THE SEDIMENT BUDGET ANALYSIS SYSTEM (SBAS): PAST, PRESENT & FUTURE

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U.S. ARMY
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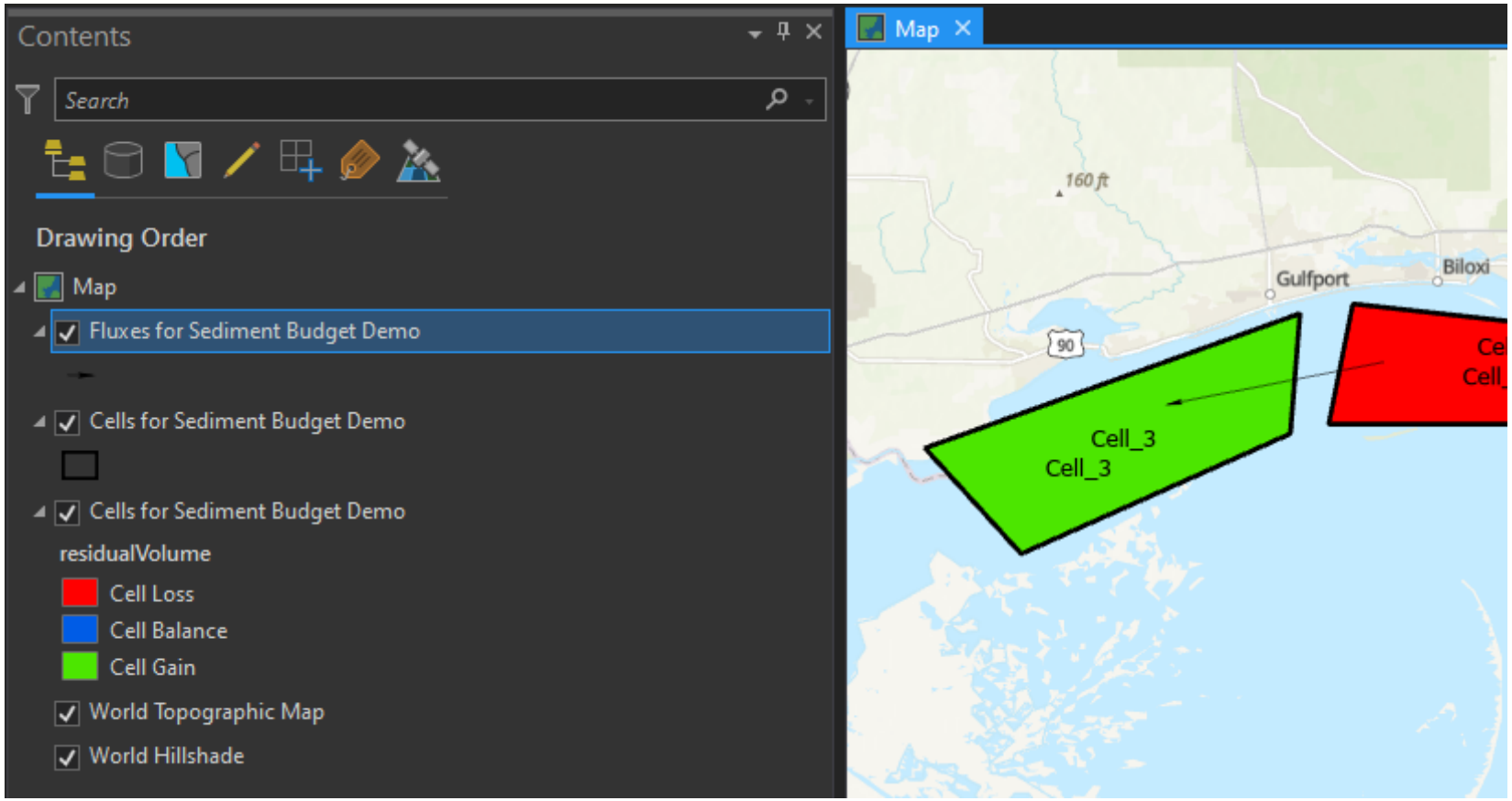
OUTLINE

- Introductions
- Sediment Budgets and the Sediment Budget Equation
- SBAS History
- SBAS 2020
- Current Efforts
- The Future Ahead



INTRODUCTIONS

FY24 Team

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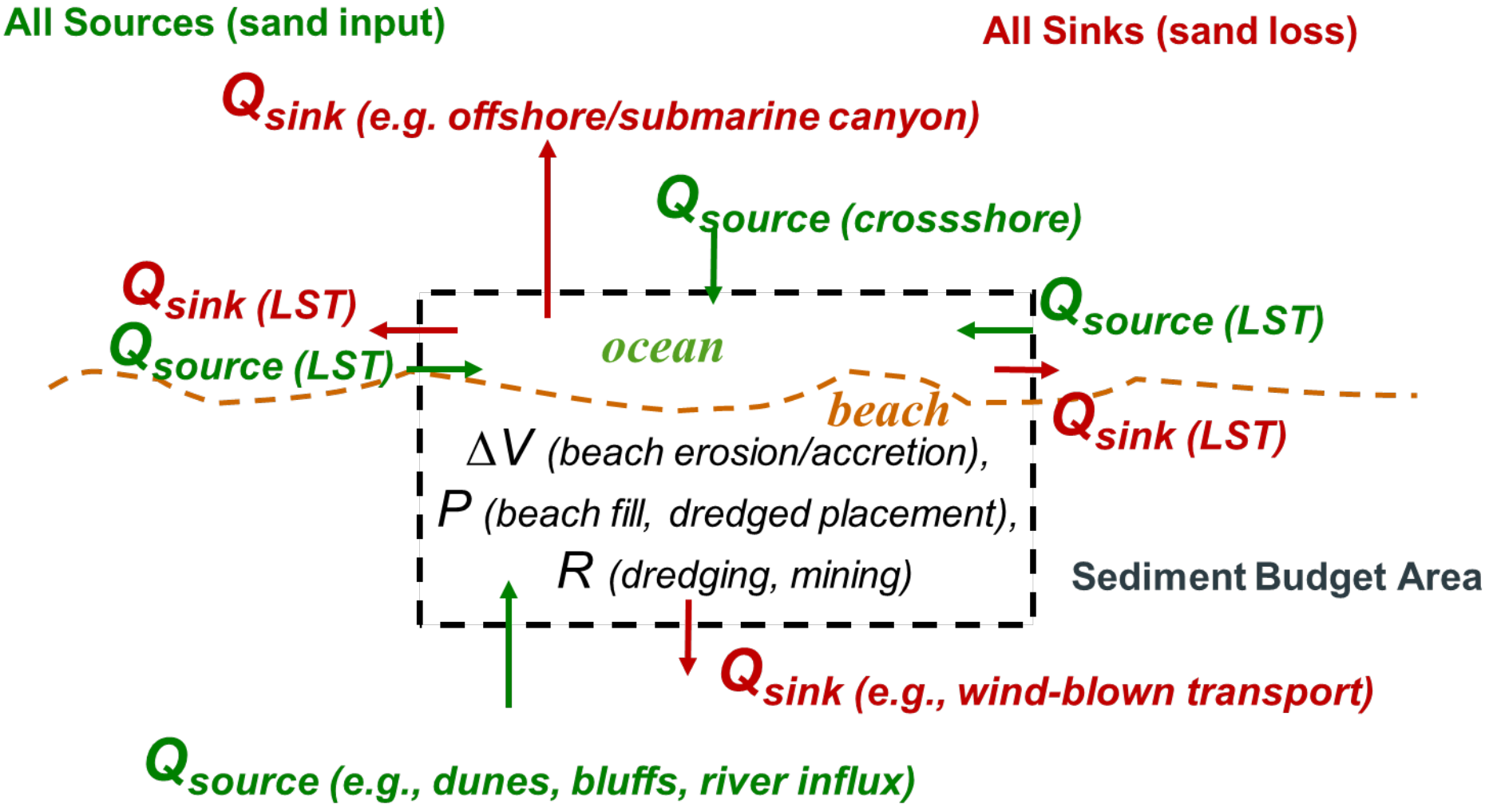
Aleks Ostojic
Charlene Sylvester
Justin Shawler
Pete Tereszkiewicz

SEDIMENT BUDGETS

- Consists of cells and fluxes
- Account of coastal sediment sources, sinks, and fluxes in the active and nearshore beach
- Conceptual and quantitative model of sediment-transport magnitudes and pathways for various time periods (historic/present/future)
- Provides the framework for understanding complex coastal systems
- Provide ground-truthing for more detailed models
- Tool for communication with clients, sponsors, and partners
- Important for planning/investigating feasibility for projects

