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Description/Challenges

- Standardize the use of 1) spatial and 2) meteorological and oceanographic data for defining sediment budgets and reducing the uncertainty in estimates and variability
- Determine the amount of sediment entering/leaving a system and quantify the inlet sink for balancing the budget.

Objectives

- Develop tools and methods to utilize spatial and hydrodynamic data to provide input into a sediment budget
- Provide access to data and tool via a web service

BLUF: RPAT is an ArcGIS data calculator and semi-automated methods to facilitate gathering regional process information, and "smart analysis" of lidar bathymetry and topography to extract volume/shoreline change for the purposes of constructing sediment budgets and providing boundary/quality-control information for numerical models. This work addresses Statement of Need (SoN) 2013-N-5 "Automated Feature Extraction for Sediment Budgets."

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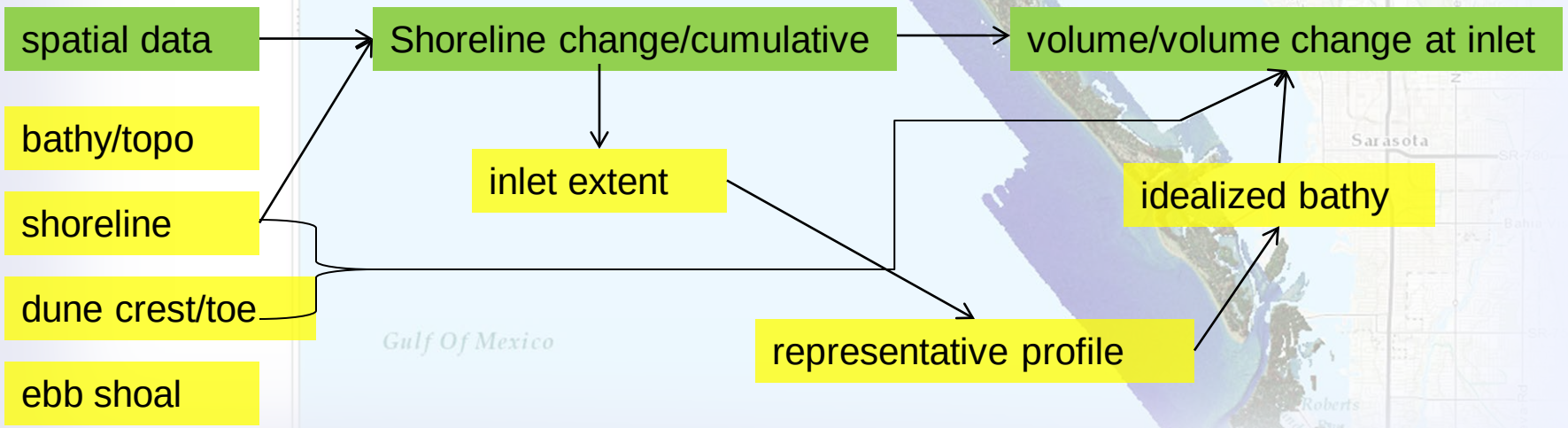
Approach

- Longshore sediment transport rate calculator using WIS data
- Provide input into sediment budgets utilizing three-dimensional spatial data
  - Shoreline change and cumulative change
  - Inlet influence extent
  - Representative profile
  - Delineate ebb shoal feature
  - Volume/volume change at inlet



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Longshore Transport Rate

- <u>WaveNet application</u>
  - Downloading script to extract and pre-process oceanographic tidal data
  - Download based on time range, water level datum, data interval, and observed data type

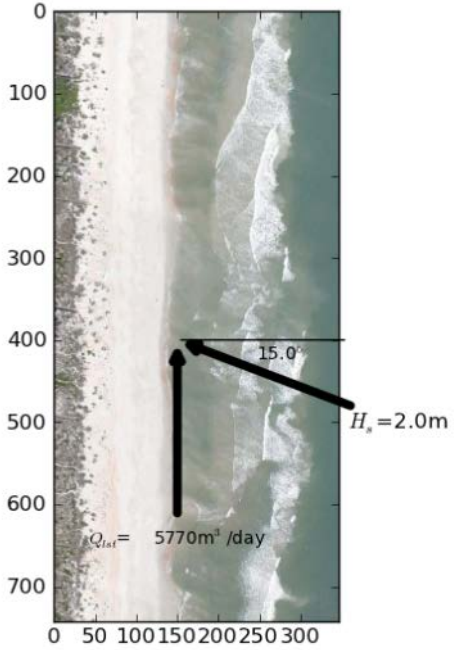
- <u>Longshore transport rate</u>
  - Ingest nearshore wave conditions
  - User input data or from WIS

Wave Height, Hs[m]:	2.0
angle, α[degree]:	15
Water Depth, hb[m]:	2.0
Grain Size, d50[mm]:	1.0
Water Density, ρ[m³/day]:	1024

