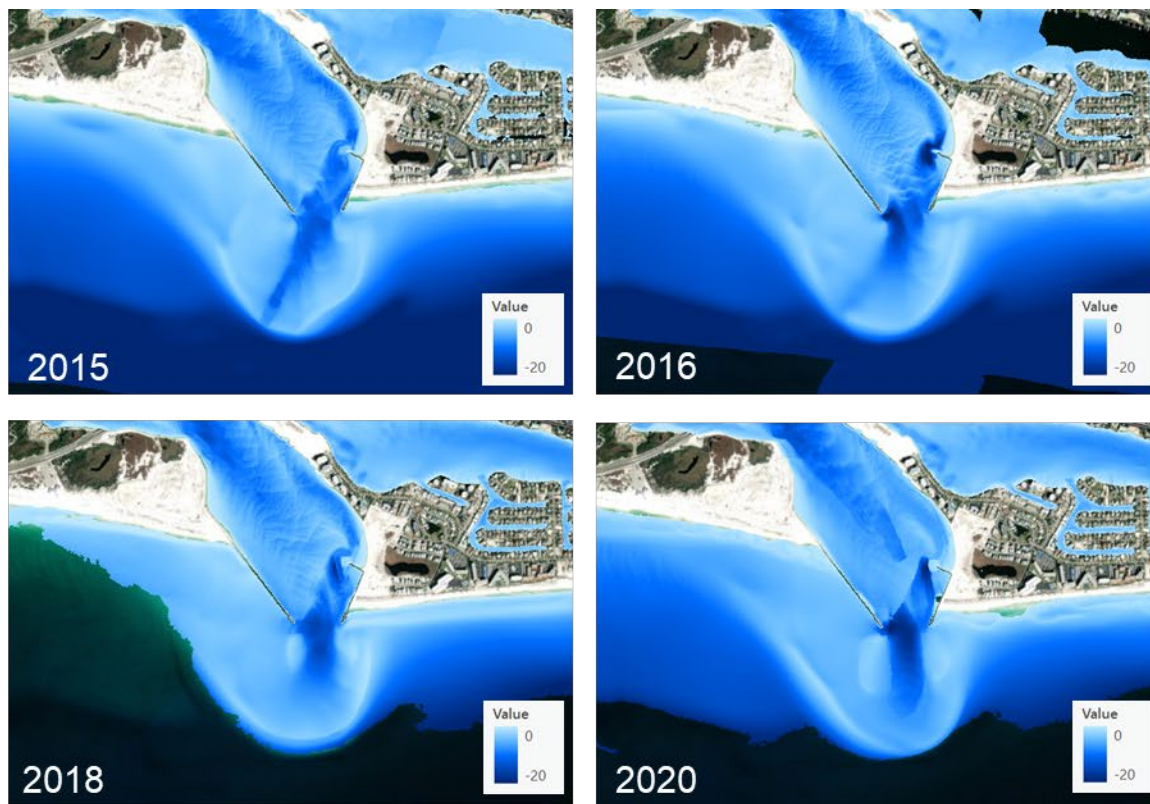




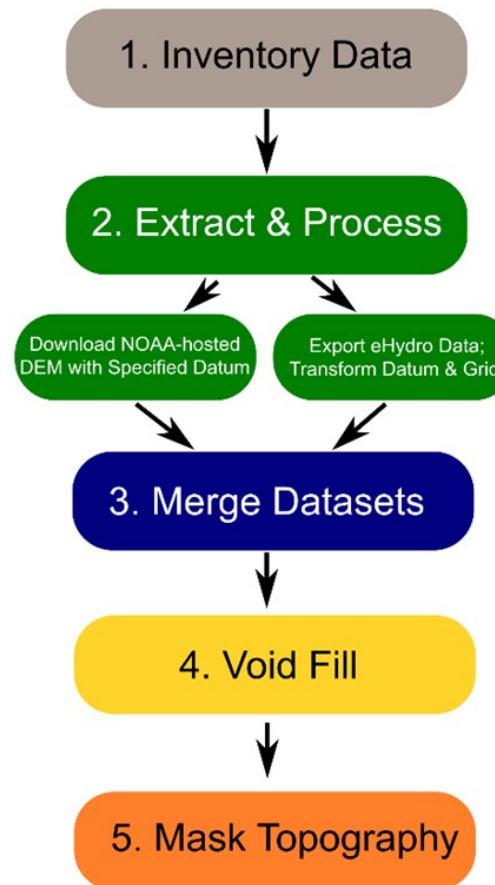
DEM COMPILATION WORKFLOW



- Fills data gaps, increases coverage
- Merges USACE NCMP topobathymetric lidar data with USACE District-collected hydrographic survey data (eHydro)
 - Match datums, coordinate systems, and acquisition dates



East Pass, FL (Panhandle)



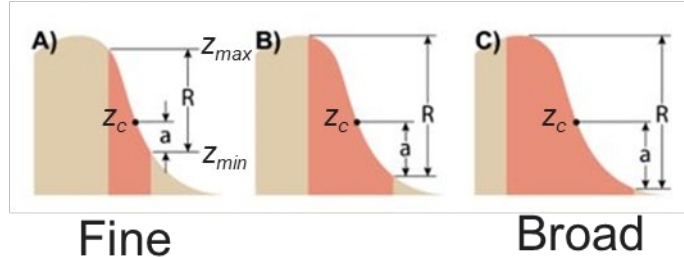


RELATIVE RELIEF



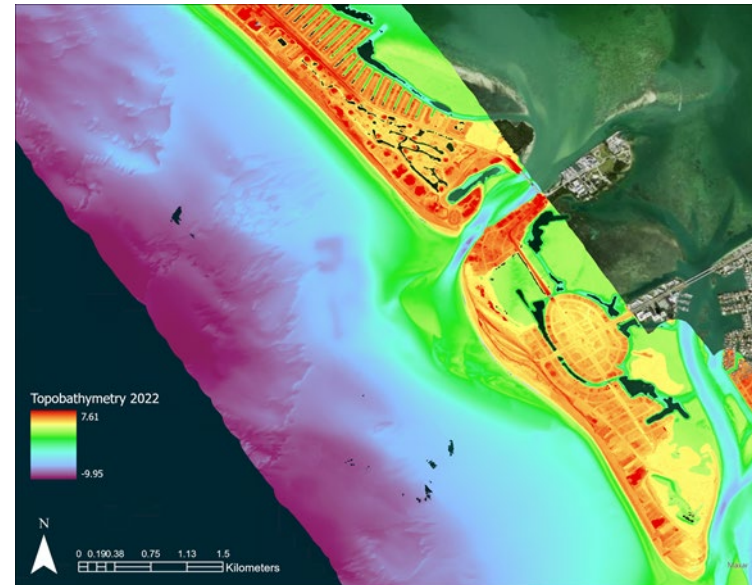
- [Wernette et al. \(2016\)](#) approach applied for dune toe extraction
- Implemented in ArcGIS Pro with a geoprocessing model
- Testing model parameters on multiple inlets

Image modified from Wernette et al. (2016)



$$RR_c = \frac{(z_c - z_{min})}{(z_{max} - z_{min})}$$

where:
 $a = z_c - z_{min}$
 $R = z_{max} - z_{min}$



New Pass Inlet, Florida

Fine-scale RR: 10m window



Broad-scale RR: 30m window

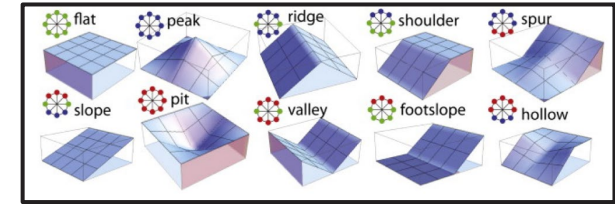




GEOMORPHONS



- [Jasiewicz et al. \(2013\)](#) approach for segmentation of DEMs into 10 geomorphons
- Implemented in ArcGIS Pro
- Testing classification parameters on multiple inlets



Raster cell size = 1m

Flat terrain angle threshold = 1.5

Search distance = 15 m

Skip distance = 4 m



Geomorphon analysis conducted on NCMP bathymetry of New Pass FL (2015).



