MODELING INVESTIGATION OF NEARSHORE SEDIMENT TRANSPORT

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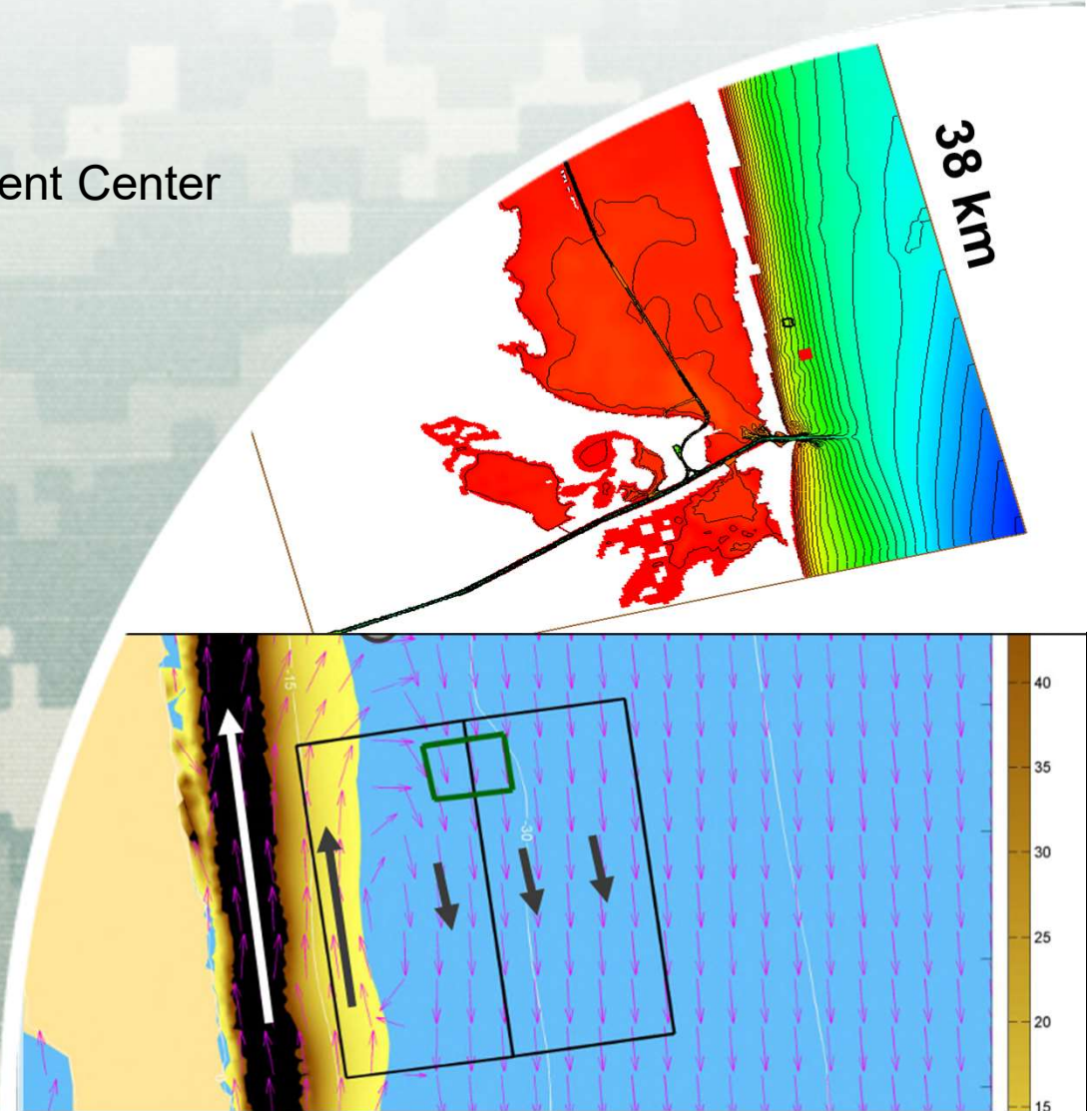