SEDIMENT BUDGET - SOURCES AND SINKS



SEDIMENT BUDGET EQUATION

Quantifying and finding balance

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

Q_{source} = input of sediment into a cell

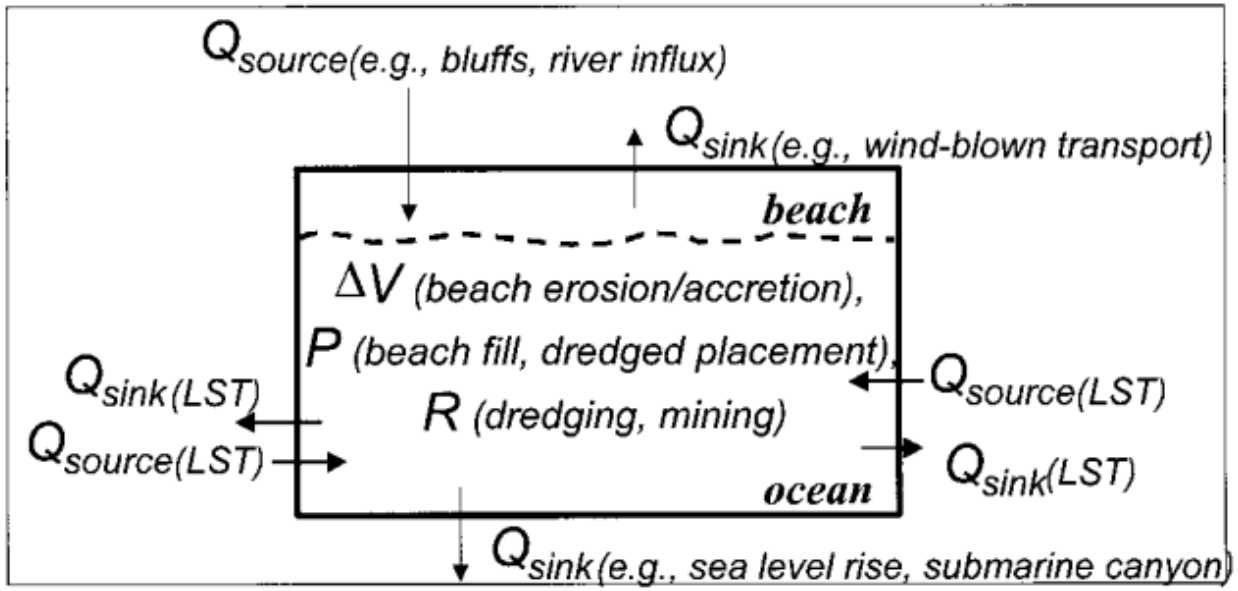
Q_{sink} = loss of sediment from a cell

ΔV = volume change within a cell

P = placement into a cell (e.g., beach fill or dredged material)

R = removal from a cell (e.g., dredging or mining)

$Residual$ = 0 for a balanced cell



SEDIMENT BUDGET TYPES (DATA FIDELITY)

Fast

Accurate

Conceptual

- Building block for more detailed budgets
- Utilize existing data, literature reviews

Interim

- Working budget
- Historical data
- Dredging records
- Shoreline change
- Numerical models

Operational

- Final budget
- May be a series of budgets
- Developed with most available data sets

SEDIMENT BUDGET TYPES (SPATIAL EXTENT)

Size of sediment budgets

Q_{source} = input of sediment into a cell

Q_{sink} = loss of sediment from a cell

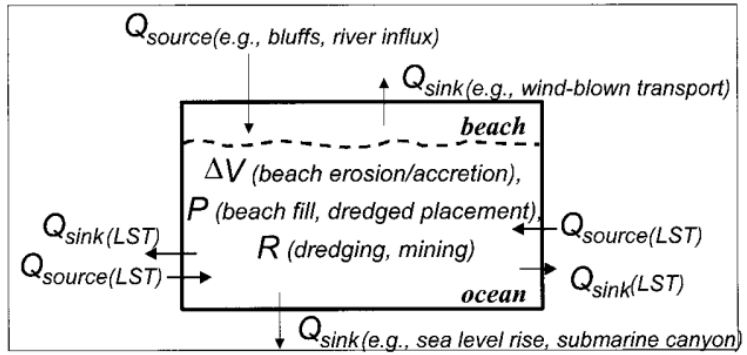
ΔV = volume change within a cell

P = placement into a cell (e.g., beach fill or dredged material)

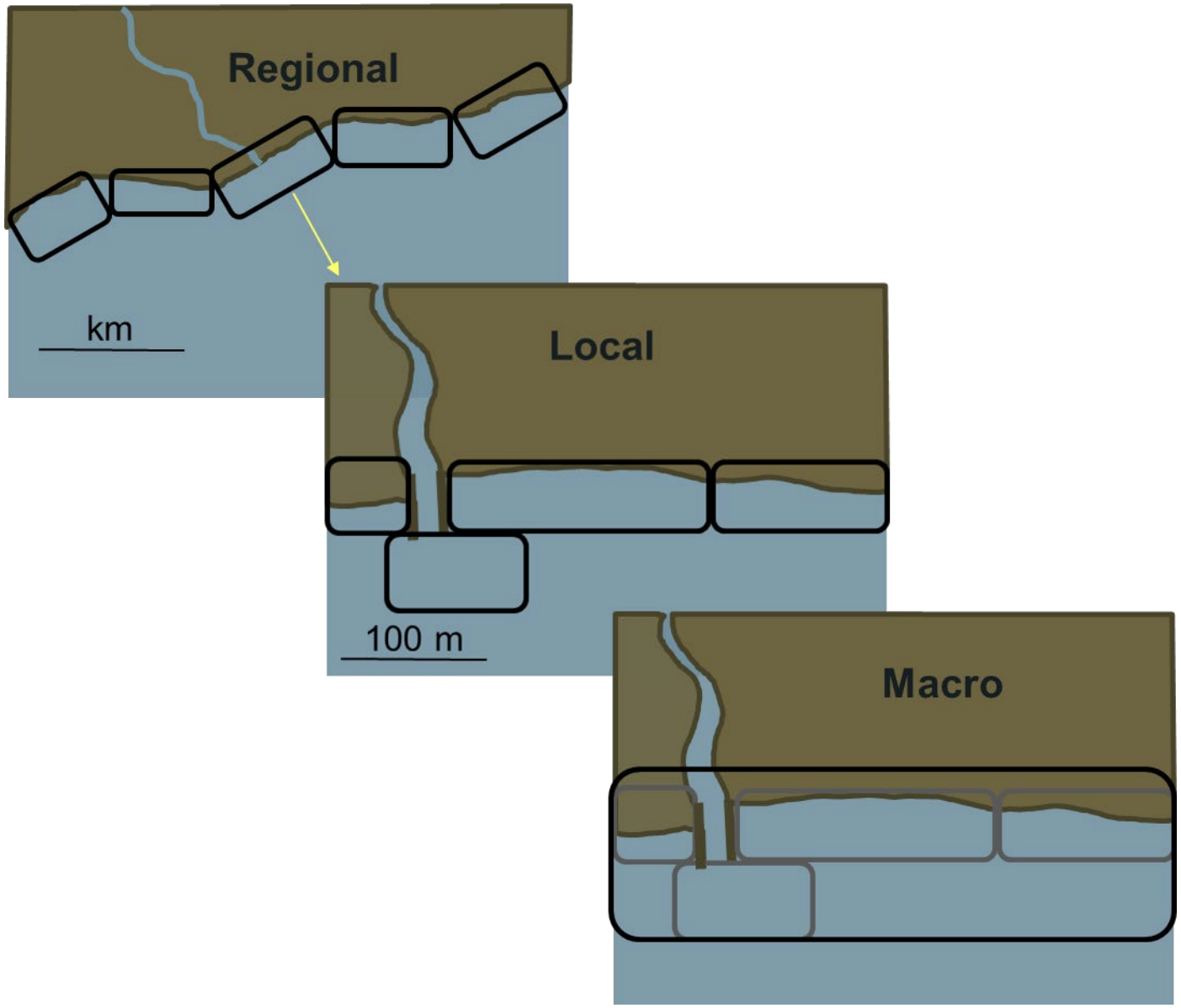
R = removal from a cell (e.g., dredging or mining)

$Residual$ = 0 for a balanced cell

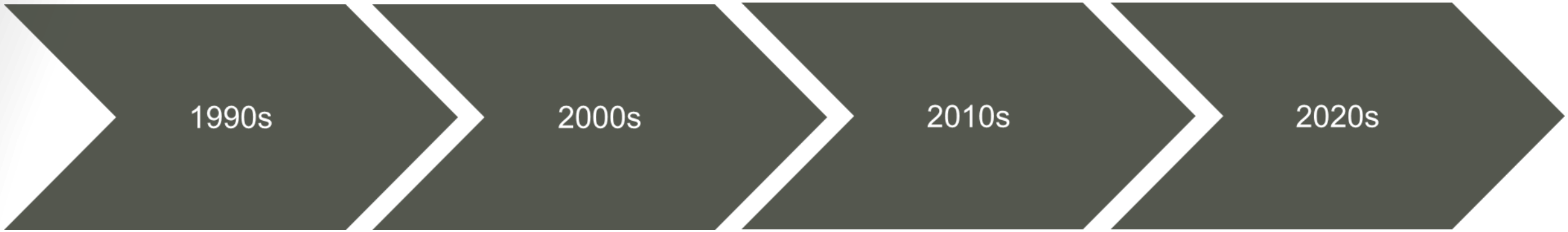
$$\sum Q_{source} - \sum Q_{sink} - \Delta V + P - R = Residual$$