Raster cell size = 10m

Flat terrain angle threshold = 0.17

Search distance = 150 m

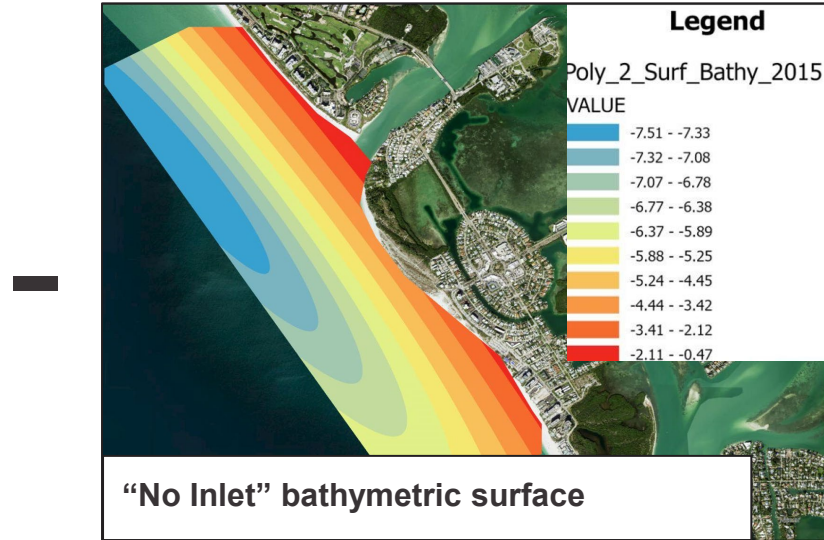
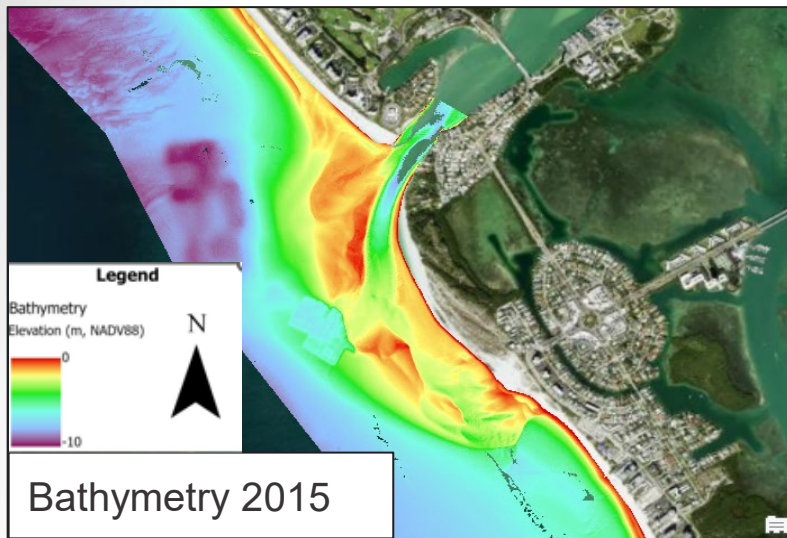
Skip distance = 40 m