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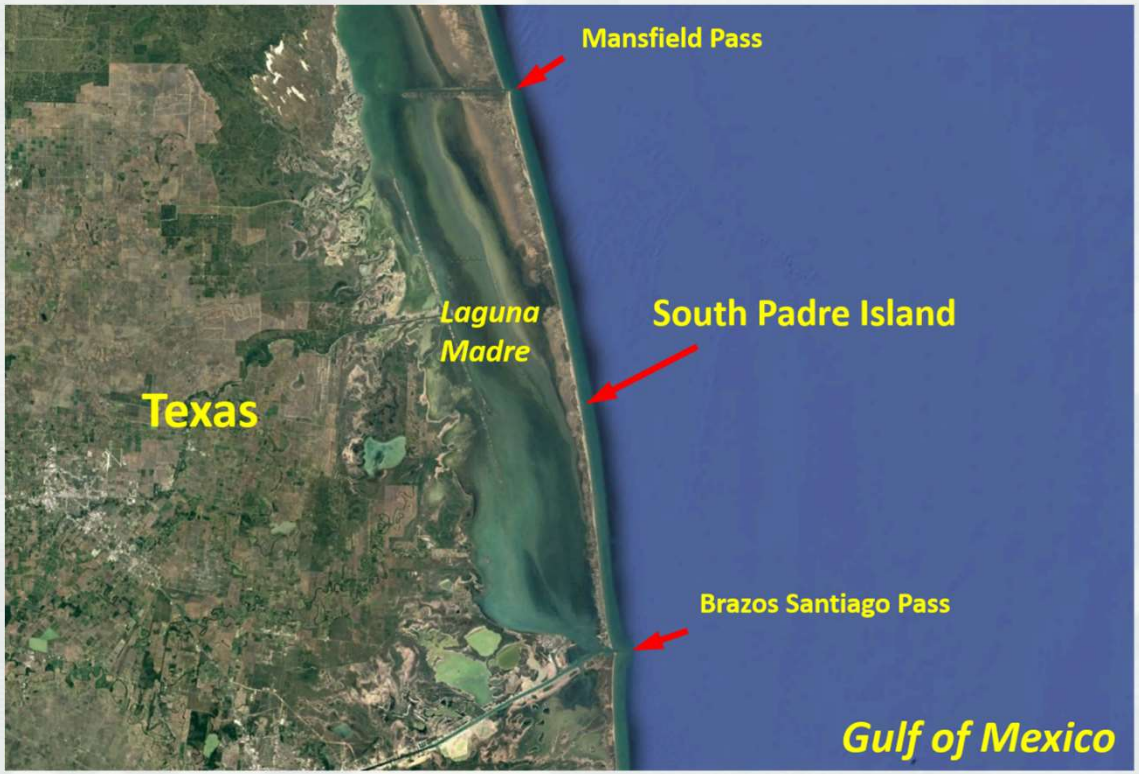
Background

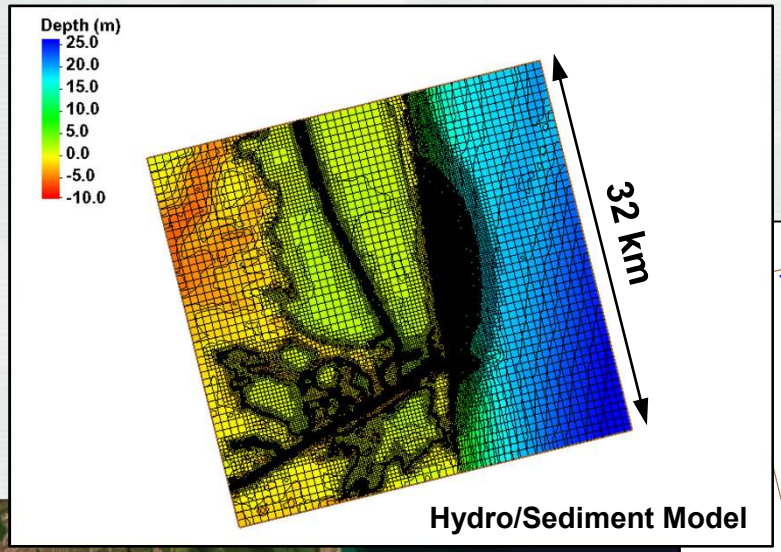
- South Padre Island is located on the southern Texas Coast between the Gulf of Mexico to the East, and Laguna Madre to the West. The southern extent of the island contains developed beaches.
- The South Padre Island Beneficial Use of Dredged Material program was established to prevent beach erosion and mitigate shoreline retreat. The program will need to continue to evolve to offset increasing rates of sea level rise and subsequent shoreline changes.