Submit

These Are The Long Shore Transport Results	
Wave Height[m]	2.0
Wave Angle [deg]	15.0
WaterDepth [m]	2.0
GrainSize [mm]	1.0
WaterDensity [kg/m³]	1024.0
Long Shore Transport [m³/day]	5770.2

$$Q_{Lst} = \frac{k\rho_w}{16(\rho_s - \rho_w)(1-n)} g h_b H_s^2 \sin(2\alpha)$$



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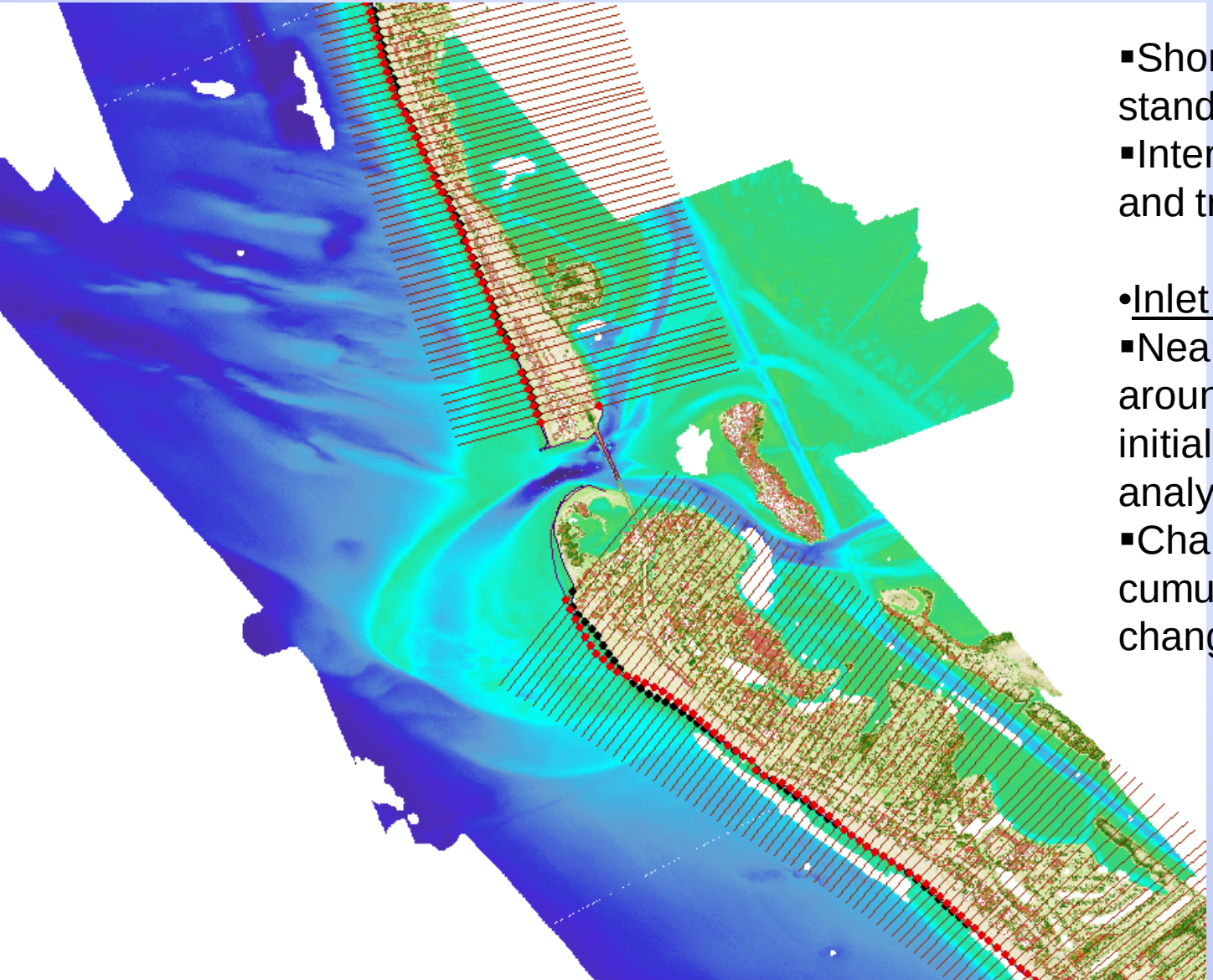
Shoreline Change



- Shoreline vector – standard NCMP product
- Intersect shoreline vector and transects

- <u>Inlet influence extent</u>
- Nearest neighbor search around inlet to create initial boundary for change analysis
- Change in slope of cumulative shoreline change for inlet extent