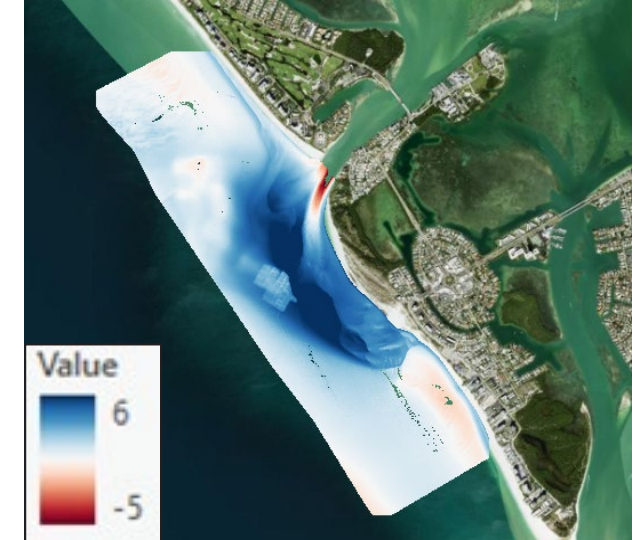
ETD VOLUME - ARCGIS PRO



Method following Beck and Arnold (2019). ArcPy code by Matheus de Assis Bose (ORISE scholar).