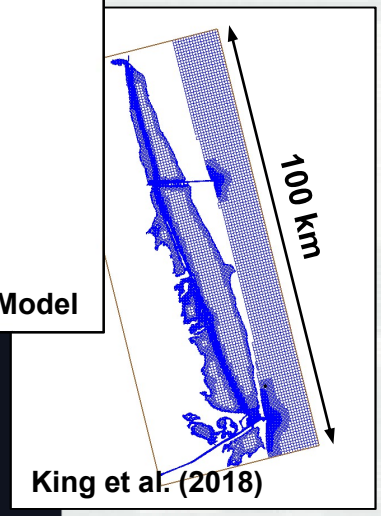


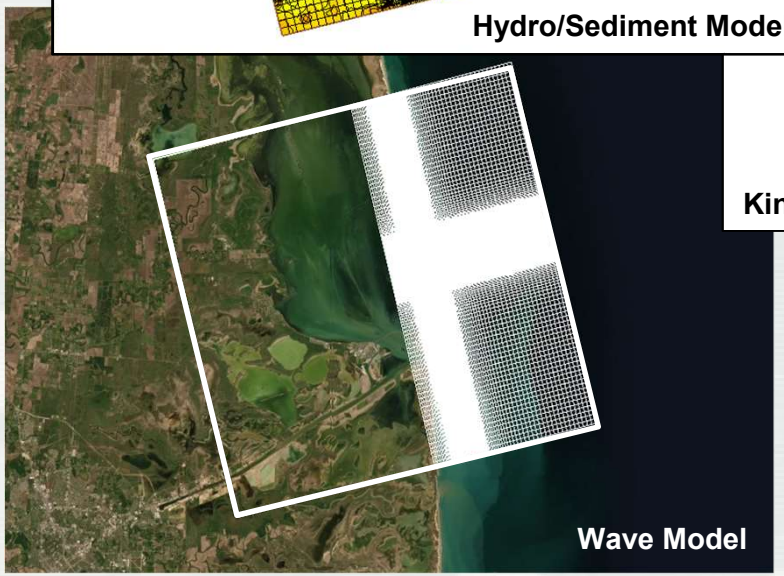
- Configuration of a coastal sediment transport model for improved understanding of regional transport pathways and assisting development of long-term sand management plan.

Coastal Numerical Model

- Coupled Coastal Modeling System (CMS)
- Depth averaged hydrodynamic and sediment transport model (CMS-Flow)
- 2-D wave transformation model (CMS-Wave)
- Model grid focusing on South Padre Island and dredged material placement areas







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Data

Boundary forcing:

