



U.S. ARMY

IMPACT OF SL RISE AND LAND USE ON SEDIMENT DYNAMICS AT COASTAL INLETS *INLET GEOMORPHOLOGY WU*

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COASTAL INLETS RESEARCH PROGRAM

FY20 IN PROGRESS REVIEW

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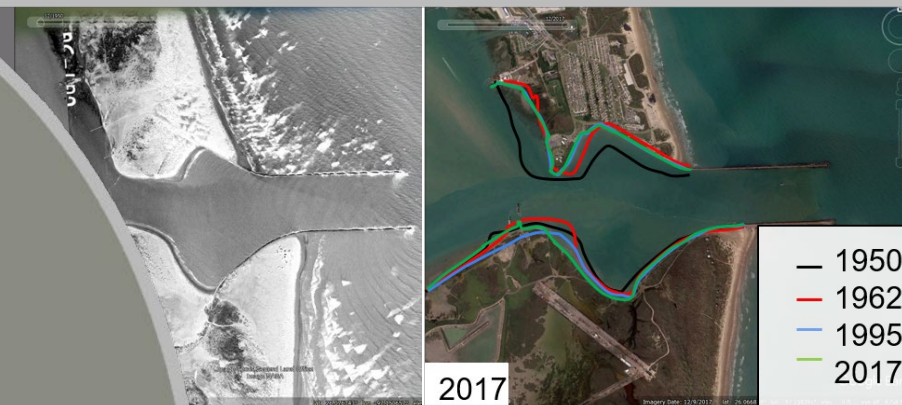
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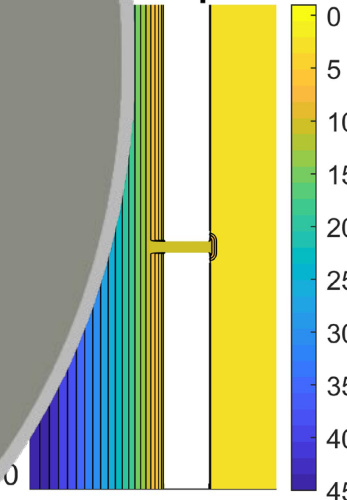
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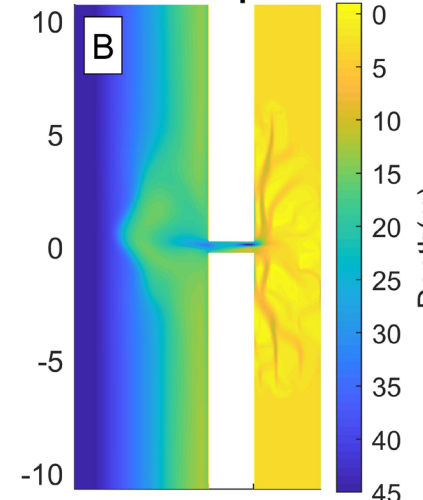