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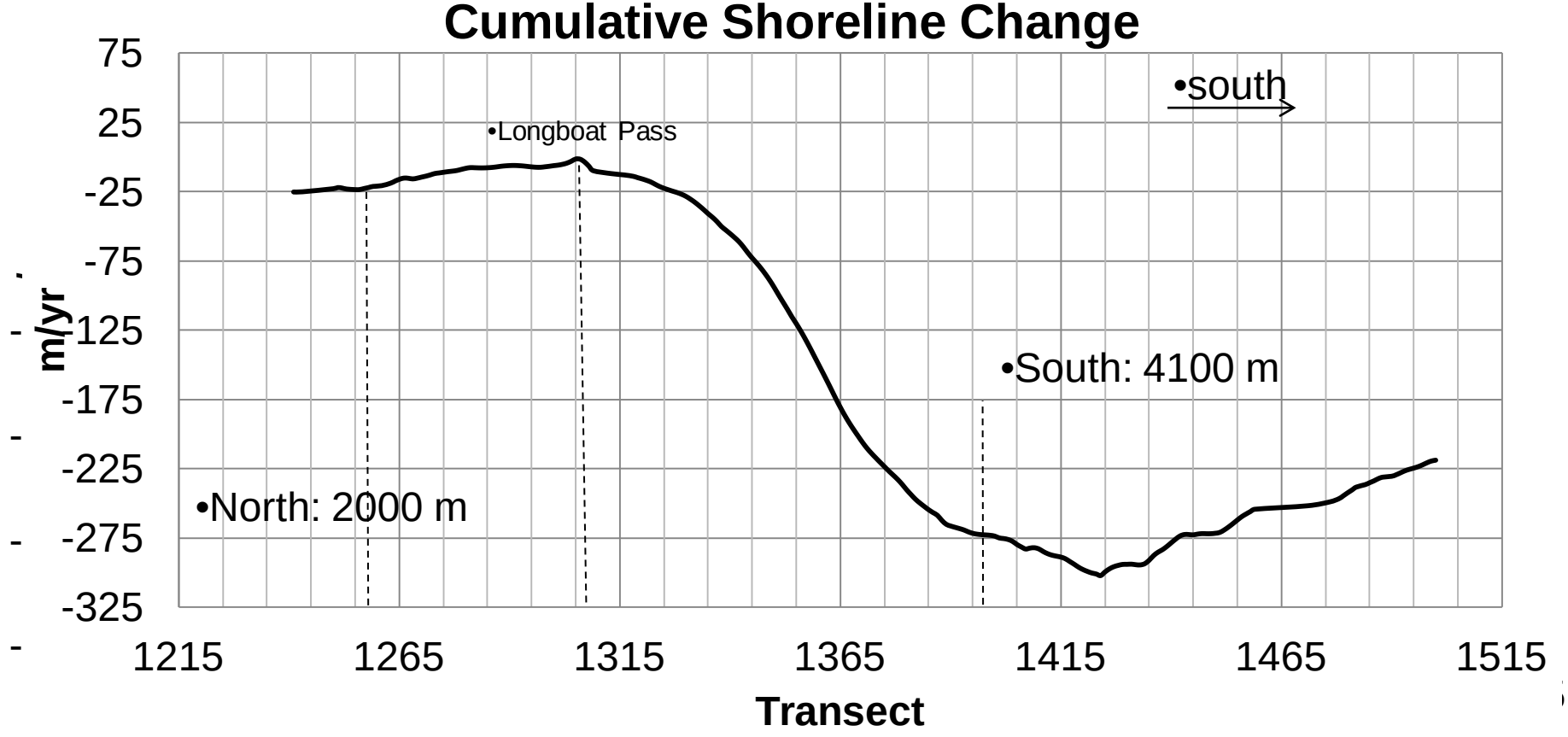
Shoreline Change



