

NEXT GEN U.S. INLETS ATLAS

COASTAL INLET RESILIENCE IN 3D GEOMORPHIC GIS

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COASTAL INLETS RESEARCH PROGRAM
 FY23 IN PROGRESS REVIEW



U.S. ARMY



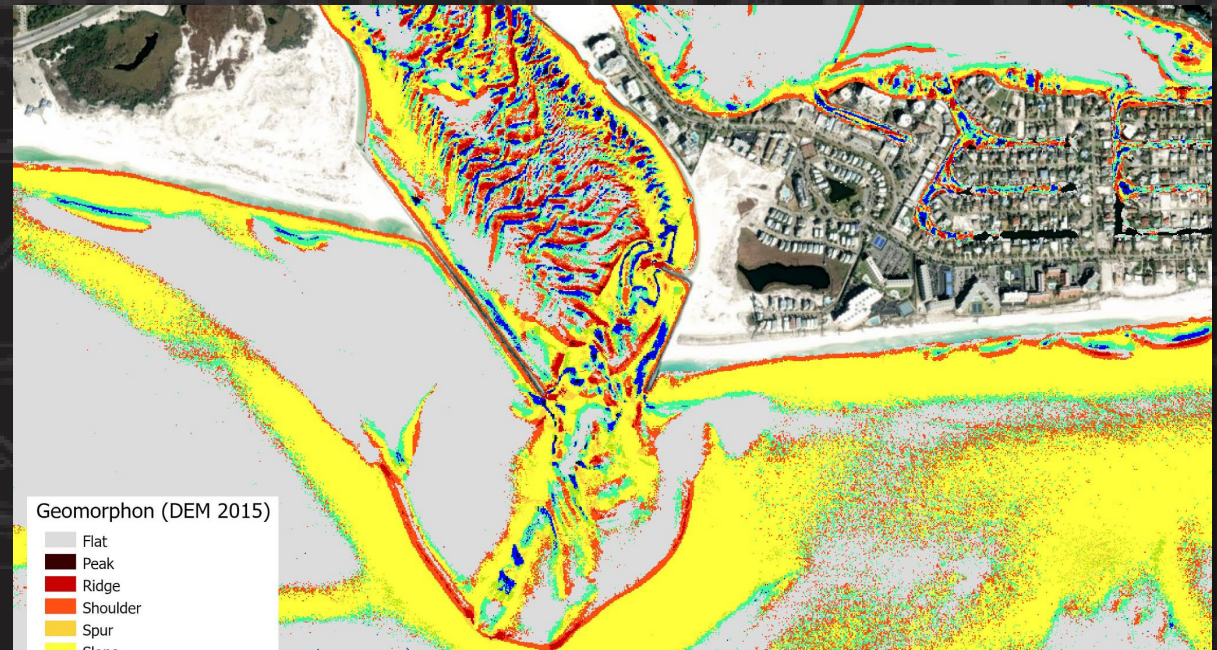
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PROBLEM STATEMENT