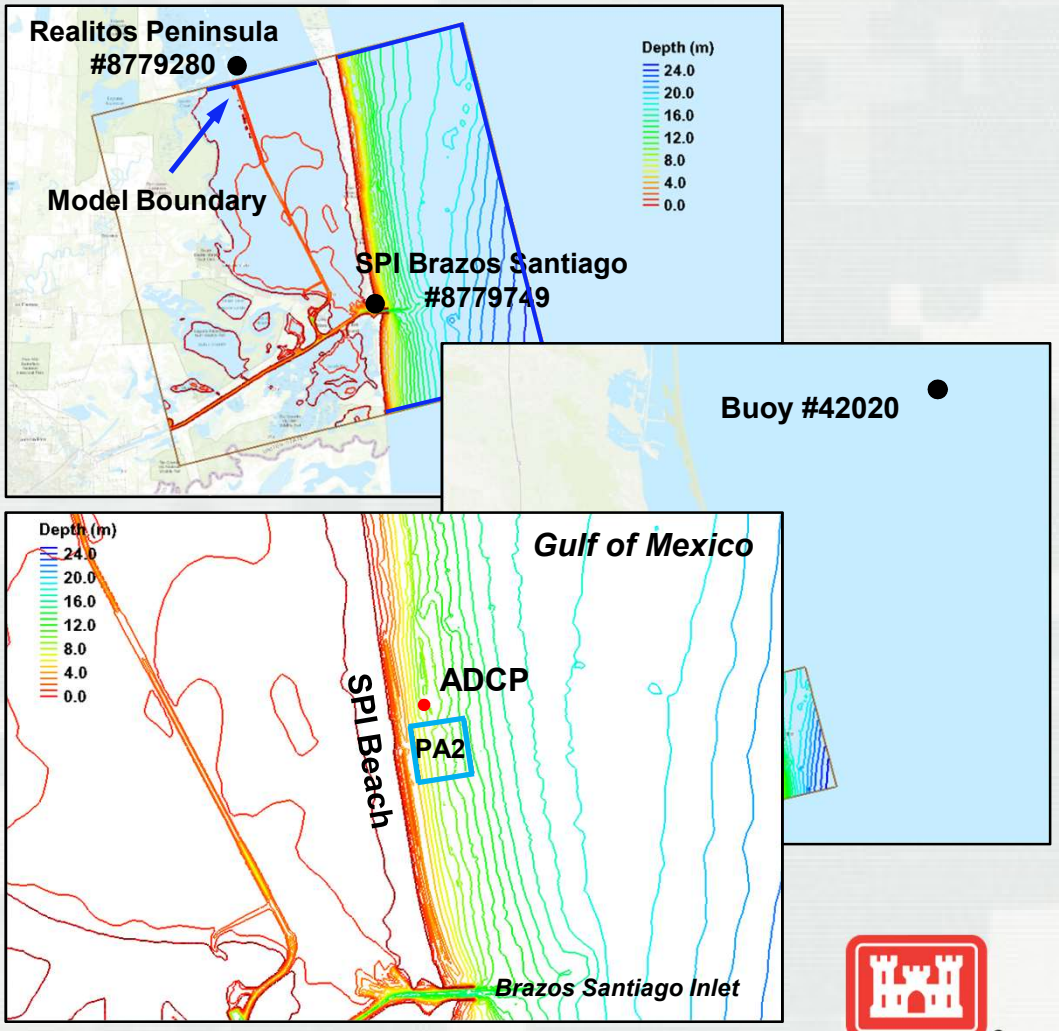
- NOAA coastal gages (Brazos Santiago and Realitos Peninsula), water surface elevation, wind
- NOAA buoy (#42020), wave spectra, wind

Model calibration/validation:

- Nearshore ADCP gage
- PA2, bathymetry surveys at material placement area

Survey Periods

- January to October 2019



Model Validation

- Measured (ADCP) and calculated water surface elevation, longshore current, wave parameters (Jan 12 – Feb 12, 2019)