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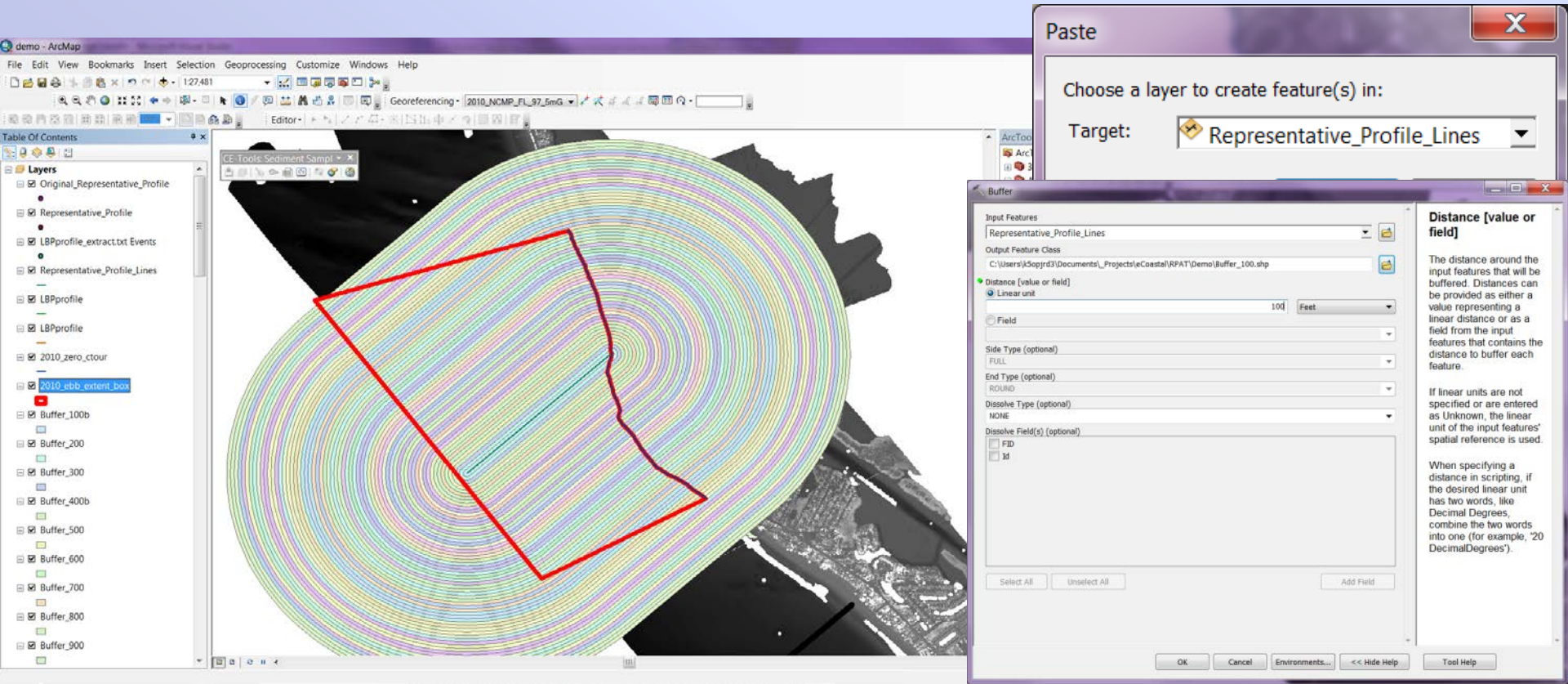
Representative Profile

- Use the representative profile to create idealized bathymetry for the inlet area
  - Move representative profile to center of inlet area using shoreline contour to define angles
  - Create buffers around the initial representative profile at varying spacing



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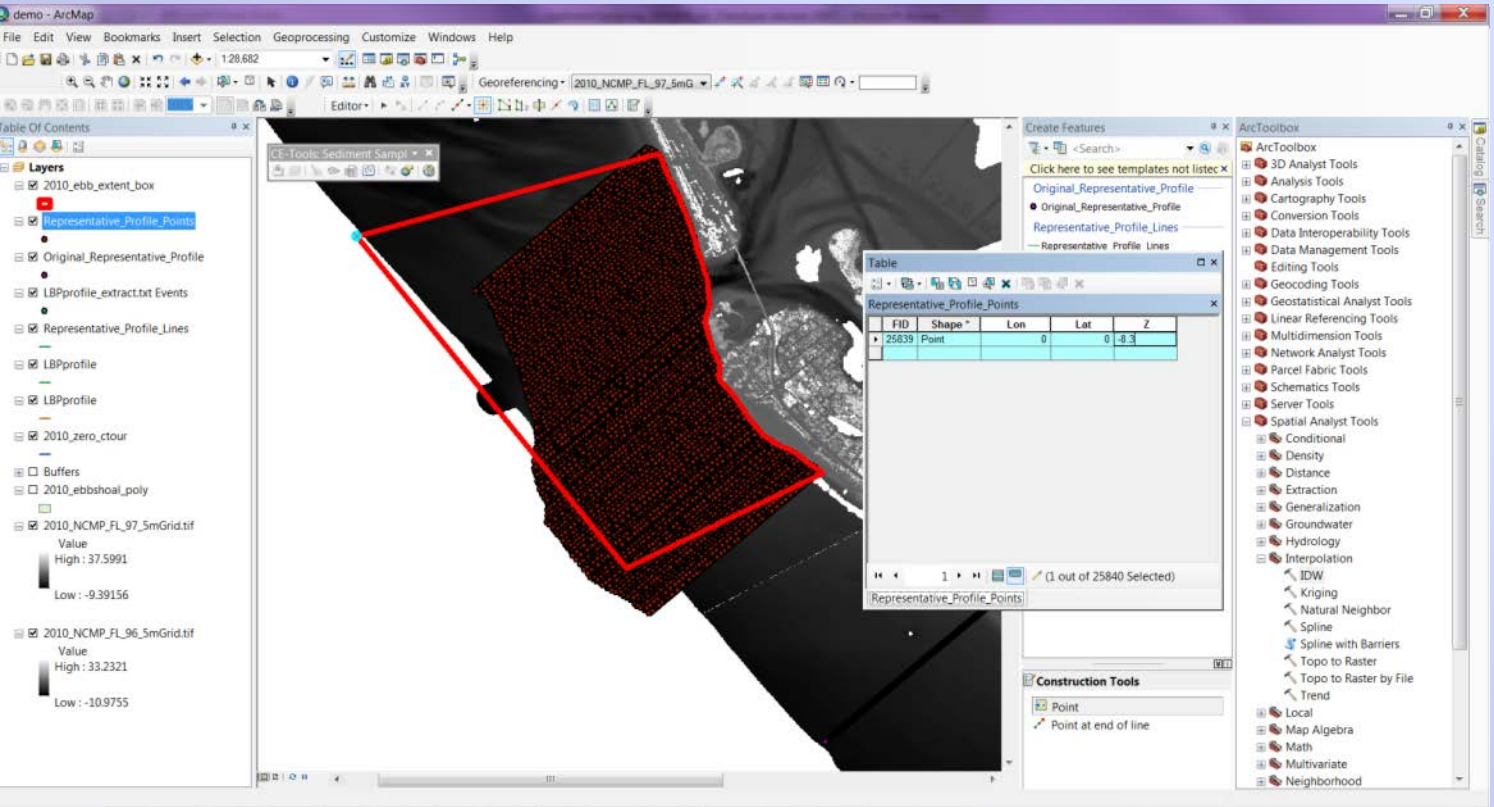
Idealized Bathymetry