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

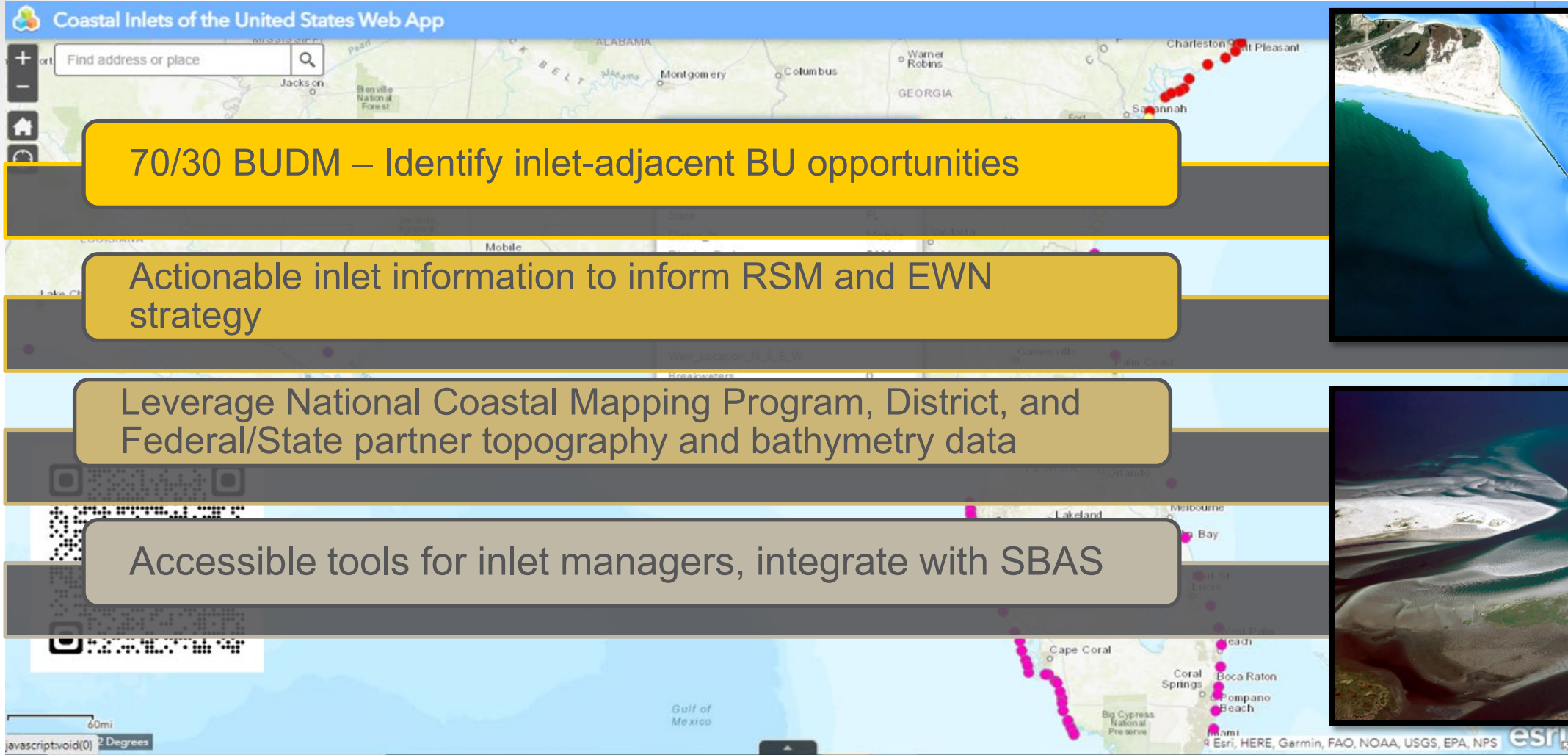
FY22 1657 – Remote Sensing of Back Bay Environments