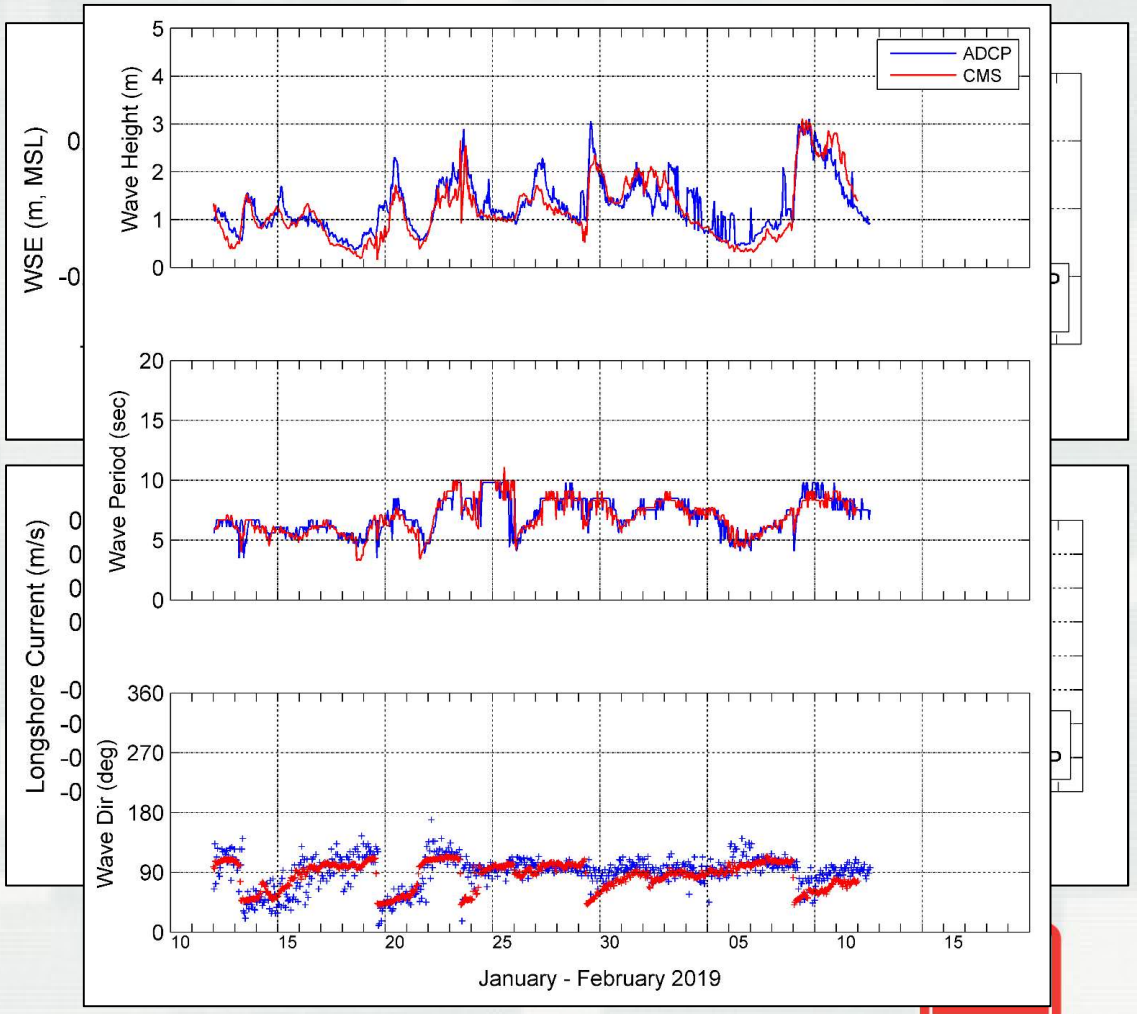
Goodness-of-Fit Statistics

Significant Wave Height

RMSE: 0.35 m

CC (R^2): 0.7

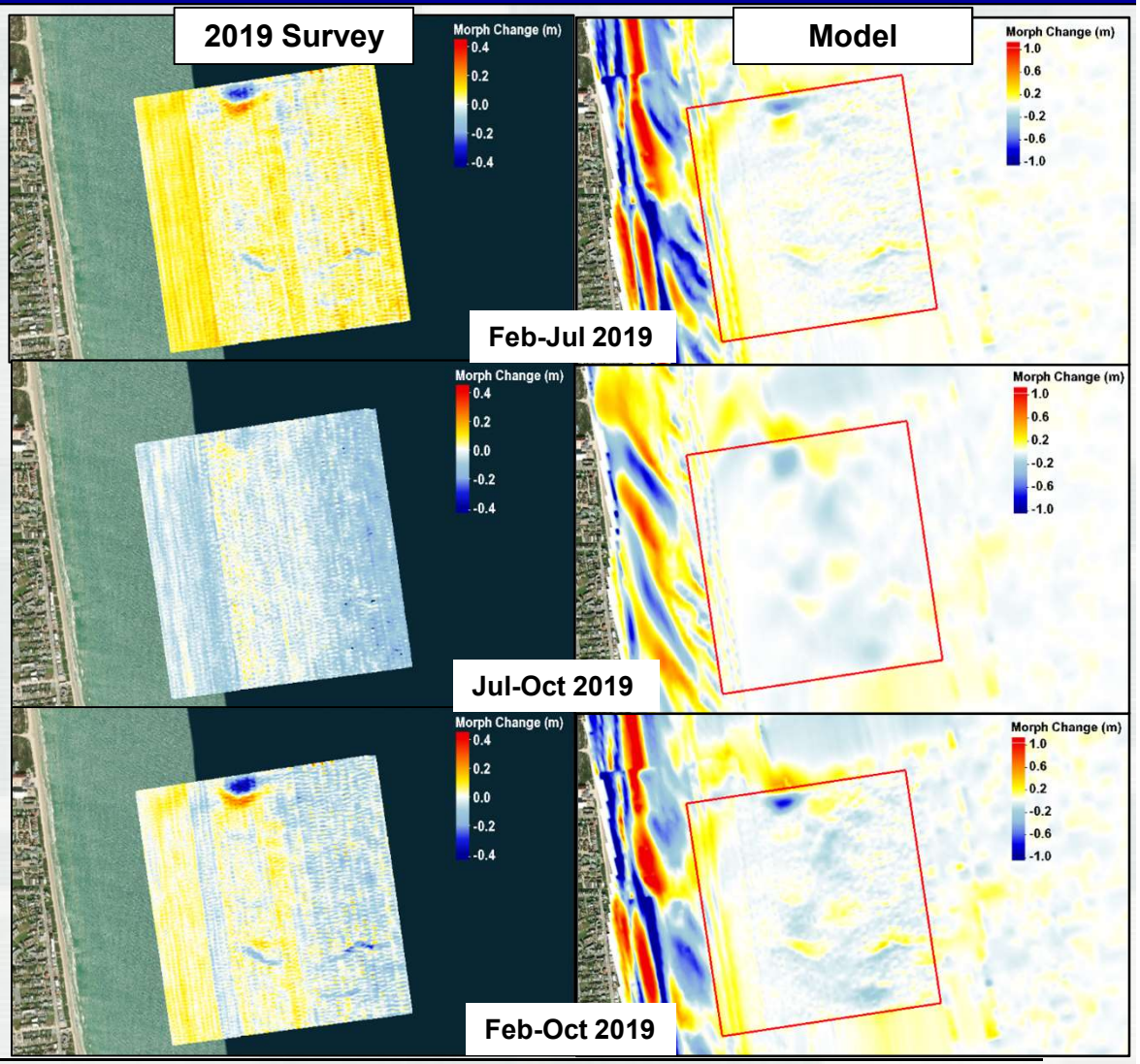