- Create the idealized bathymetry
  - Extend the profiles to cover the inlet area
  - Interpolate the profiles to create a grid to use for comparison with existing bathymetry



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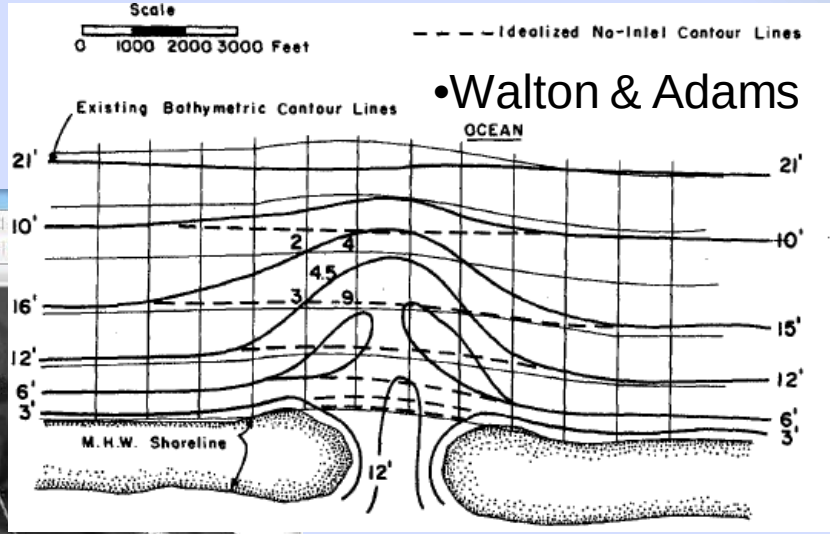
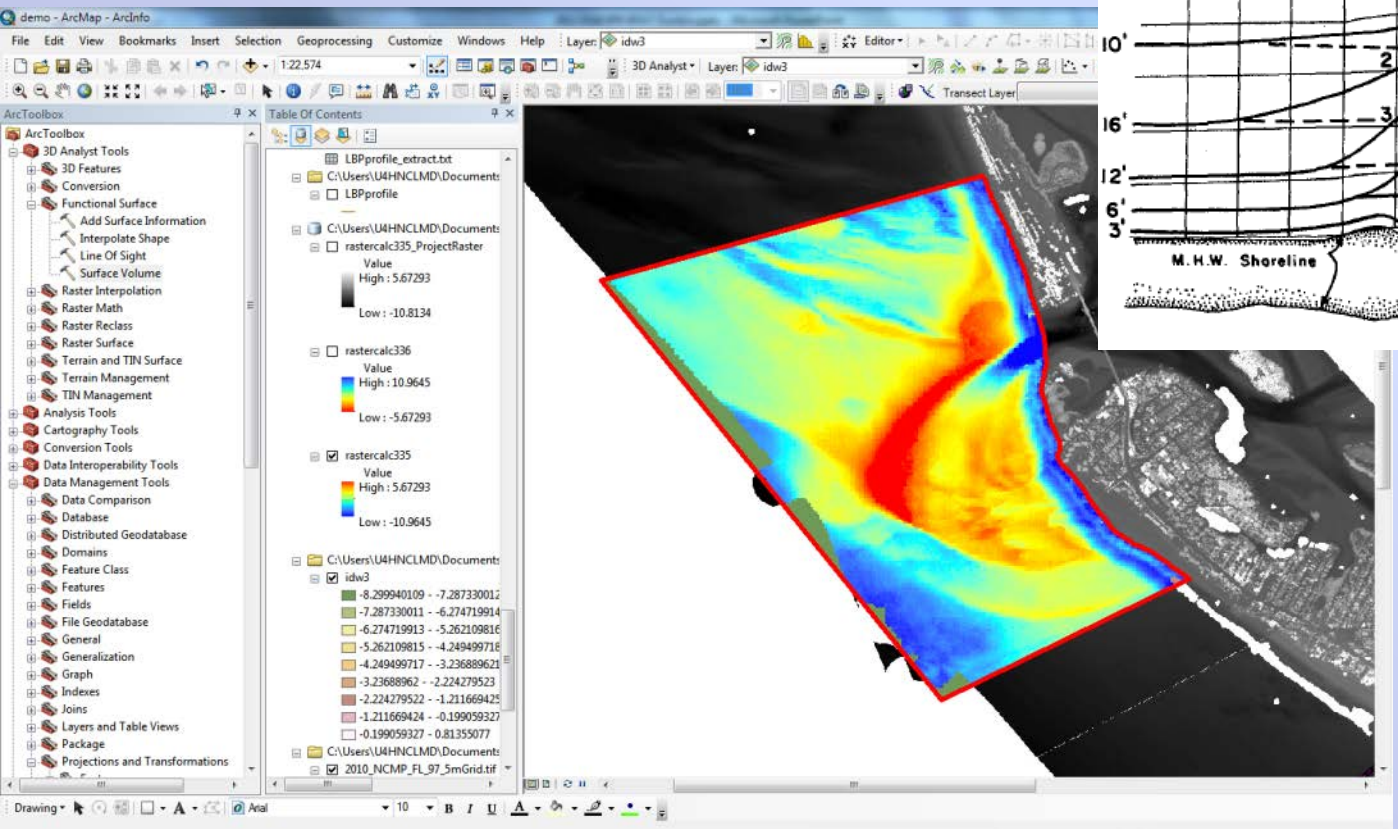
Idealized Bathymetry