HC4

Initial Depth



Final Depth



US Army Corps
of Engineers



CHL

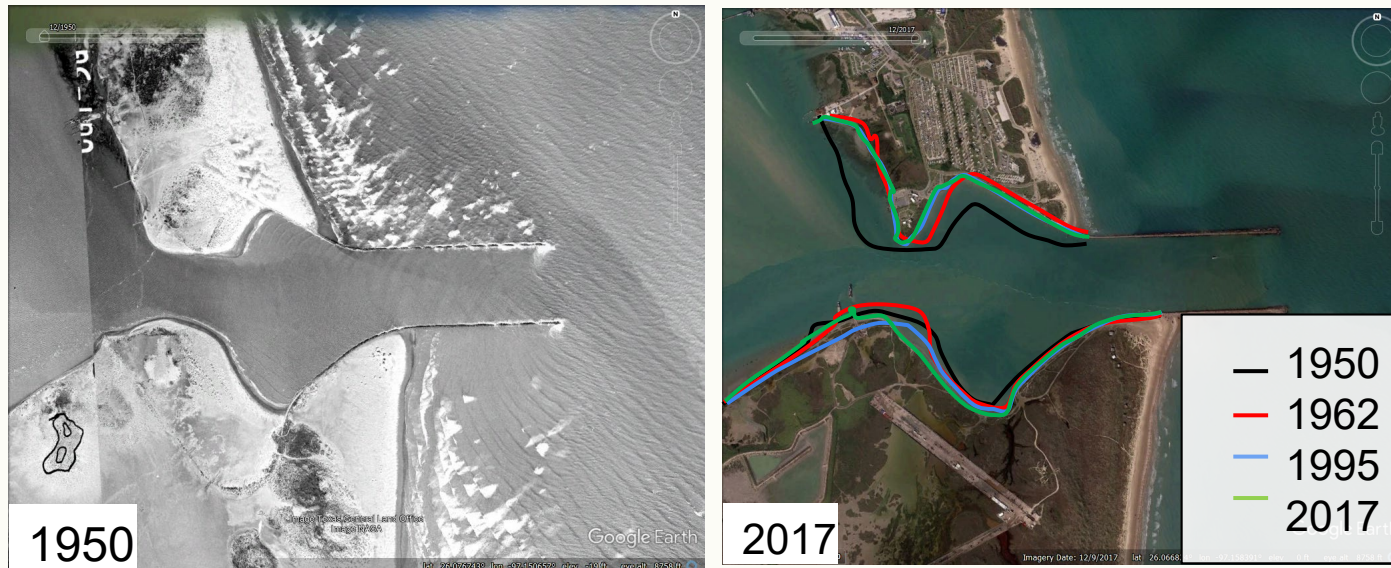
COASTAL &
HYDRAULICS
LABORATORY



ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

Engineering Practices and SL Rise Present Challenges in Understanding the Evolution of Tidal Inlet Systems and Associated Impacts to Navigation

- Existing theory suggests a primary factor controlling hydrodynamics and, by analogy, sediment transport is hypsometry i.e., vertical distribution of surface elevation (bathymetry)
- One factor not previously explored is sediment availability, which can alter bay morphology and hypsometry leading to potential feedbacks that could modify hydrodynamics of the inlet.
- Continuing evolution of land use practices (armoring, reclamation) and sea level change will alter coastal inlets/bays from present day configurations and associated sediment transport characteristics.
- Need to develop approaches to assess inlet/bay system likelihood of undergoing fundamental shifts in sediment transport patterns due to these influences (anthropogenic, sea level rise)



SONs

FY19 1356 (Long-term Modeling of Barrier Island Tidal Inlets)

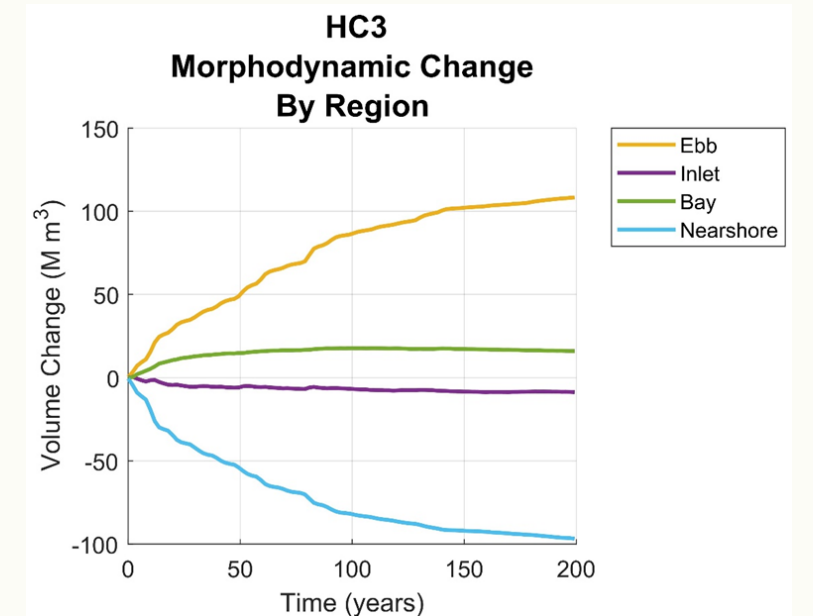
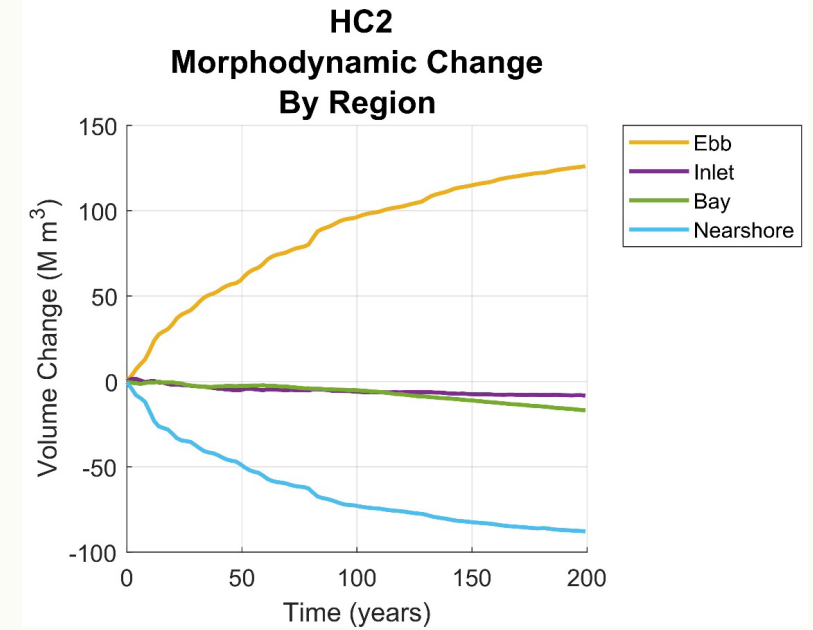
FY19 1370 (Testing and Evaluation of USACE Coastal Numerical Models)