(Rosati, 2005)



SEDIMENT BUDGET ANALYSIS SYSTEM (HISTORY)



Sediment Budget Analysis System Creation

- Standalone executable for Windows 95 and 98
- Allowed the user to create and quantify cells and fluxes

Transition to ArcView

Incorporation into geospatial software, allowing visualizing and mapping improvements

Transition to ArcMap

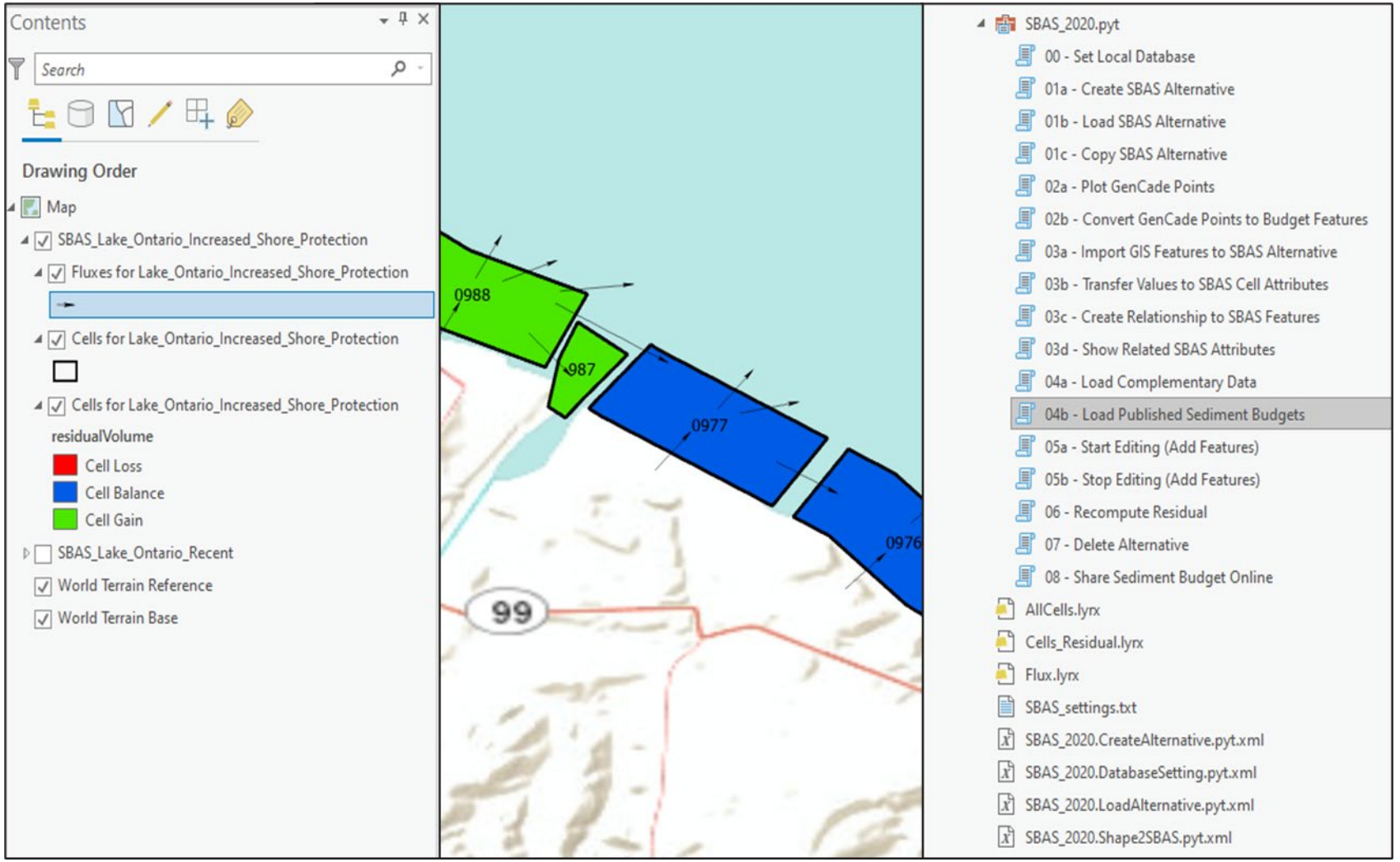
- Create and manage regional sediment budgets

SBAS 2020

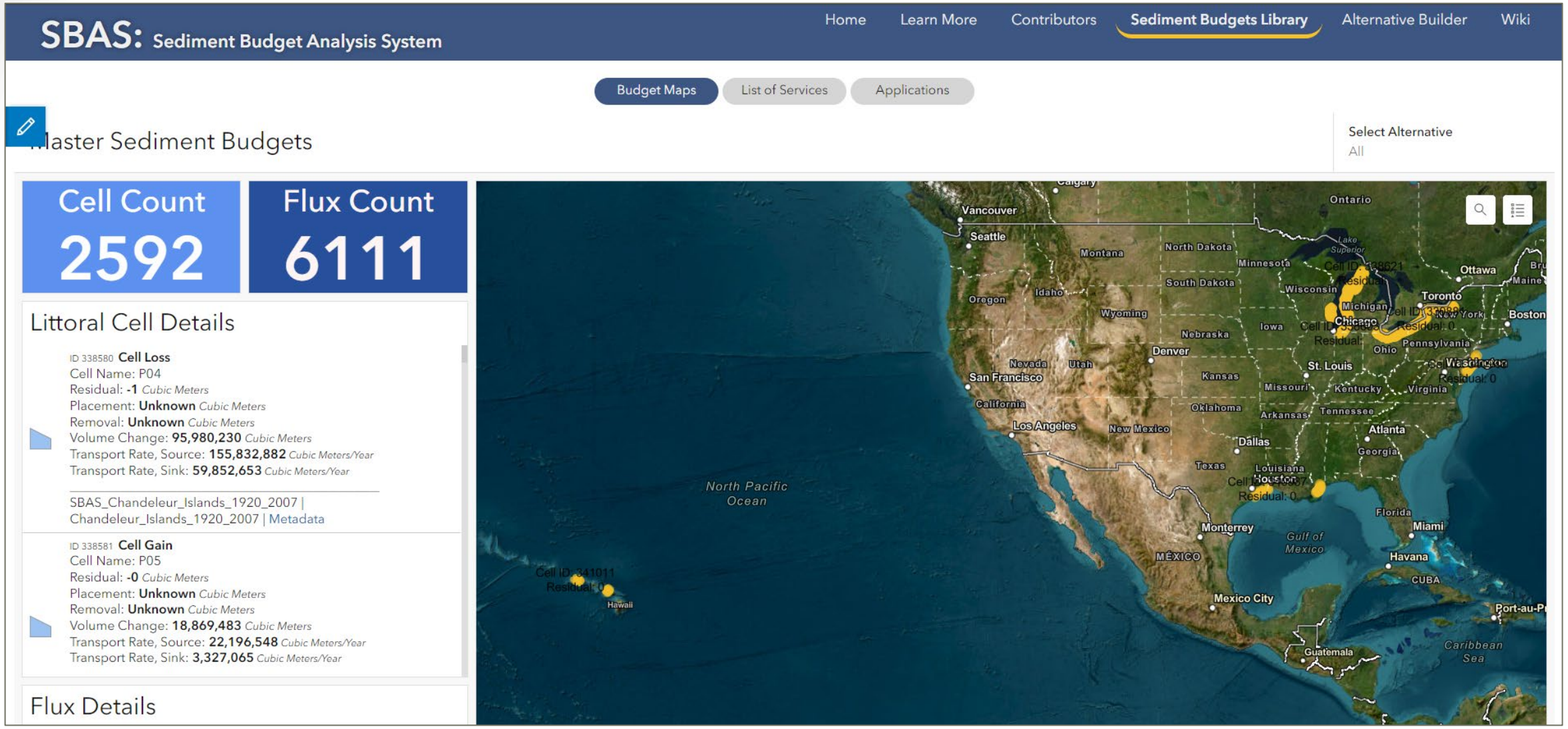
- Upgrade to ArcGIS Pro
- Creation of the SBAS ArcGIS Online (AGOL) Hub

SEDIMENT BUDGET ANALYSIS SYSTEM (OVERVIEW)

- Create and quantify fluxes and cells
- Import existing datasets and previously created shapefiles
- Import GenCade results (shoreline change/sediment transport rates)
- Publish results on the SBAS Hub