RRMSE: 12.9%



Model Validation

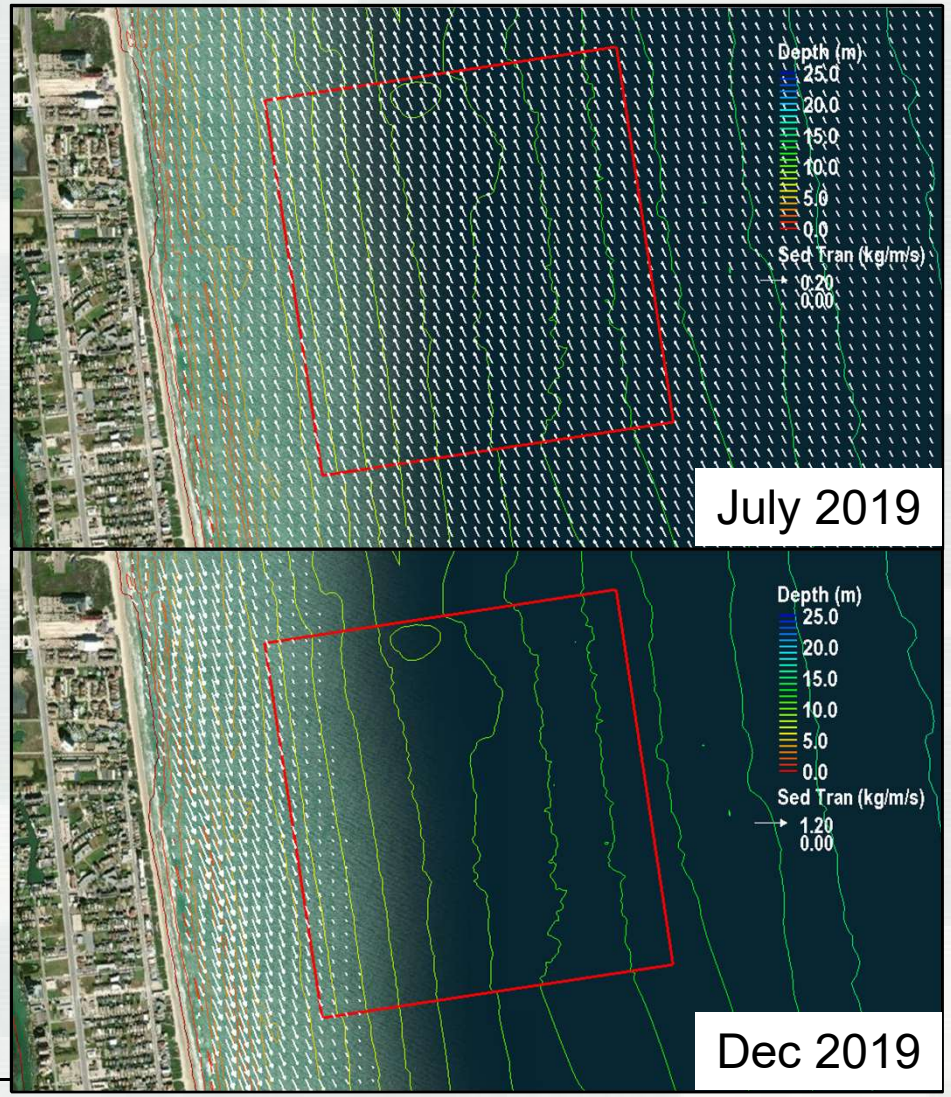
- Measured and calculated morphology change at PA2 (Feb – Oct, 2019)
- Consistent erosion and accretion pattern in nearshore placement area

Period (2019)	Volume Change (m^3)	
	Survey	CMS
Feb-Jul	108800	15839
Feb-Oct	-34913	-27717