17-N-71 (Modeling Effects of Sea Level Change at Tidal Inlets)

Capability and Strategic Impact Statement

Develop methodology to determine the likelihood of an inlet system to shift from import/export due to modification in land use and engineering practices (channel modification, wetland restoration, inundation due to sl rise)

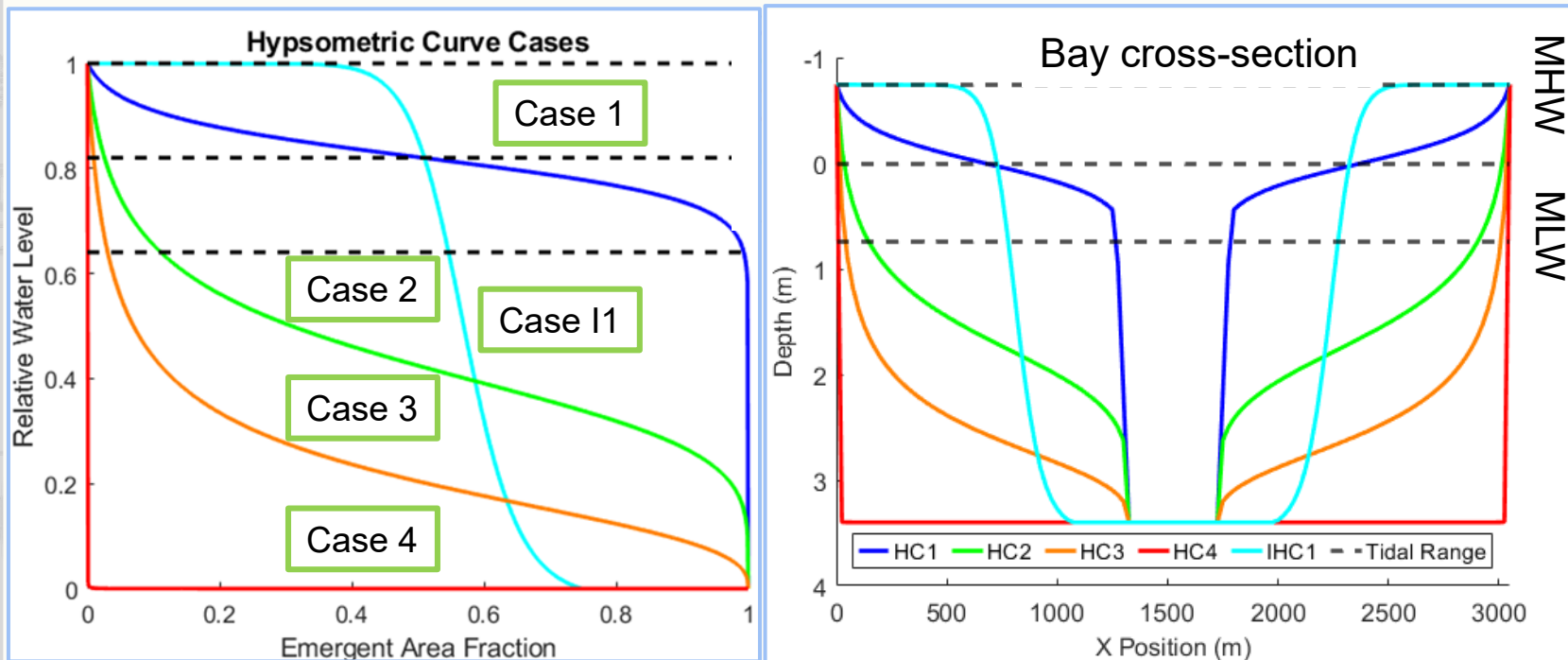
Use this information to inform planners & stakeholders of possible impacts to navigation.