FY23 was Year 1 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

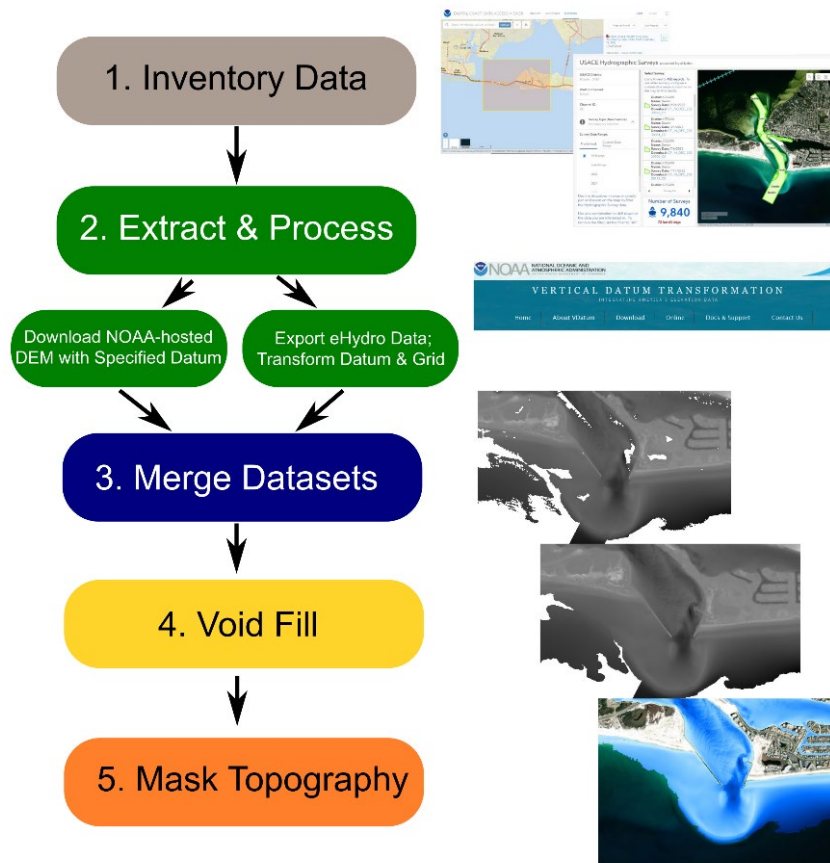




DEM WORKFLOW



- Inventory and download of available bathymetric datasets from NOAA Digital Coast (includes USACE NCMP) and eHydro Hydrographic Survey Viewer
- Post-processing to align surveys with respect to horizontal projections and vertical datums
- Mosaic, fill data voids, and mask topography
- QAQC
- Implemented in ArcPro – Williams support



East Pass Inlet, FL
2015 USACE NCMP Topobathy Lidar
2016 USACE NCMP Topobathy Lidar
2018 USACE Post-Michael Topobathy Lidar & CF_14_DEC_20181109_CS eHydro data
2020 NOAA NGS Topobathy Lidar & CF_14_DEC_20200624_AD eHydro data
Fire Island Inlet, NY
2016 USGS CoNED DEM
2017 USACE NCMP Topobathy Lidar & NY_22_FII_20170428_CS eHydro data
2020 USACE NCMP Topobathy Lidar & NY_22_FII_20200330_CS eHydro data
2022 USACE NCMP Topobathy Lidar & NY_22_FII_20220425_CS eHydro data

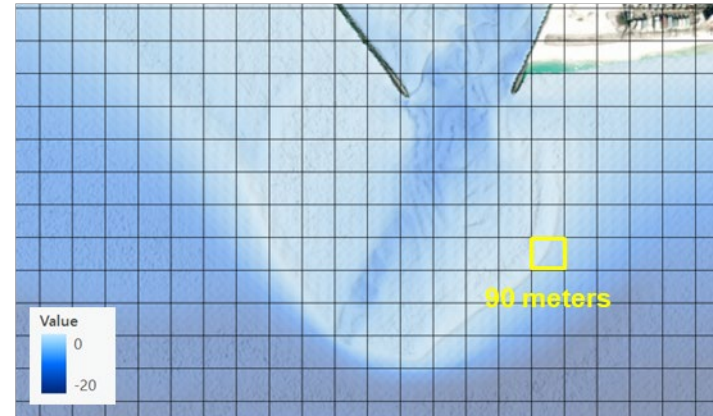
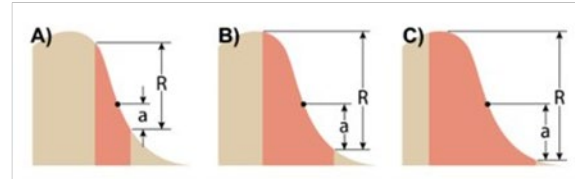