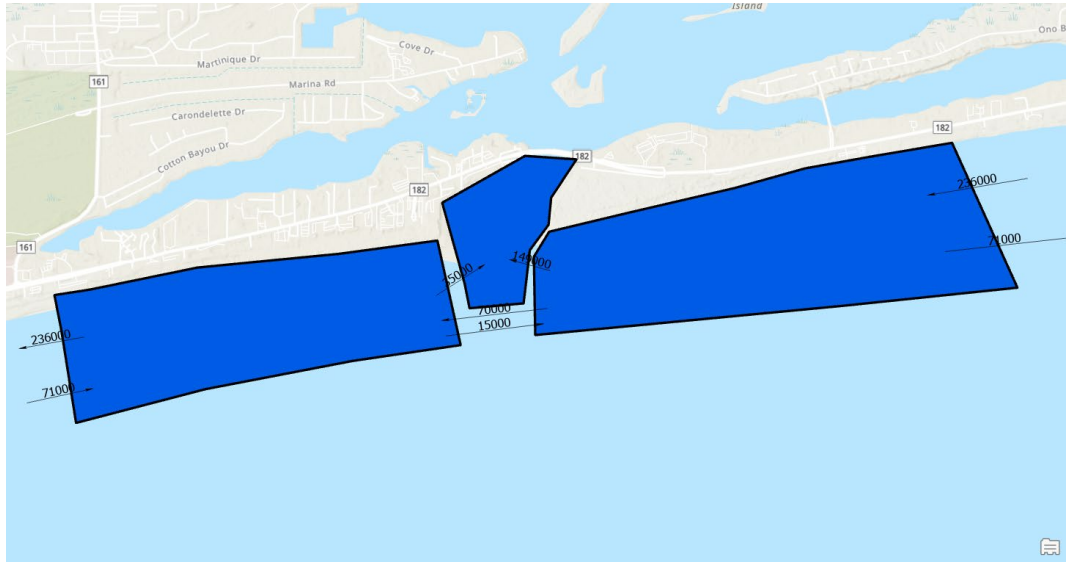


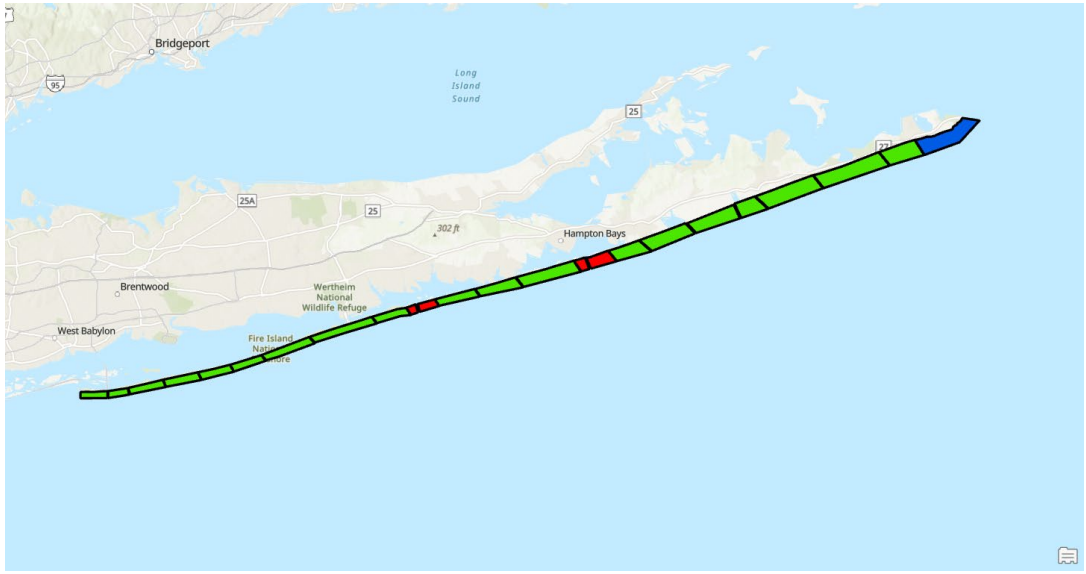
SEDIMENT BUDGET ANALYSIS SYSTEM



CURRENT EFFORTS (DIGITIZATION)

- 46 Digitized
  - At least one budget from each Division
  - Micro-inlet focused budgets to macro regional scale
- 18 Ready for Upload
  - Florida
  - Texas
  - North Carolina
  - New York
  - Virginia
- 3 Uploaded
  - Hawaii
- Missing Oregon, Washington, Alaska

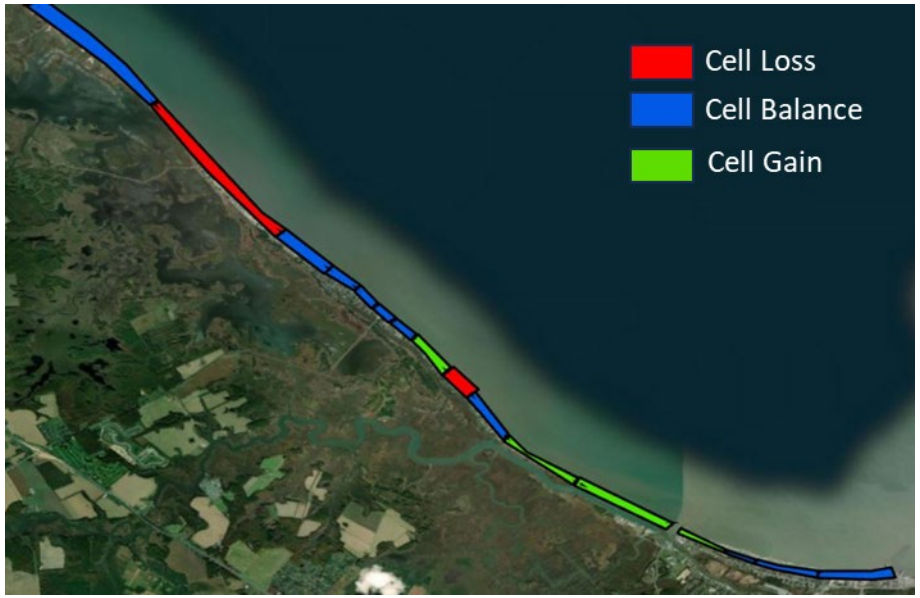




CURRENT EFFORTS (DELAWARE BUDGET)

Project Goals:

- Develop a conceptual-level regional sediment budget for the Delaware coast from Pickering Beach to the Maryland border
- Test integration of multiple methods for sediment budget development
- Create proof of concept for using SBAS to link open coast and estuarine sediment transport



CURRENT EFFORTS (DELAWARE BUDGET, CONT.)

Past Sediment Budgets

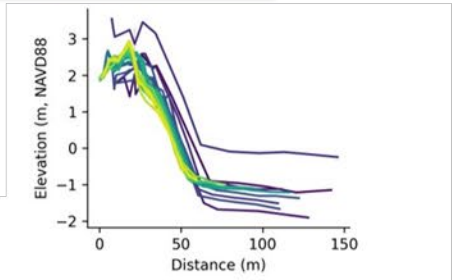
Maurmeyer, 1978

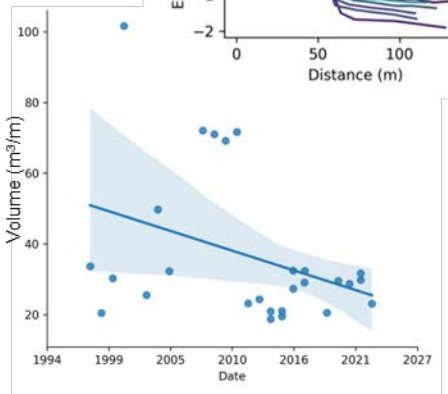
PBS&J (2010)/CB&I(2015)

NAP DMUP (2018)

Beach Profiles

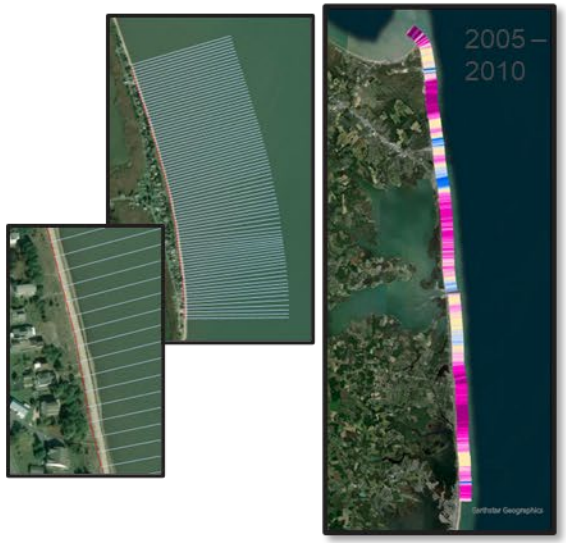
(Area Under the Curve)