Long-term Modeling of Tidal Inlets

Approach

1. Minimal tidal flats with large inter-tidal storage “bathtub”
2. Extensive inter-tidal flats minimal inter-tidal storage (creek networks)
3. Transition between the two cases



Methodology

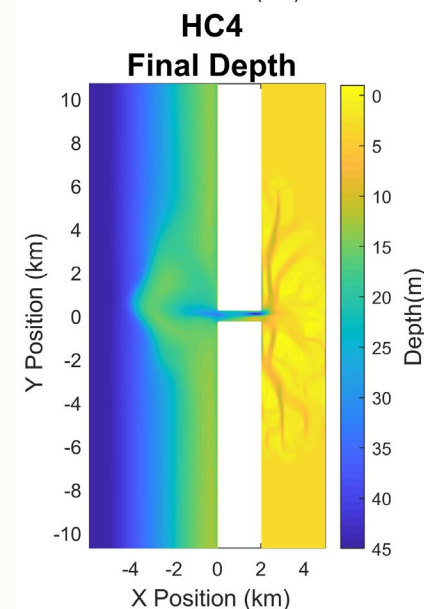
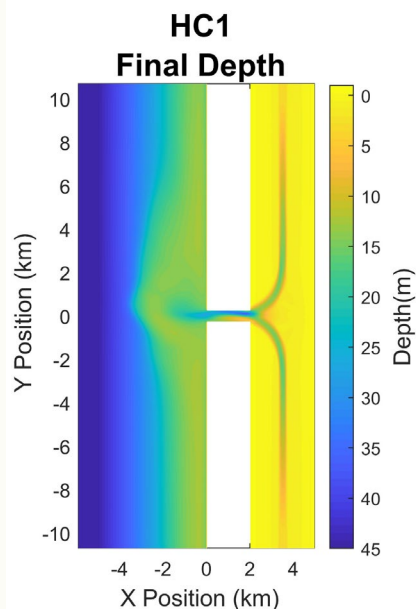
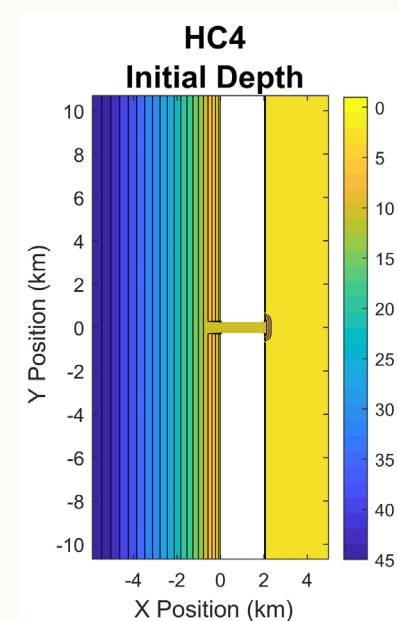
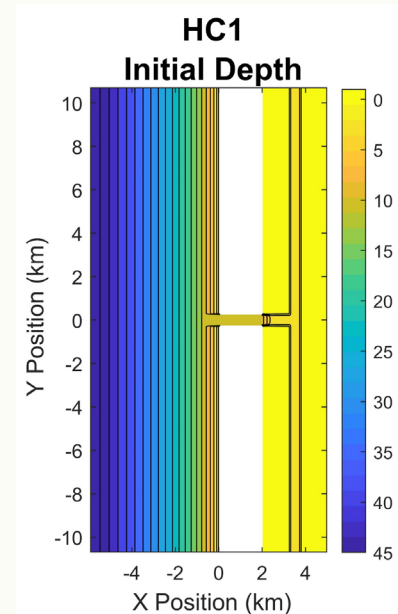
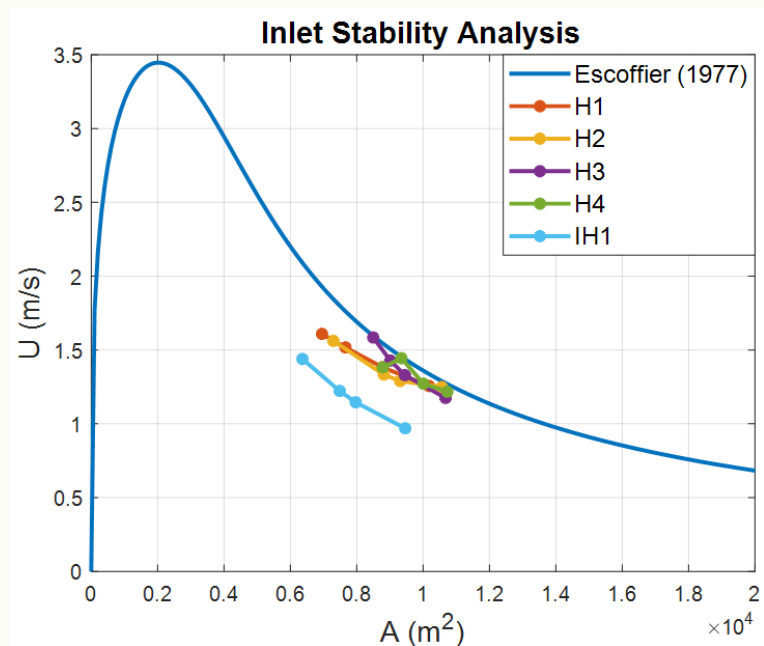
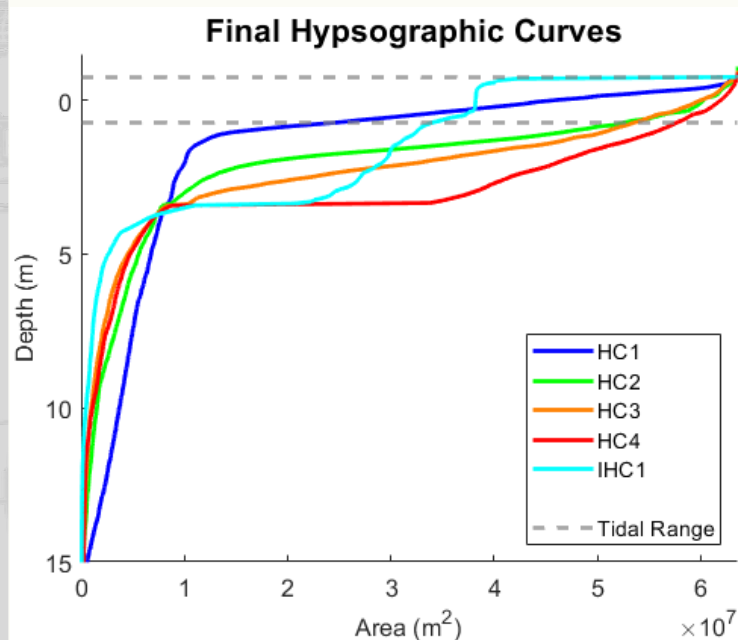
- Run 200 ‘effective’ years using a Morphology Acceleration Factor of 10
- 20 years of wave conditions at 2-hour intervals
- Idealized grids forced with tides based on harmonic constituents for Humboldt, CA
- 5-different hypsometric curves implemented

Summary – Technical Achievements

FY20

Model Run Analysis:

- Analyze and compare bay metrics (e.g. tidal prism, cross-sectional area, hypsometry, velocity/stage curves, and Escoffier parameters) from simulations representing different land distributions