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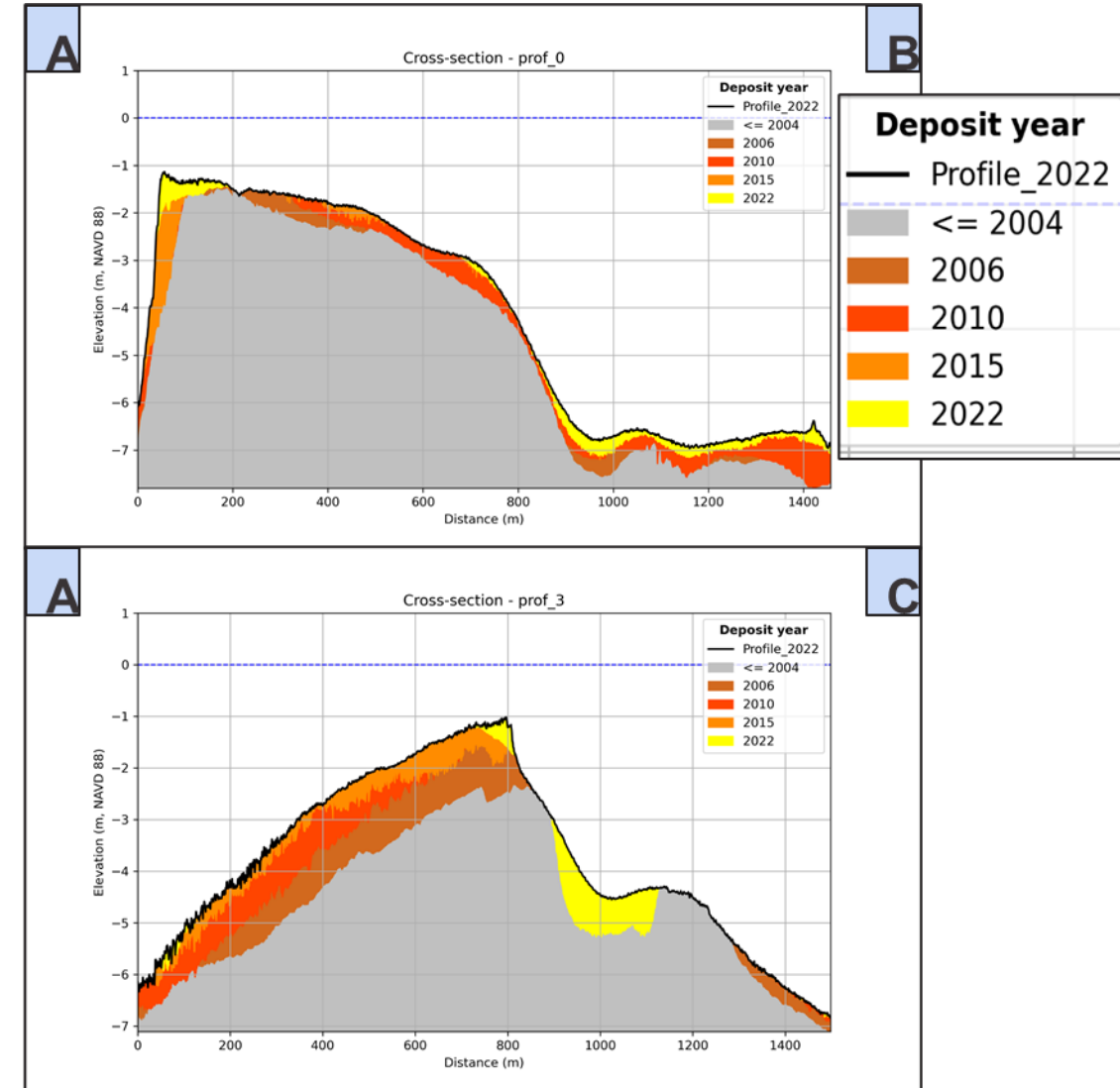
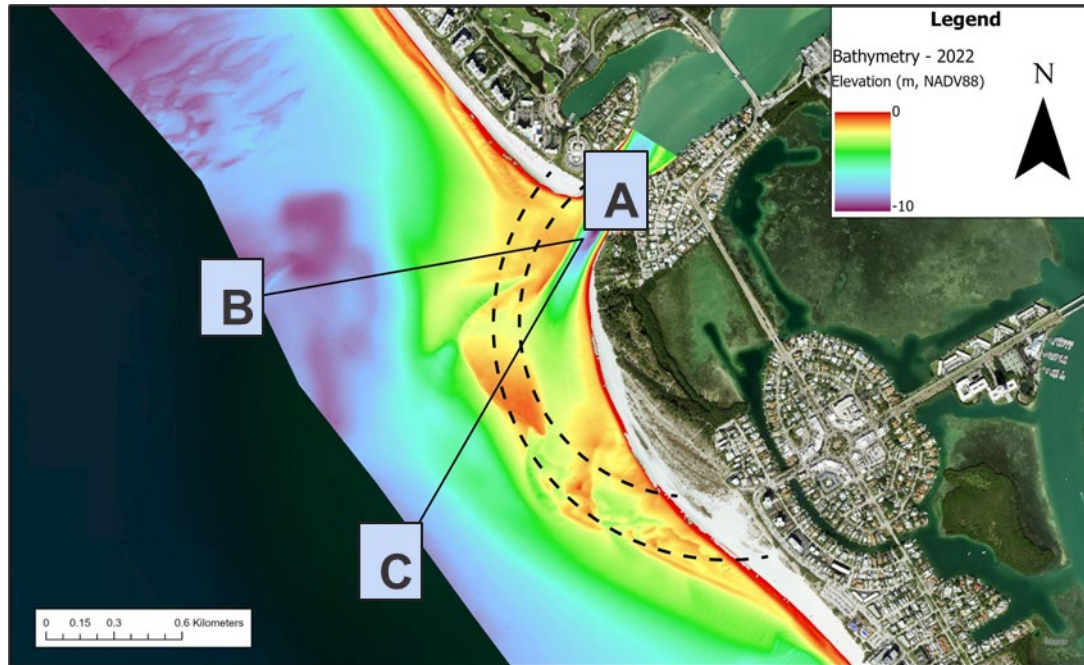
Sum of Positive Values.	
Year	Volume (m ³)
2015	5,814,216.5



CHRONOSTRATIGRAPHIC MAPPING



- Based on approach of Pearson et al. 2022
- ArcGIS Pro ArcPy codebook (de Assis Bose)
- Identify deposit year and thickness