RELATIVE RELIEF

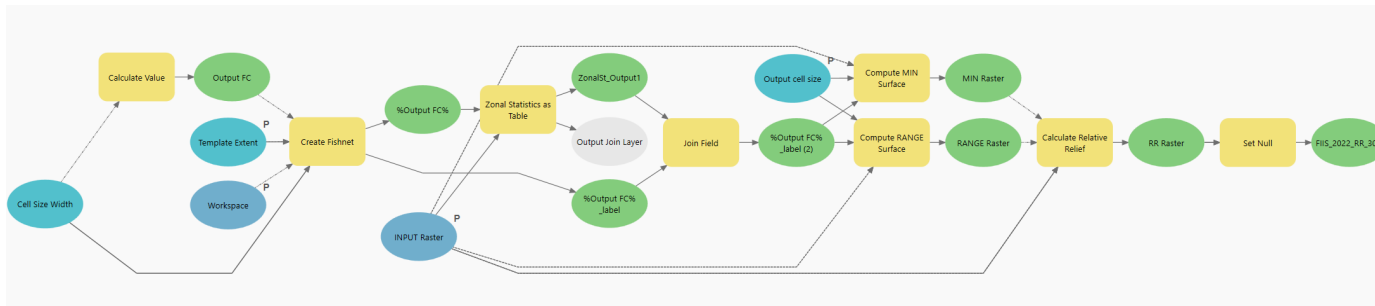
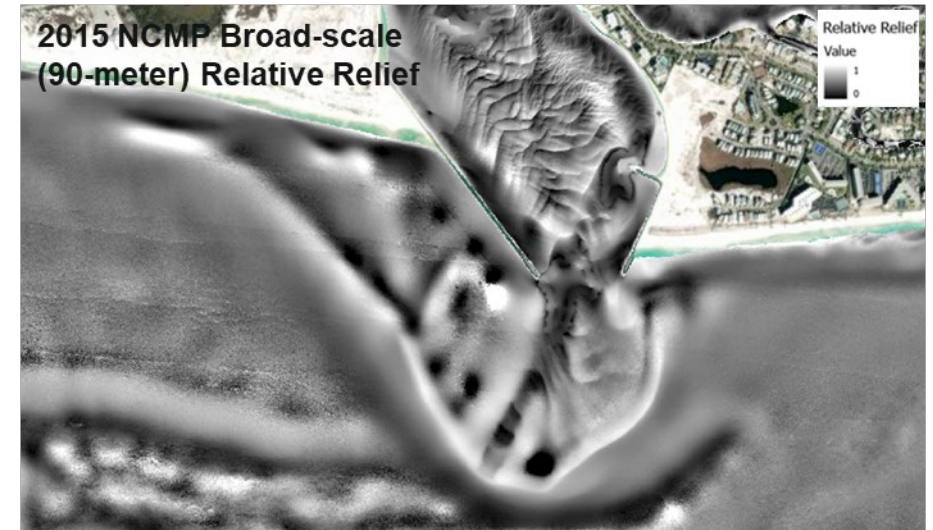


- [Wernette et al. \(2016\)](#) approach applied for dune toe extraction
- Compares DEM cells to those in a neighborhood
- Compute at fine and broad-scale
- Implemented as a Geoprocessing Model in ArcGIS Pro 3.x