JALBTCX Quick Response Toolbox

Volume change with Lidar



Volume change with profiles (XYZ to DEM)

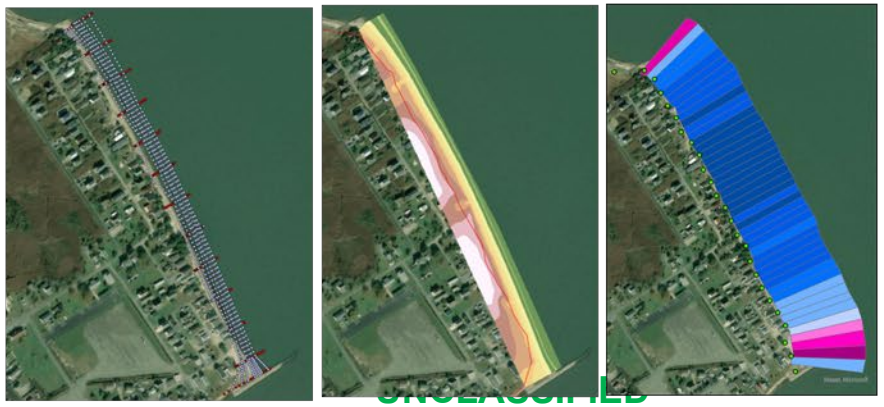
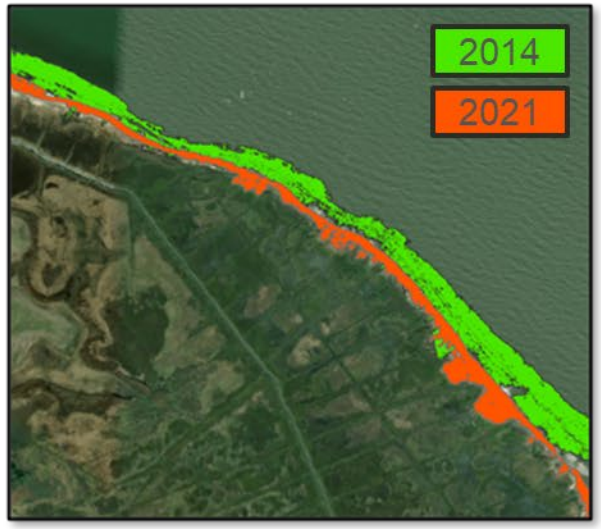
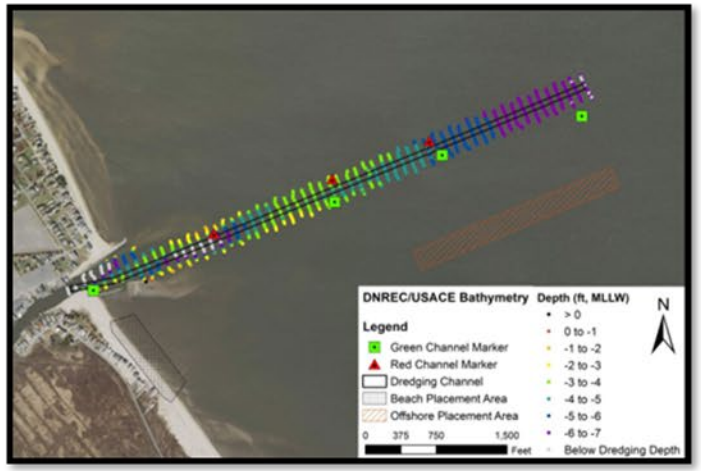