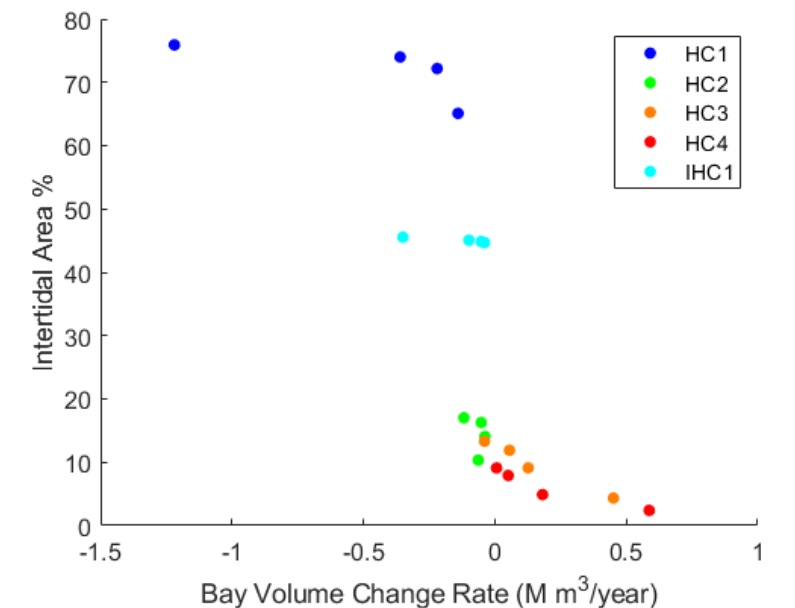
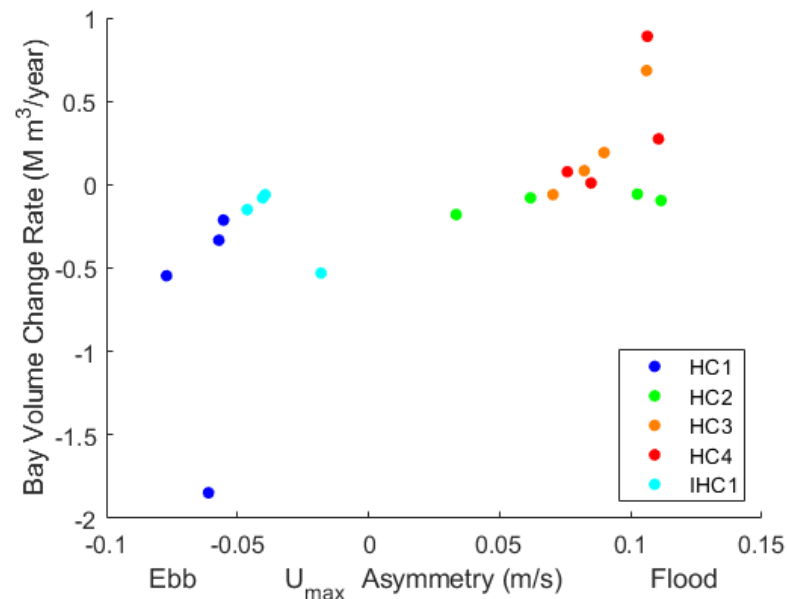
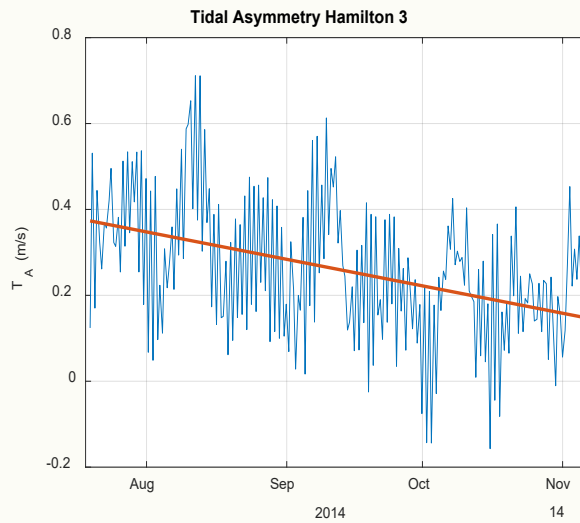
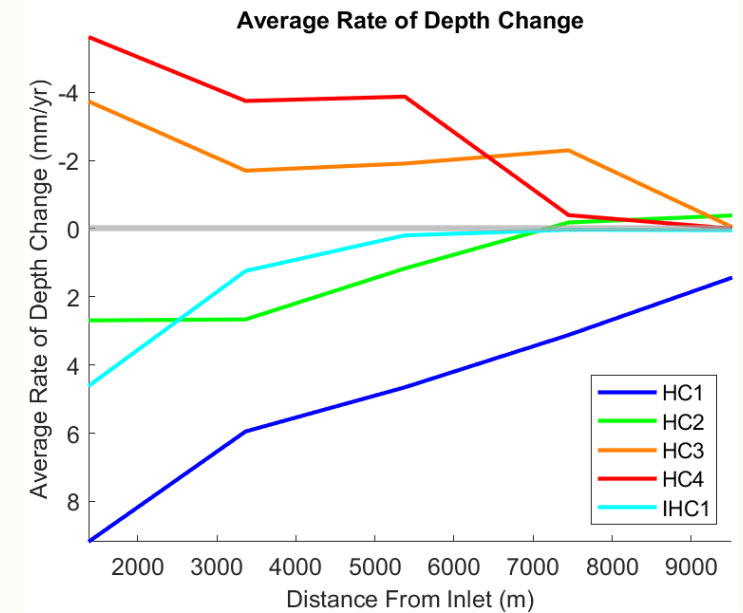