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



2015 NCMP 3-meter DEM at East Pass Inlet with broad-scale (90-meter) neighborhood

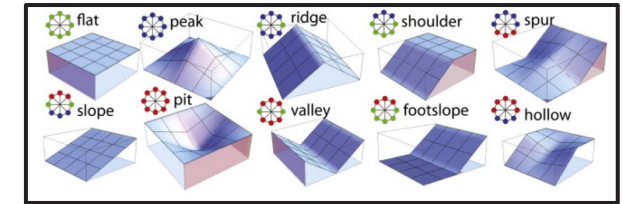




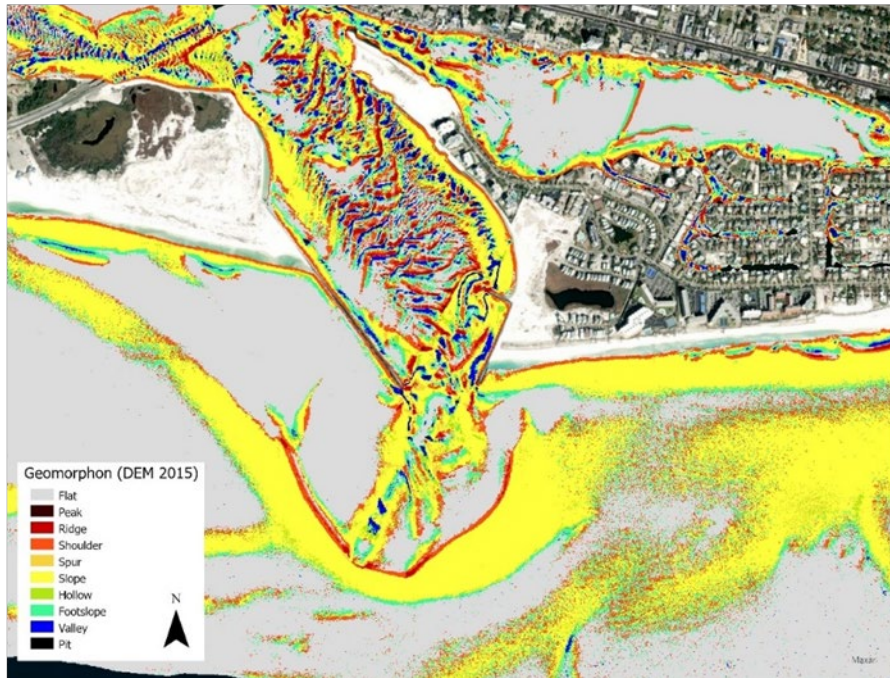
GEOMORPHONS



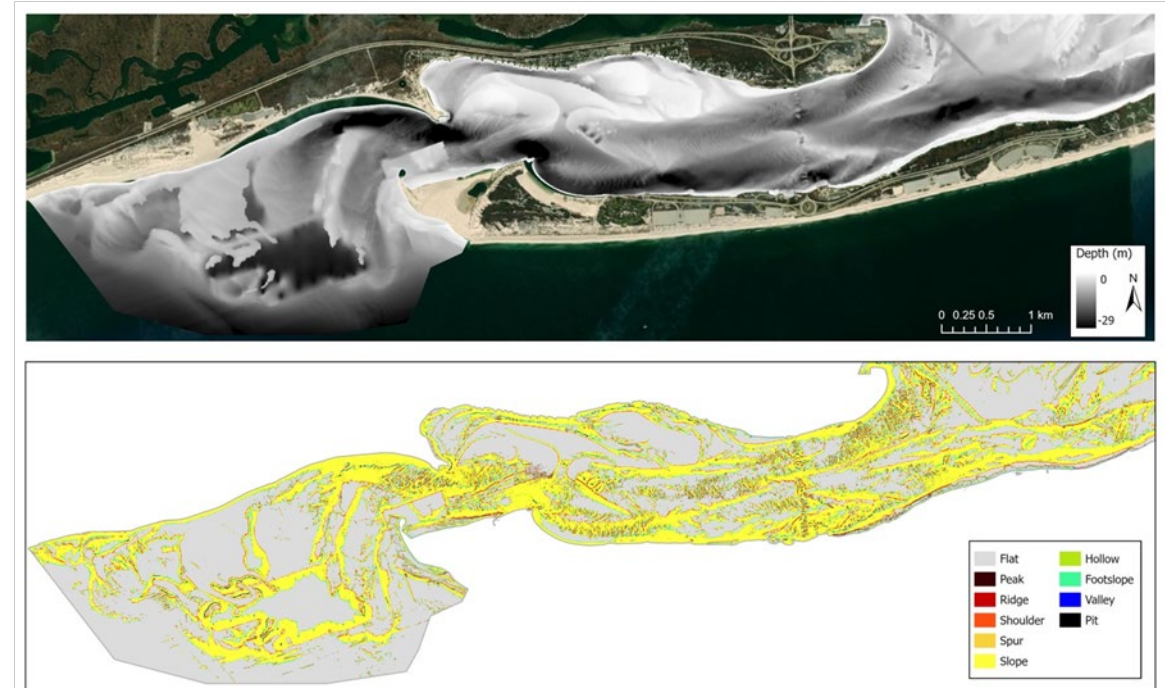
- [Jasiewicz et al. \(2013\)](#) approach for segmentation of DEMs into 10 geomorphons
- Implemented in GRASS GIS or ArcGIS Pro 3.x.
- ArcPro application and parameter evaluation – De Assis



East Pass Inlet, FL
 Flat terrain angle threshold = 1.3
 Search distance = 15 m
 Skip distance = 4 m



Fire Island Inlet, NY
 Flat terrain angle threshold = 1.7
 Search distance = 15 m
 Skip distance = 4 m