Image Classification

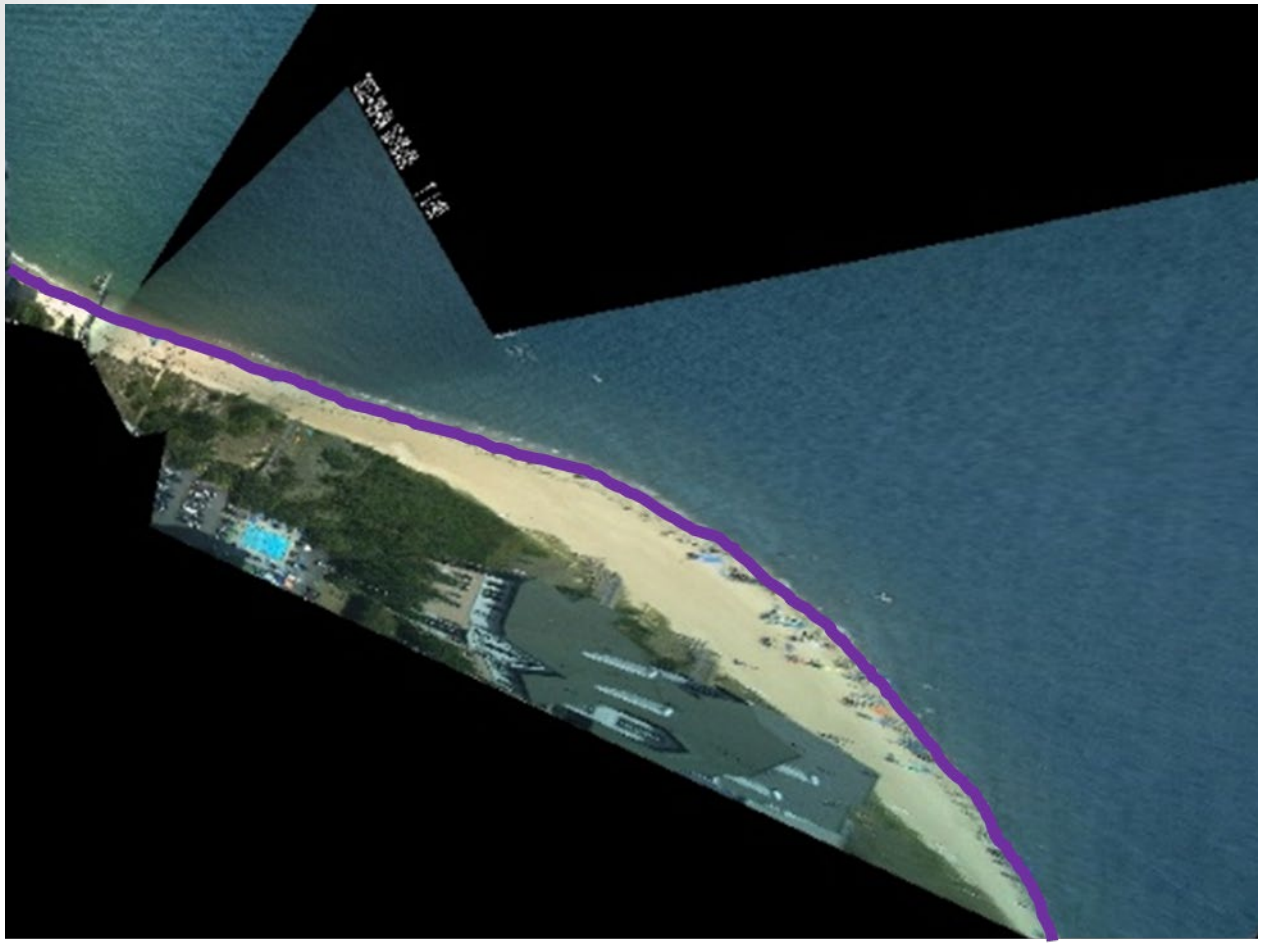


Bathymetric Change

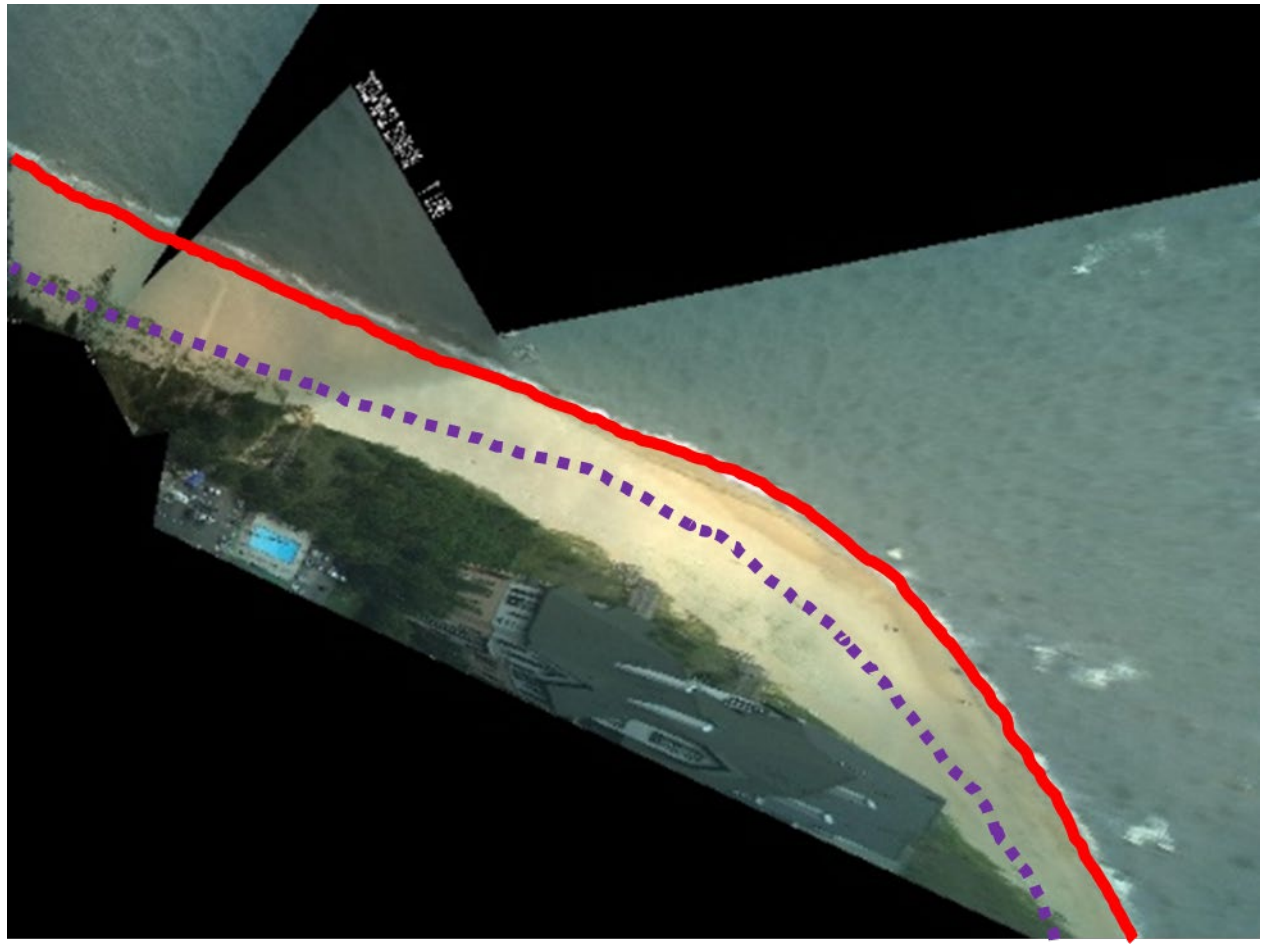


CURRENT EFFORTS
(CONCEPTUAL BUDGETS WITH CORPSCAM)