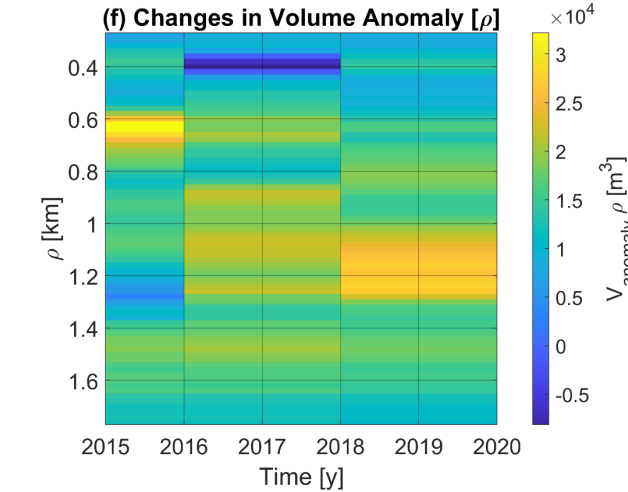
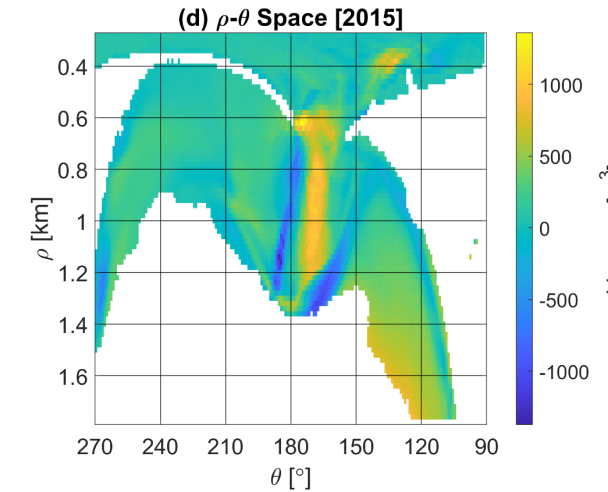
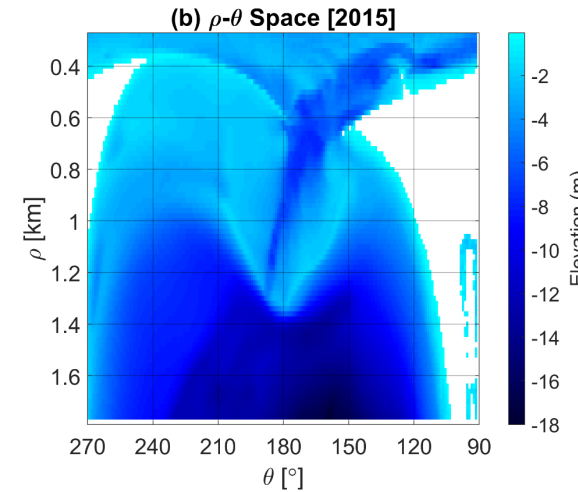
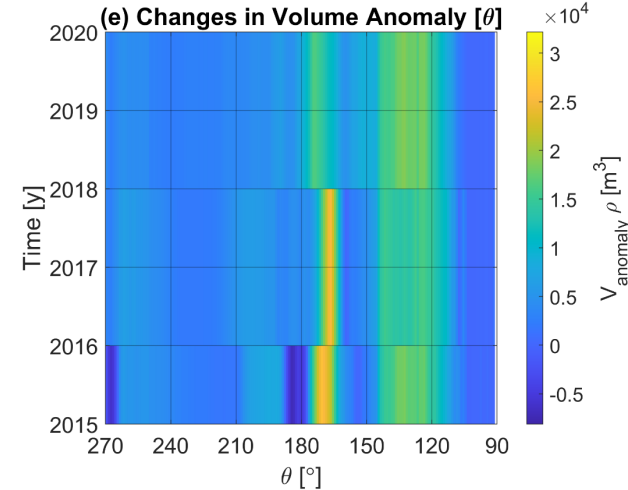
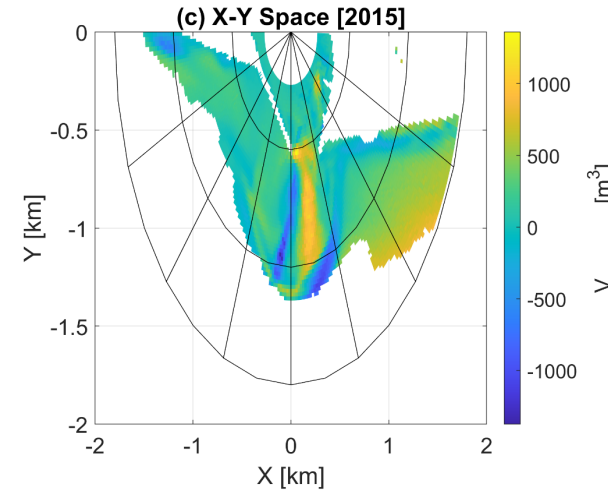
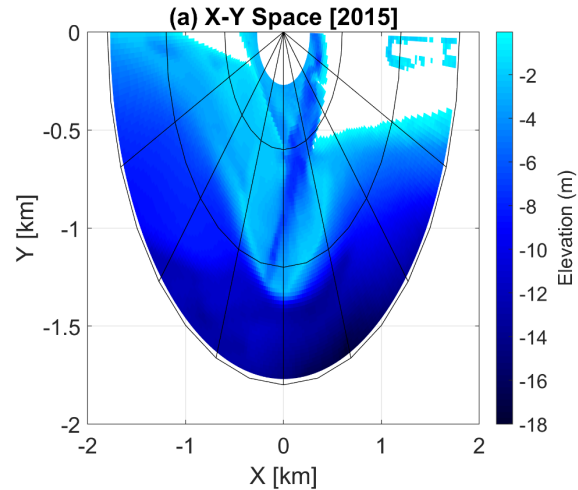