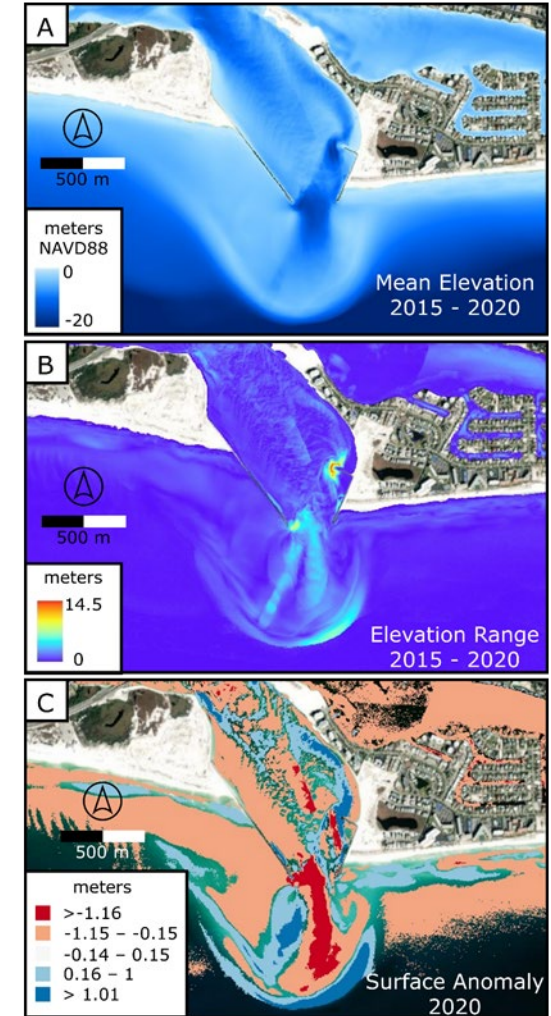
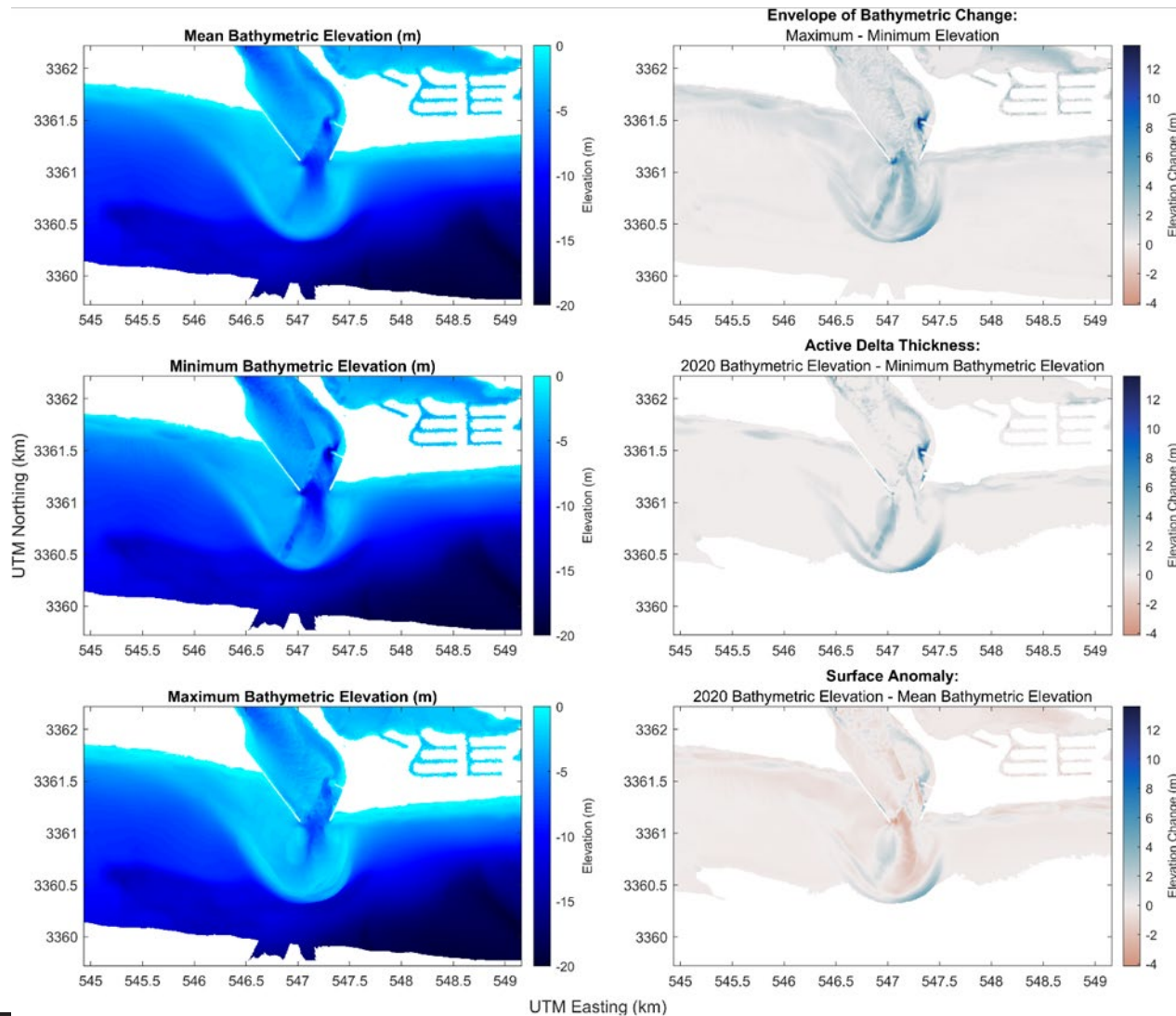
STRATIGRAPHIC MAPPING