September 4, 2022, 1800 UTC

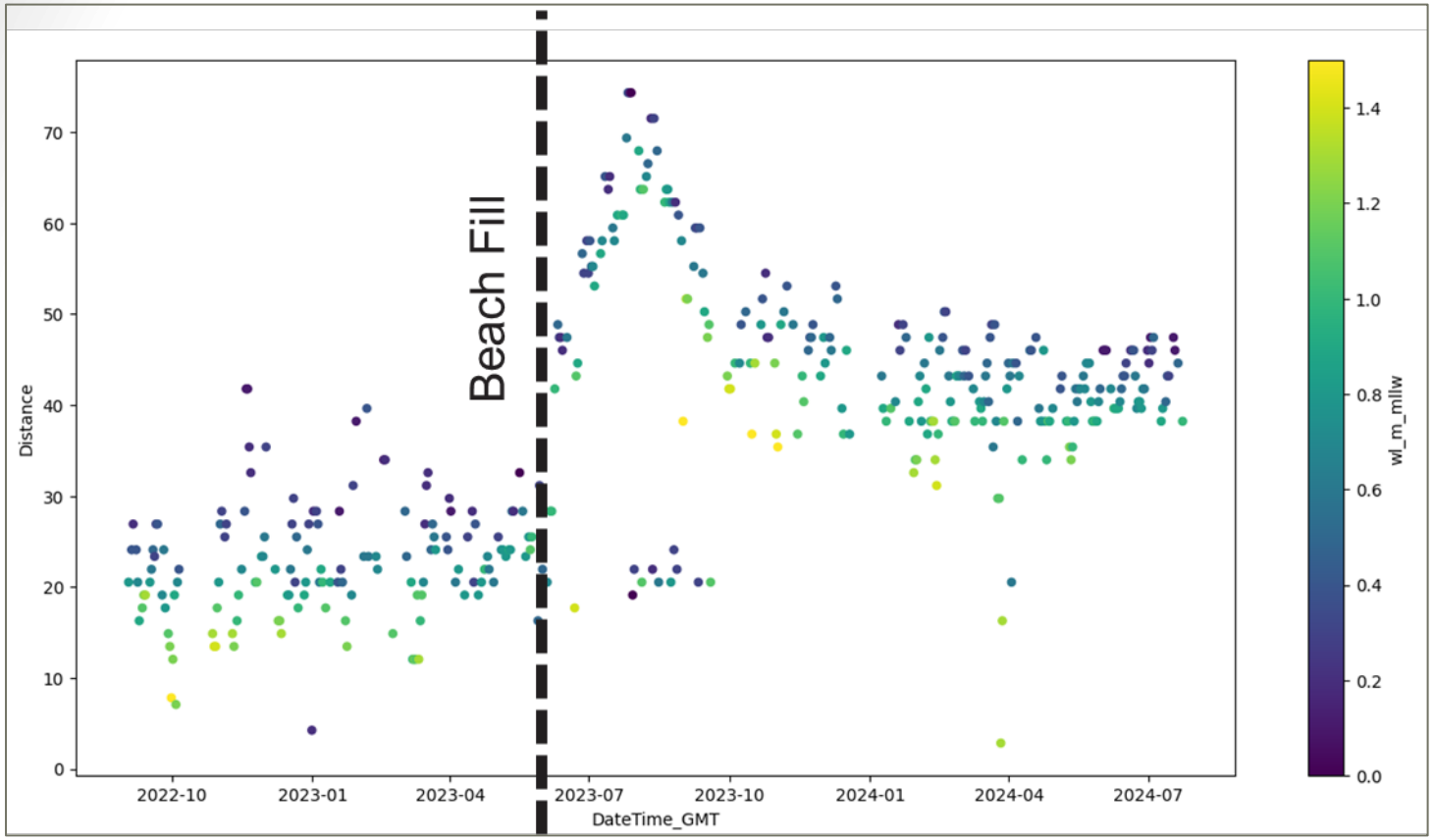


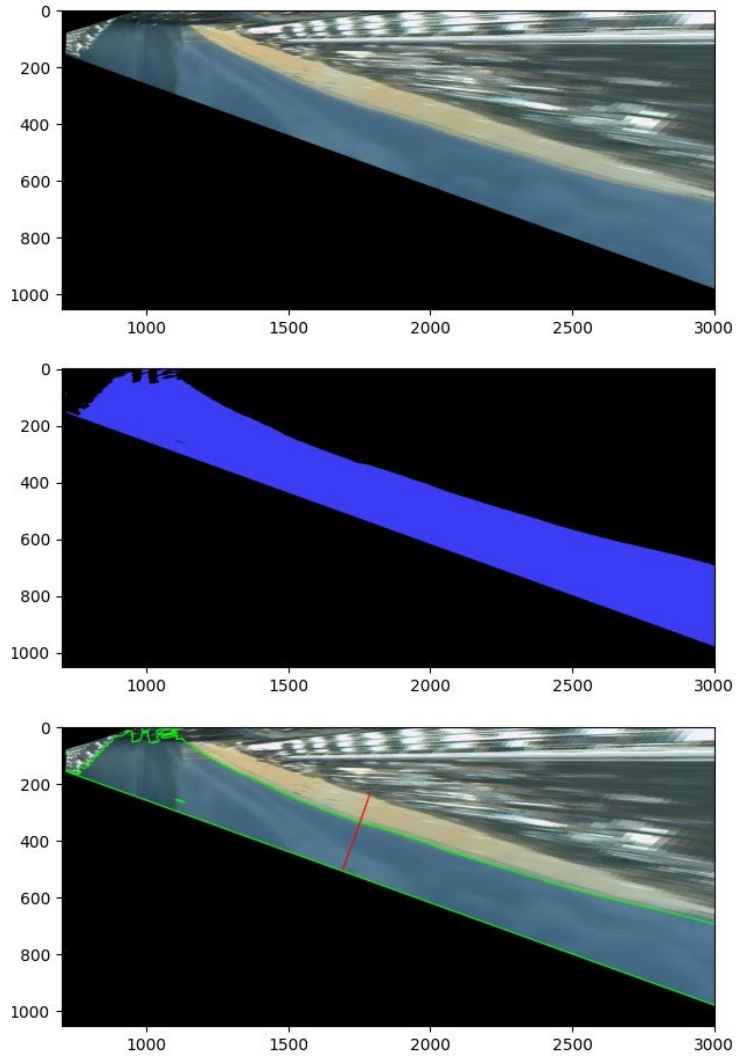
August 22, 2023, 2000 UTC



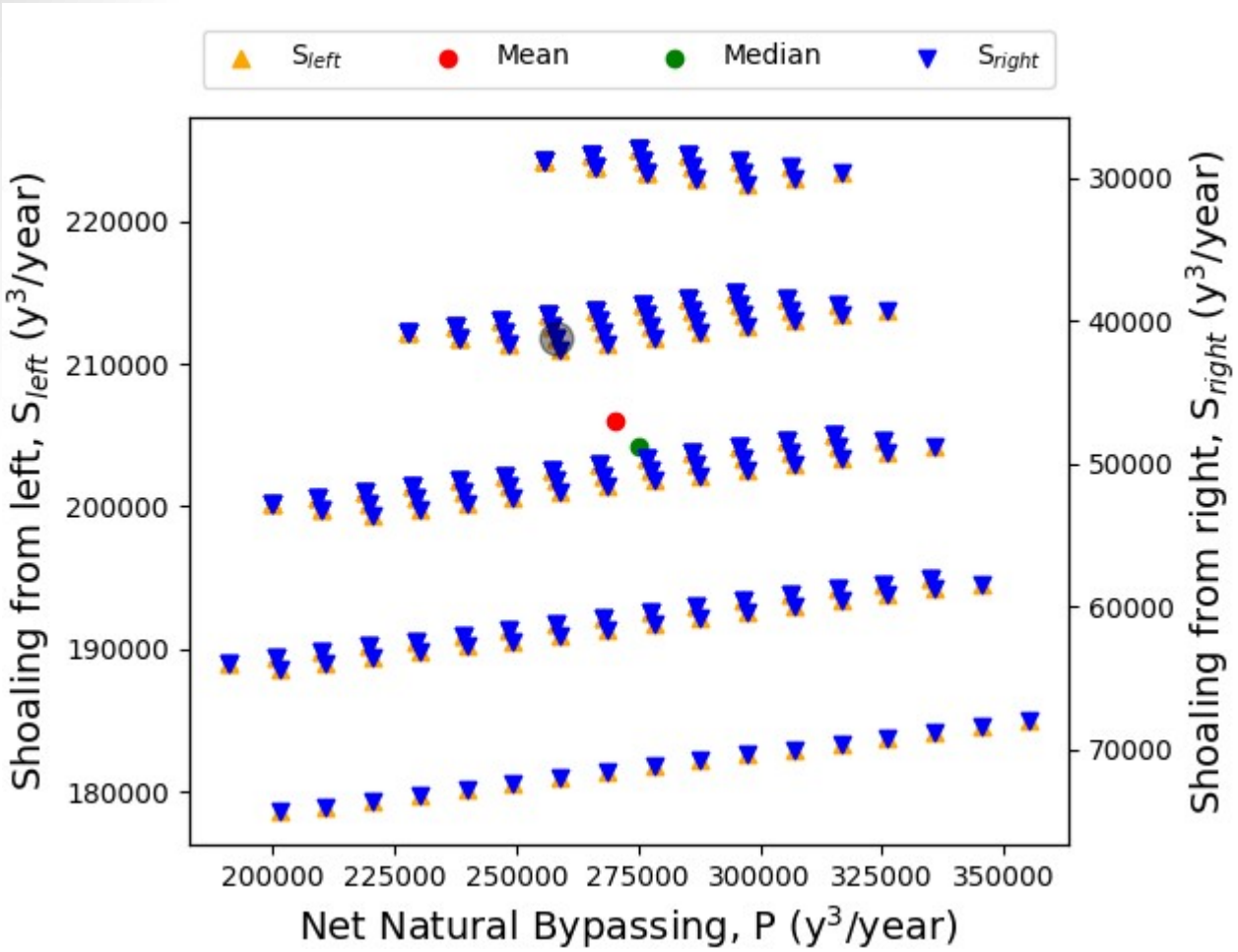
Virginia Beach, VA (CorpsCams)

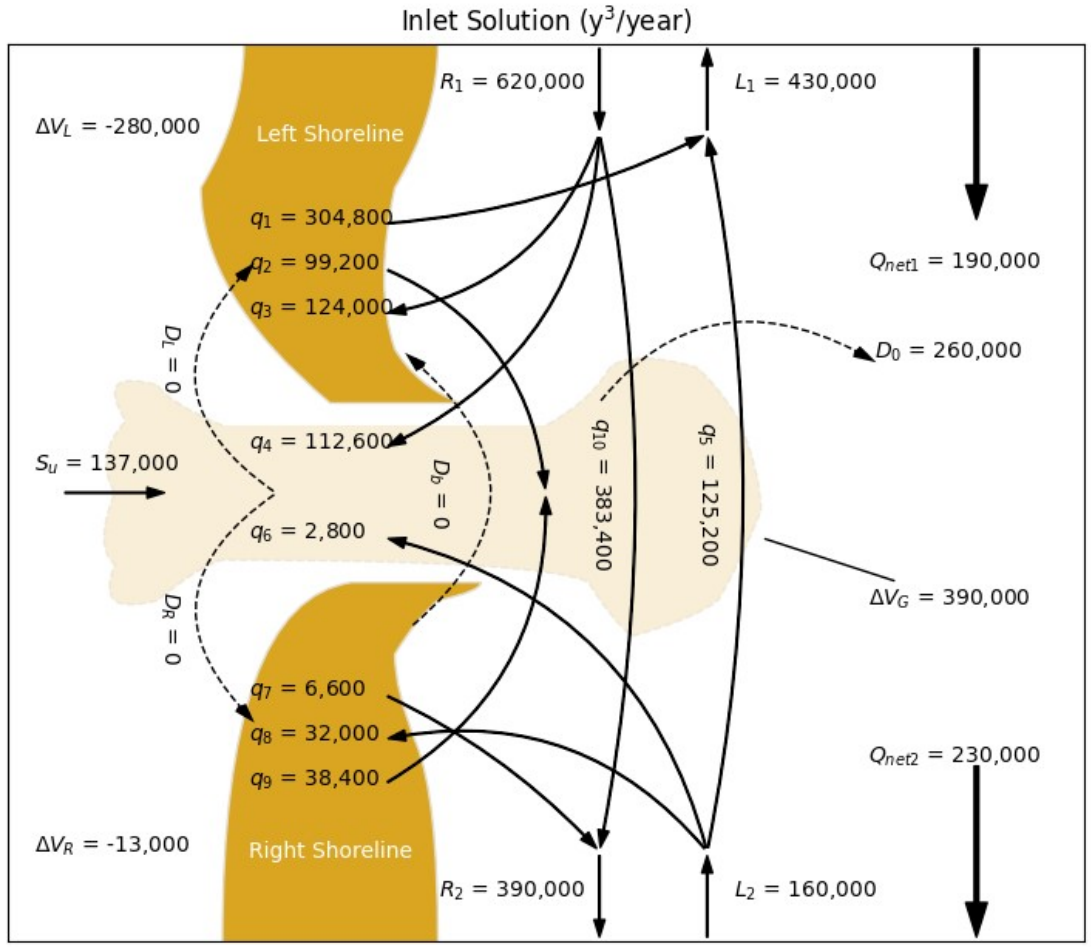
CURRENT EFFORTS, CONT.
(CONCEPTUAL BUDGETS WITH CORPSCAM)





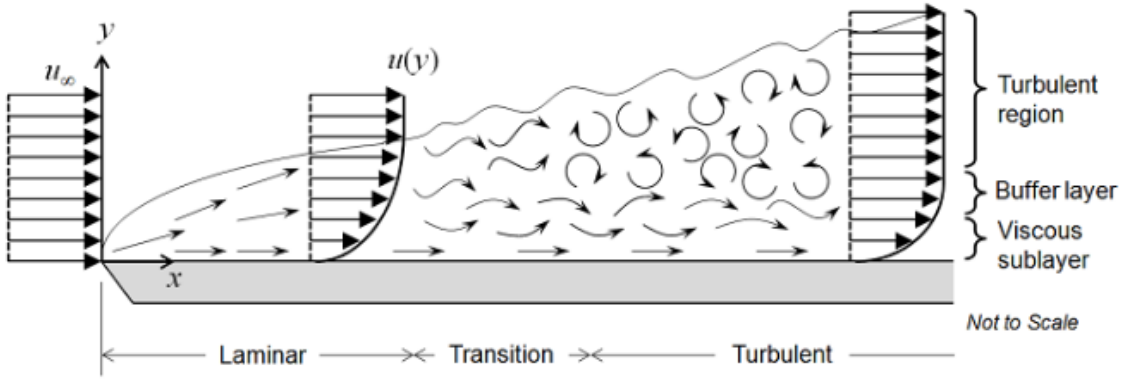
CURRENT EFFORTS (SEDIMENT BUDGET CALCULATOR)