CONFORMAL MAPPING



- Based on approach of Pearson et al. 2022
- Established Matlab workflow
- Tested at multiple inlets
 - East, West, Gulf, Alaska coasts
- Future work = ArcPy code, ArcGIS toolbox?



East Pass FL 2015 bathymetry in XY (a) and polar (b) space. Volume anomaly (above the mean surface) in XY (c) and polar (d) space. Timeseries of rotation (e) and migration (f) of inlet features.





SUMMARY

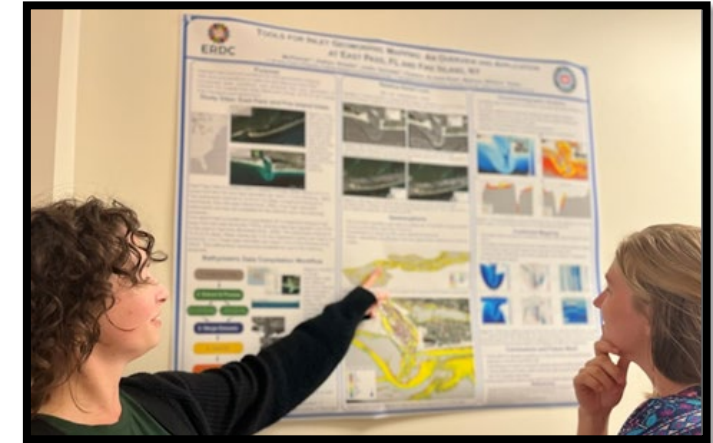


FY24 Major Advancements in Capability

- Conformal mapping MATLAB script
- ArcPro workflows applied to 8 inlets
- Tested tools estimating ebb shoal area and volume
- Met with USACE uCOP for webhosting

FY24 Major Products & Collaborations

- Technical Note in revision
- Poster – ASBPA
- ORISE with University of FL completed
- Summer 2025 ORISE – funds setup



FY25 Products & Advancements

- JALBTCX Workshop conference presentation (Oct. 2024)
- Prototype geodatabase with products from FY23, FY24, and FY25
- Expand analyses/workflows to include geographically and geomorphologically diverse inlets and channels, including US Northeast, Southeast, Great Lakes, West Coast, and Texas Gulf Coast in FY25
- Finalize approaches for using relative relief and geomorphons for extraction of ebb shoal and inlet channel
- TR/JA documenting workflows and expanded database