- Compare the idealized 'no inlet' bathymetry with the existing bathymetry
  - Volume in inlet area



•Walton & Adams



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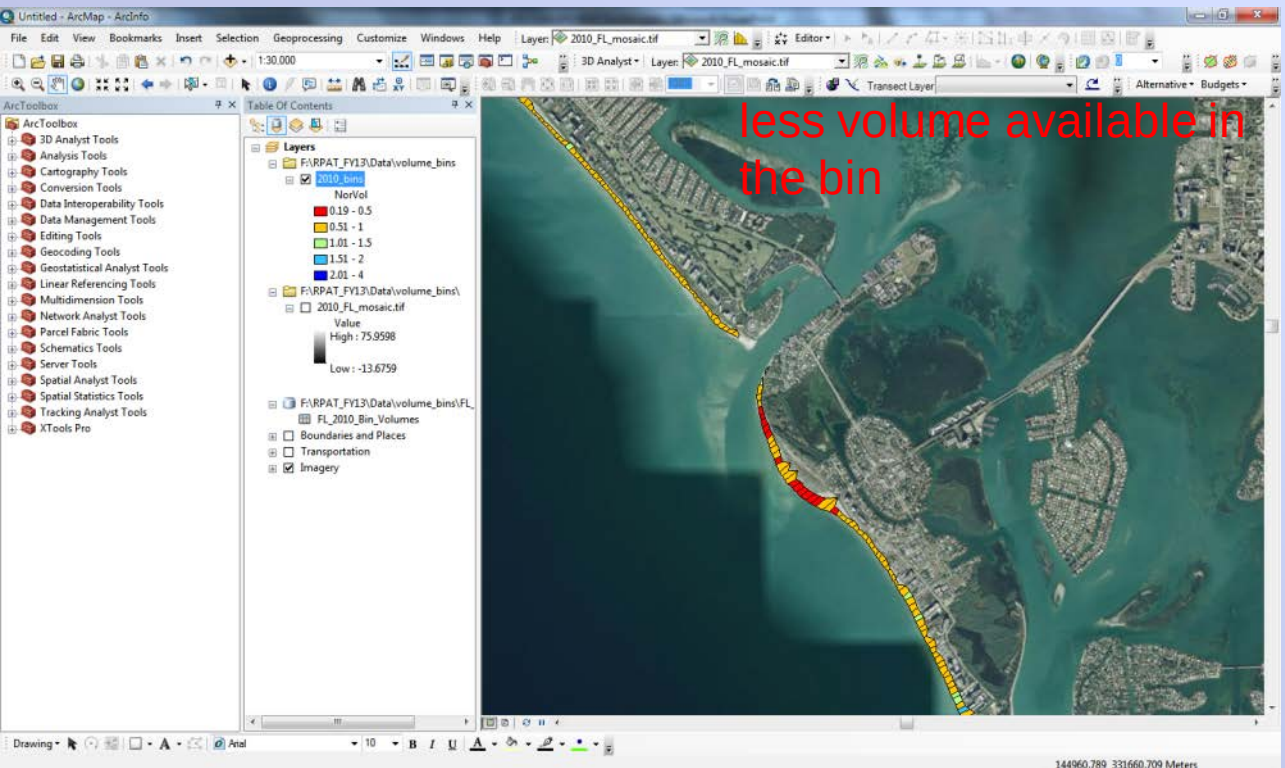
Volume