MATLAB – K. McPherran

ArcGIS Pro – Sylvester/Bose

- Based on approach of Pearson et al.
- Replicated MATLAB workflow
- Alternative in ArcGIS Pro: multi-dimensional datasets



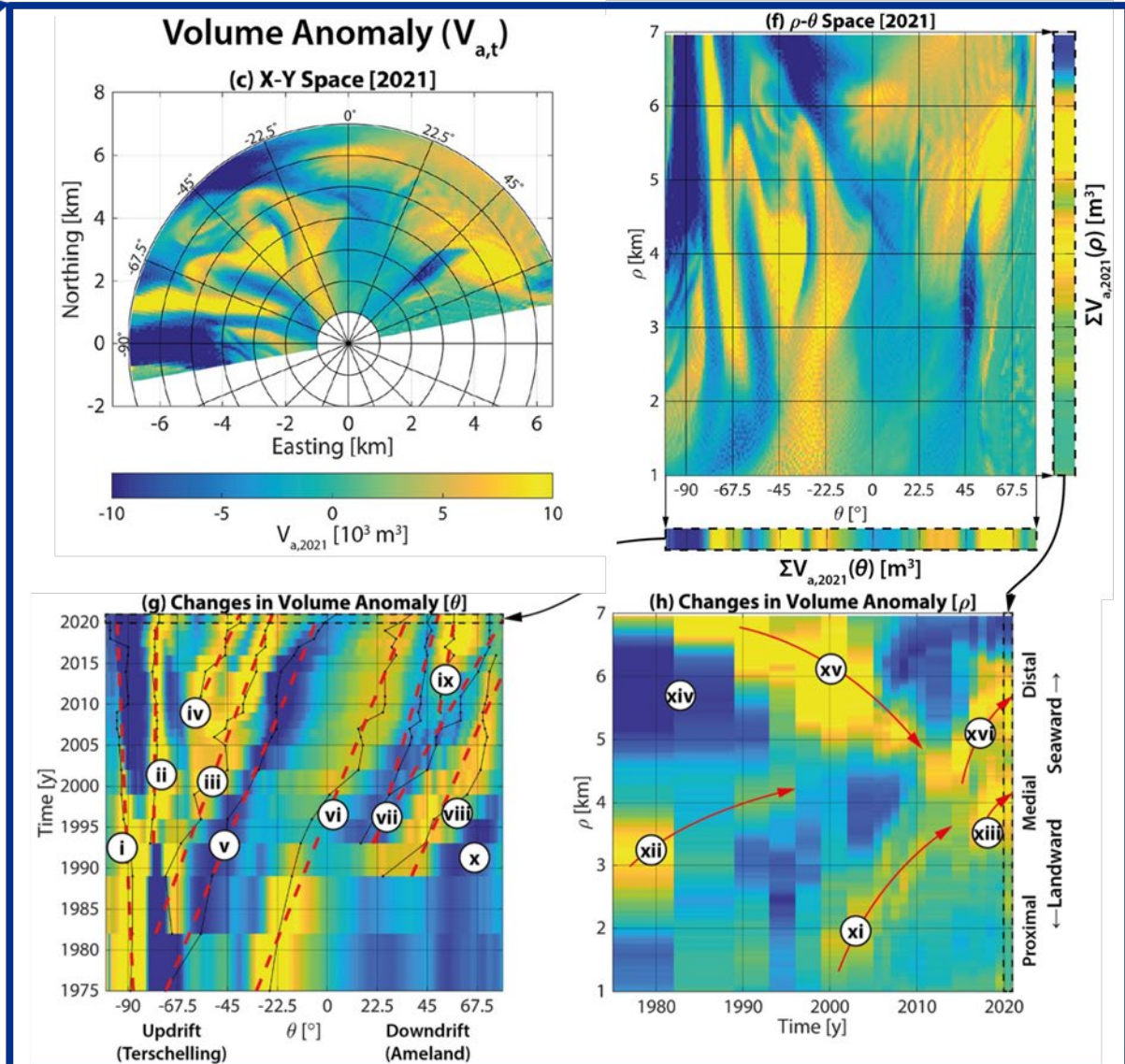
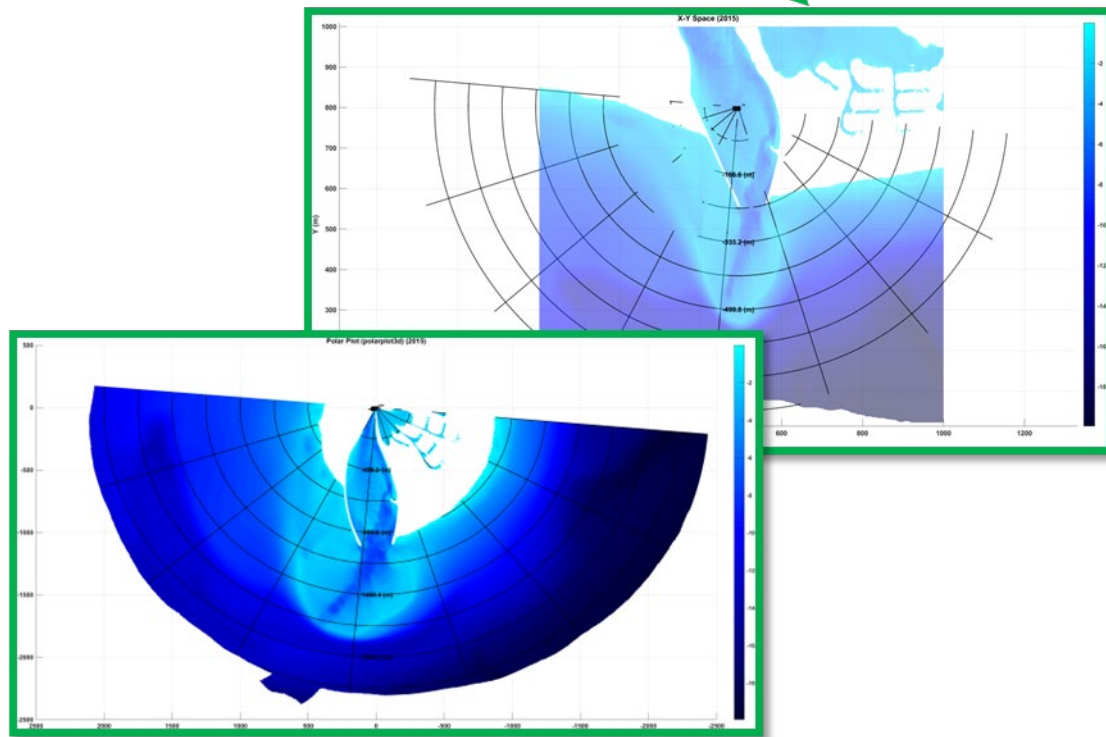
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CONFORMAL MAPPING



- Based on approach of Pearson et al.
- Working on MATLAB workflow
- Future work = ArcPy tool





SUMMARY



FY23 Major Advancements in Capability

- Workflow for DEM products
- Multi-dimensional dataset products
 - Statistical surfaces
- Geoprocessing model for relative relief products
- Geomorphons input parameter evaluation and sample products
- Conformal mapping Matlab script

FY23 Major Products & Collaborations

- PDT Kickoff Meeting – March '23
- Tech Note – May '24
- Tech Discussion – Feb '24
- ORISE with University of FL

FY25 Products & Advancements

- Prototype geodatabase with products from FY23 and FY24
- 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 FY24 and FY25
- Evaluate approaches for using relative relief and geomorphons for extraction of ebb shoal and inlet channel
- TR/JA documenting workflows and expanded database