Summary – Technical Achievements

FY20

Model Sediment Transport Analysis:

- Investigate the switch from net import to export
- Compare various bay metrics to net sediment transport

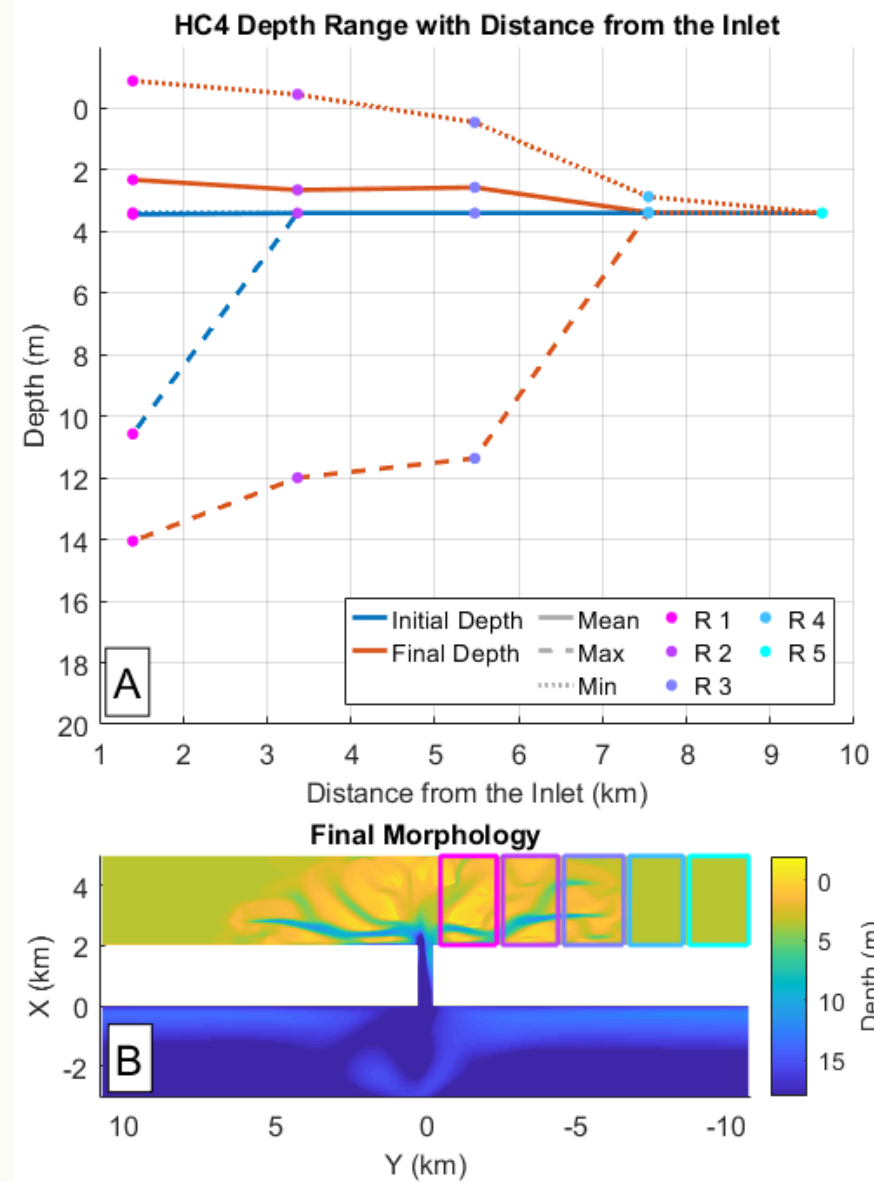
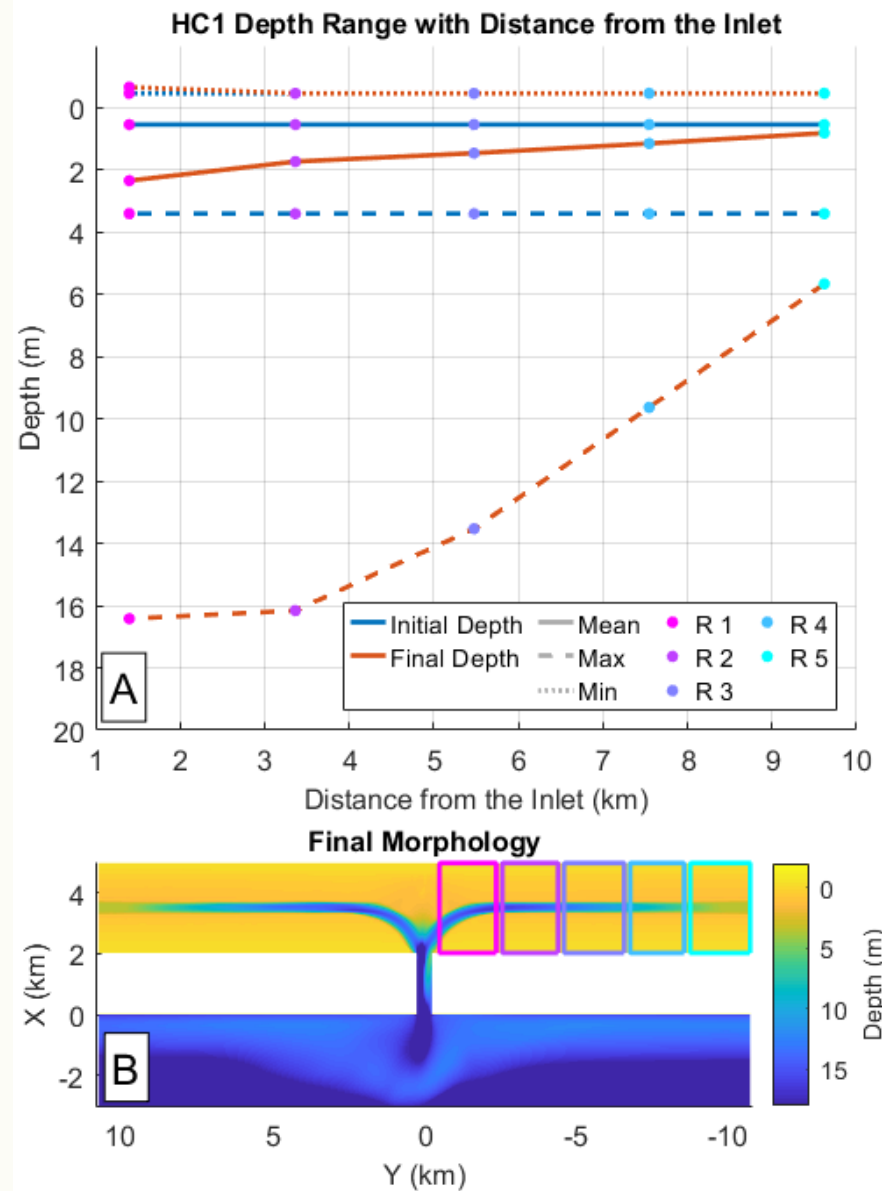


Summary – Technical Achievements

FY20

Model Run Analysis:

- Investigate morphology change as a function of distance from the inlet



Summary

FY20 Major Advances in Capability

- Analyze bay metrics and compare to existing theories/established concepts
- Analyze and compare bay metrics between different cases (e.g., import/export systems)
- Compare morphology and morphology change as a function of distance from the inlet

FY20 Major Products & Collaborations

- Effect of Basin Hypsometry on Long-term Inlet Hydrodynamics and Sediment Transport TR (In prep)
- CIRP TD
- Conference paper (delayed COVID)
- Leverage new start on wetland nourishment

FY21 Products/Advances

- Hypsometry gives VERTICAL distribution but what about HORIZONTAL distribution?
- Quantify the effect of land distribution to inlet import/export
- Prepare JP
- Publish TR
- CIRP TD