- ArcGIS tool that calculates volume available using a seaward and landward boundary, such as the shoreline and dune line or back line (landward limit of dune field)
  - Volume calculated for each bin created (transect lines are used to divide the region alongshore)



- Total Volume and Area of each bin are calculated
- For comparison between bins, the volume is divided by the area to account for larger/smaller bin sizes

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Volume Change

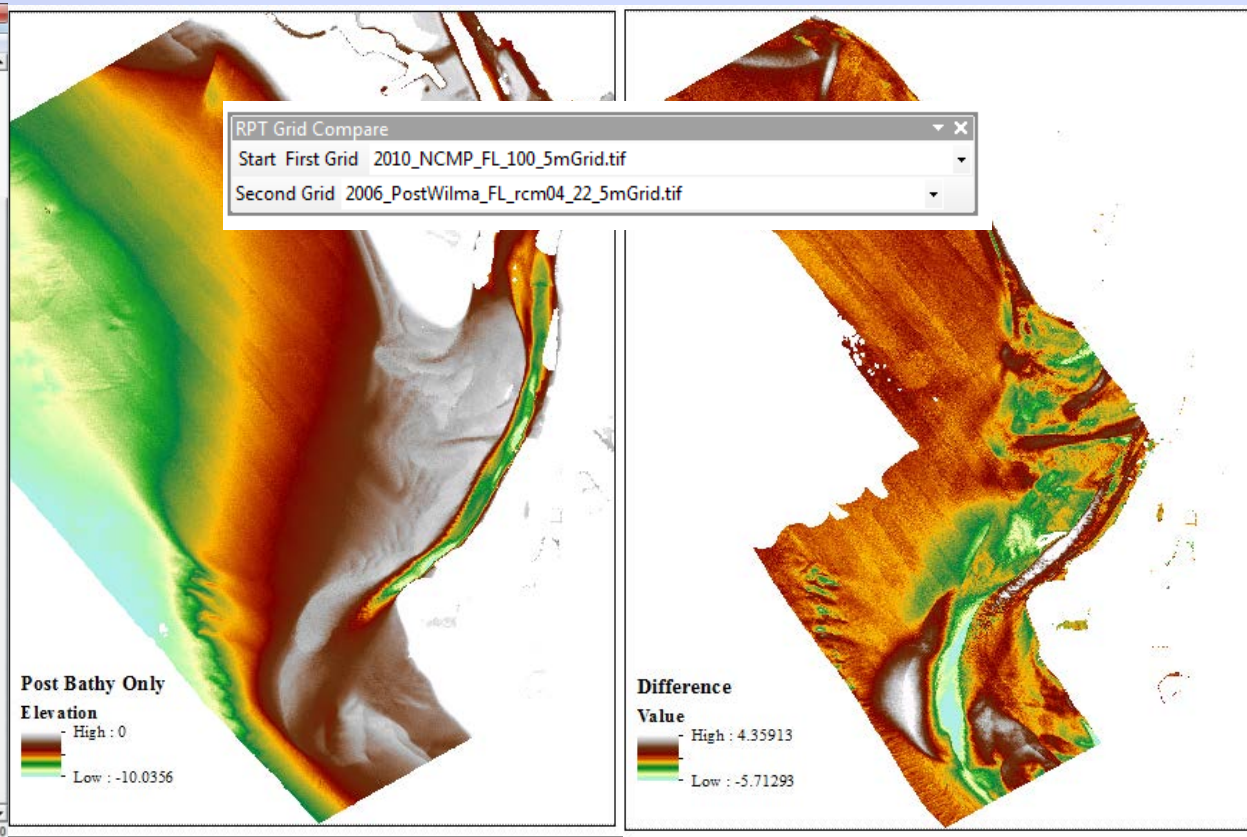
- ArcGIS toolbox that allows the user to select the before and after raster grids for volume change comparison
  - Ebb shoal feature, inlet influence extent bounding box, or other boundary can be used to clip the volume change grid