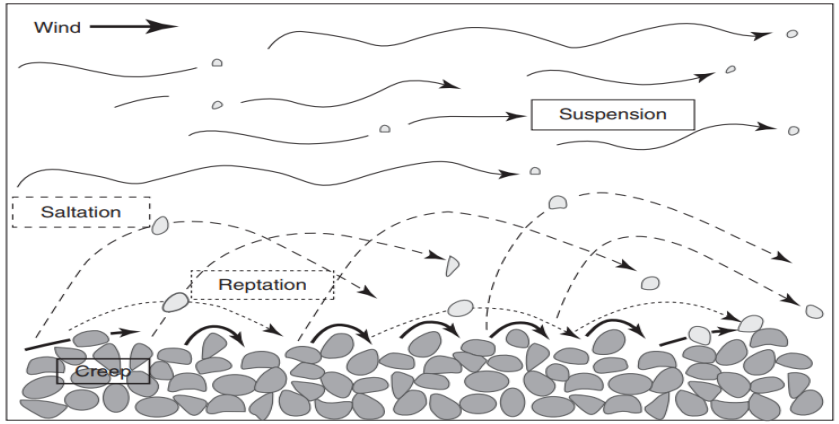




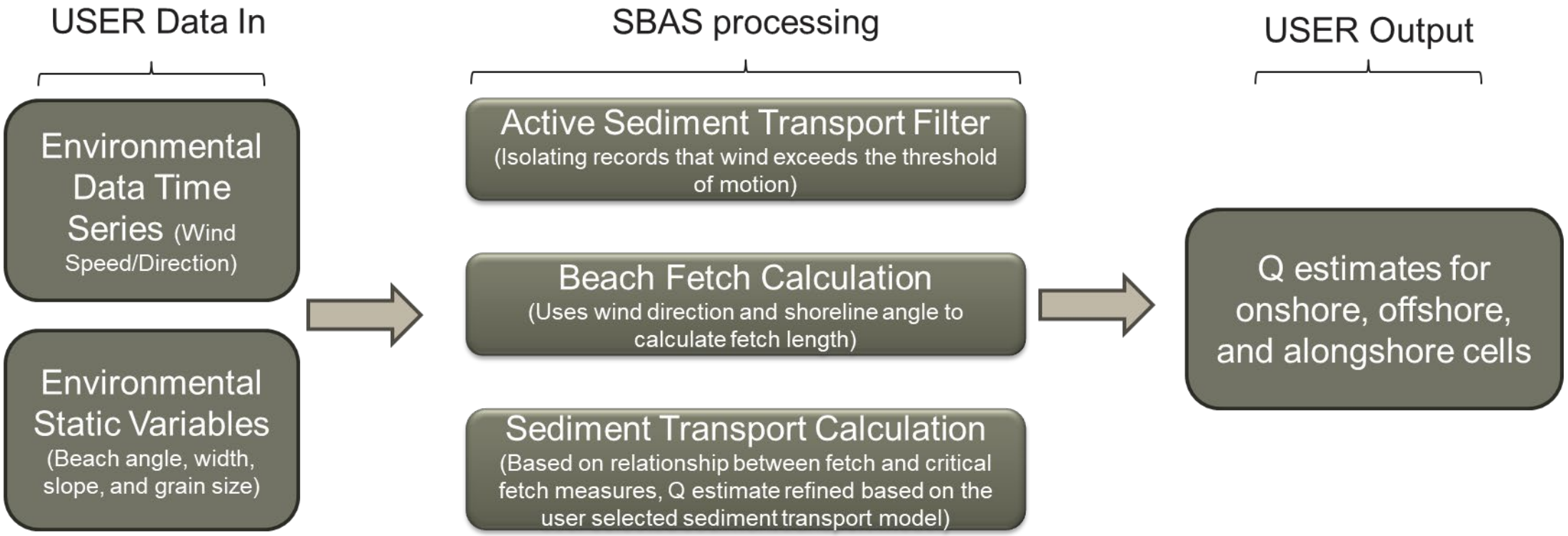
CURRENT EFFORTS (AEOLIAN TRANSPORTATION CALCULATOR)

- Depending on geographic location aeolian sediment transport across coastal systems can be significant to the sediment budget.
- Factors such as grain size, mineralogy, wind speed, wind direction and beach slope can all enhance aeolian sediment transport.





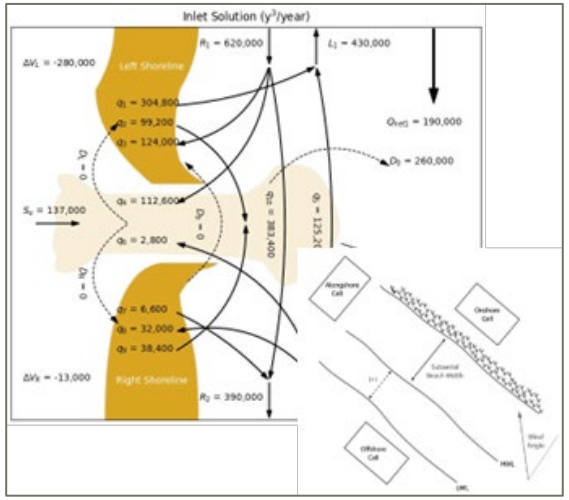
CURRENT EFFORTS, CONT. (AEOLIAN TRANSPORTATION CALCULATOR)



FUTURE EFFORTS

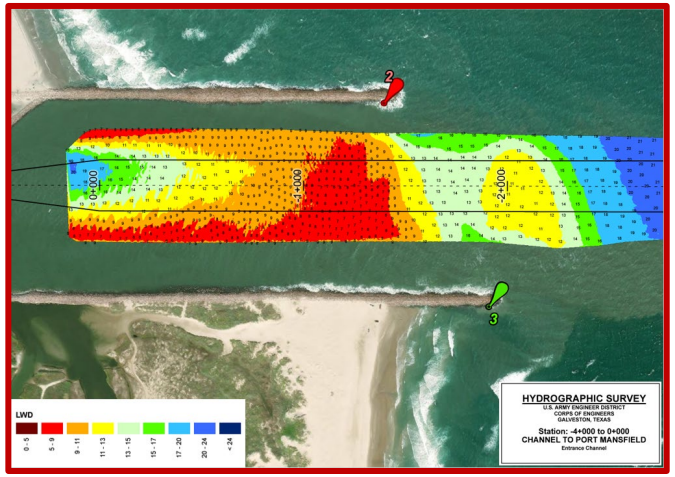
CoastSat

Calculators

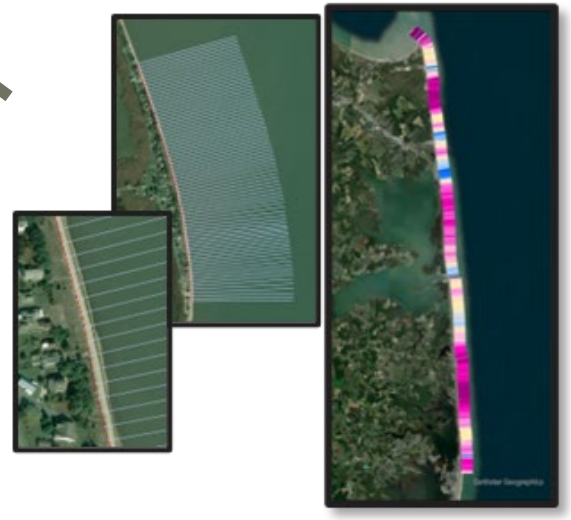


SBAS 2025

CSAT



JALBTCX Volume Change Toolbox



FUTURE EFFORTS, CONT.

SBAS: Sediment Budget Analysis System

The **Alternative Builder** is a free sediment budget creator, visualization and calculation tool set designed to work with sediment budgets created and shared within our community.

Step 1: Select Your Base Alternative

Starting with **Step 1**, select a baseline conceptual budget. This budget will include littoral cells, respective cell volumes, and sediment transport rates from sediment budgets that have been shared by the author to the public.

Step 2: Add You Cell Values

You will use this series of cells and arrows, representing fluxes into and out of cells (sources and sinks) to assign volumes in **Step 2** of sand placement, removal, or volume change, within selected cells. Repeat Step 2 for each littoral cell that needs modification.

Step 3: View Your Budget

View your summarized budget with computed residuals in **Step 3**. The maps will show the original alternative scenario compared to the new alternative created during your online session.

Note:

- The online calculator will use a pre-defined sediment-budget equation to recompute a residual volume for each littoral cell.
- The online scenarios are reset each night. If you are interested in creating a sediment budget in the ArcGIS Pro environment, please download the SBAS 2020 toolbox.

CONCLUSIONS

- SBAS has historically been used by USACE to develop sediment budgets
- Efforts currently underway to increase data availability and explore new sediment budget creation methods
- Future work focused on expanding data importation capabilities to make sediment budget creation faster, cheaper, and easier

QUESTIONS

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