volume_change.py - F:\RPAT_FY13\Data\volume_change_test\volume_change.py

File Edit Format Run Options Windows Help

```
#set local directory
cwd = os.getcwd()
env.workspace=cwd

# Check out any necessary licenses
arcpy.CheckOutExtension("spatial")

# Set overwrite option
arcpy.env.overwriteOutput = True

#set local directory
tifPre = cwd + "\\2004_RCM04_18g_5mGrid.tif"
tifPost = cwd + "\\2010_NCMP_FL_96_5mGrid.tif"
ebb_poly = cwd + "\\maximum_polygon.shp"

# set environments
arcpy.extent=tifPost
arcpy.SnapRaster=tifPost
arcpy.cellSize = tifPost

# set scratch workplace
arcpy.CreateFolder_management(cwd, "scratch")
env.workspace = "scratch"

# Bathy only grids
print ('create bathy only grids')
bathyPre = Con(tifPre, tifPre, "", "VALUE < 0 ")
bathyPost = Con(tifPost, tifPost, "", "VALUE < 0 ")

# subtract bathy only grids (post-pre)
print ('subtracting the grids')
diffout = Minus(bathyPost, bathyPre)

# + or - 0.5 as null value in difference grids
diffgrid = Con((diffout<-0.5)|(diffout>0.5),diffout)

# zonal statistics for maximum polygon
zone_stats = ZonalStatistics(ebb_poly, "Id", diffgrid, "SUM")

# volume change based on cell size
env.workspace = cwd
# output volume change file
vol_change_grid = cwd + "\\volume_change.tif"
vol_change_grid = zone_stats * 5
vol_change = arcpy.GetRasterProperties_management(vol_change_grid, "MEAN")
print (vol_change)
```

Ln: 1 Col: 0



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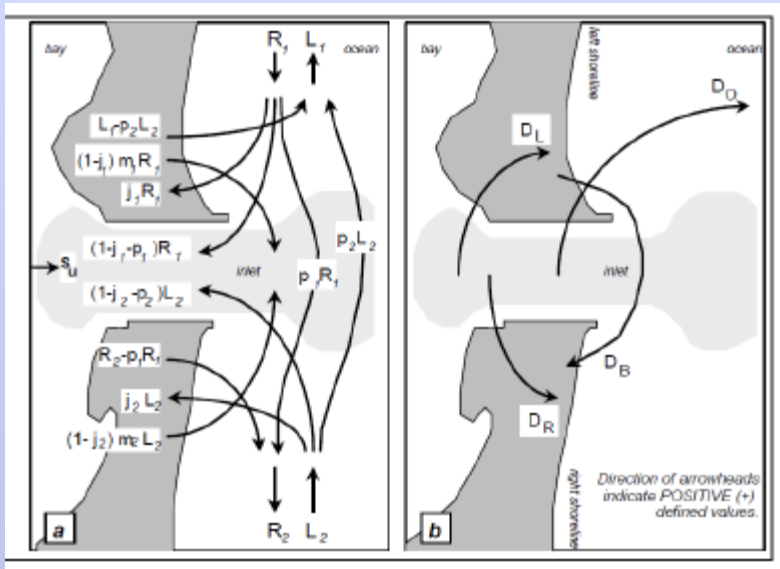
Sediment Budget Input

- Use tools/methods to determine how much sediment is entering/leaving the system
  - Volume and volume change
  - Inlet sink – representative profile beyond inlet influence compared to existing bathymetry at inlet
  - Provide input into Sediment Budget Calculator and SBAS

$$\Sigma Q_{source} - \Sigma Q_{sink} - \Delta V + P - R = Residual$$

- Q source , Q sink = Import or Export to the cell
- ΔV = Volume change within cell
- P = Placement in the cell
- R = Removal in the cell
- Residual = cell surplus or deficit, 0 = balanced cell

•Sediment Budget Calculator



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Accomplishments/Opportunities

- Methods to use spatial data for sediment budget information
- Identify extent of inlet influence
- Idealized 'no-inlet' bathymetry
- Provide input into SBAS and Sediment Budget Calculator

Deliverables

- Process to identify inlet influence extent using extracted data from the spatial data
- Process to generate idealized 'no inlet' bathymetry with ArcGIS support
- ArcGIS toolbox for volume and volume change
- LST rate calculator
- Provide access to tools and inlet data via a web service
- Tech Note

Leveraging

- National Coastal Mapping Program – spatial data products
- Coastal Inlets Research Program – inlet and waves information
- Regional Sediment Management

PDT Members

- Lauren Dunkin
- Julie Rosati
- Derek Wilson
- OPJ Mobile Spatial Data Branch