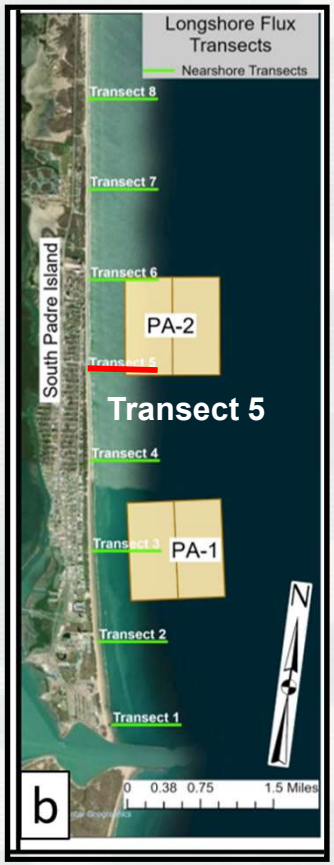
Current and Sediment Transport

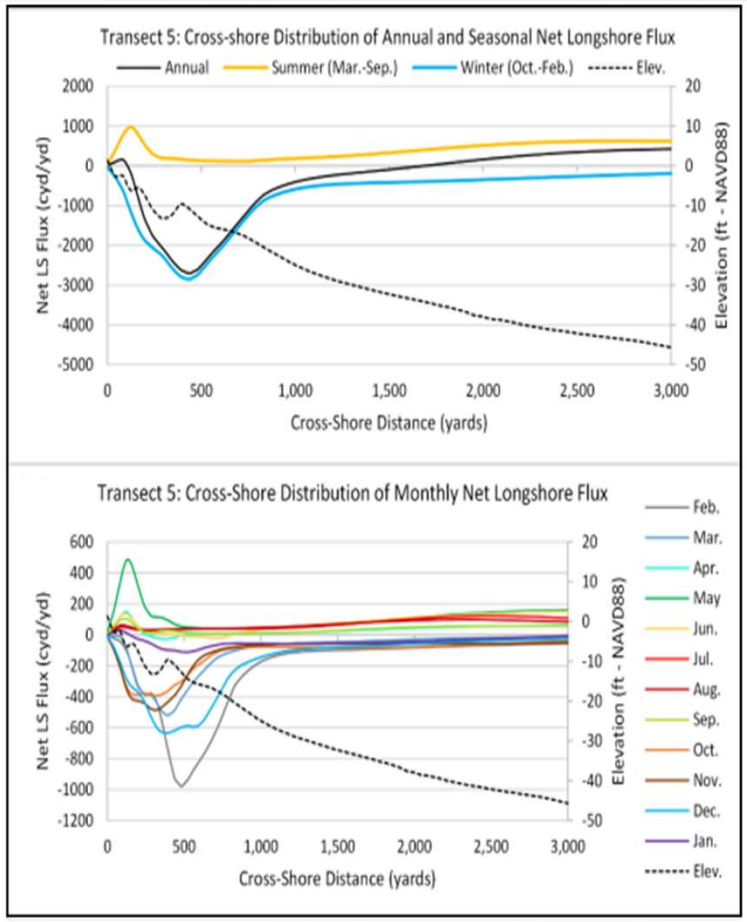
- Monthly averaged sediment transport vectors
- Summer month: current and sediment transport direction is towards north-northwest
- Winter month: high waves induce strong southward longshore current and sediment transport. Sediment transport rates are high in nearshore area



Longshore Transport

- Cross-shore distribution of annual and seasonal net longshore flux along the offshore Transect 5
- Seasonal net flux rates show different flux direction: Summer (April – September) Winter (October – March) months
- Net annual longshore flux is to the south throughout the region





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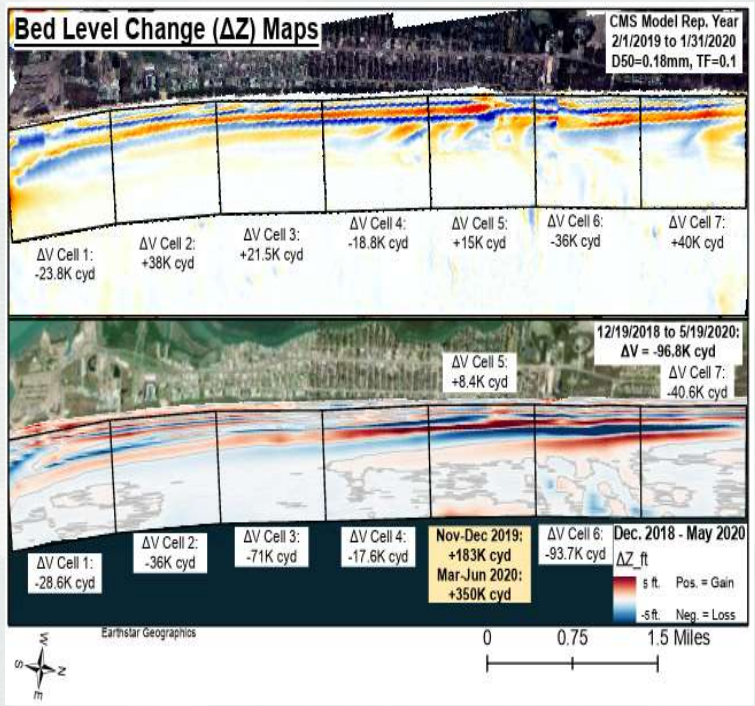
Summary

- Averaged sediment transport patterns are consistent with averaged wind- and wave-driven flow patterns.
- Calculated and measured bed volume changes show seasonal variability in bed accretion and erosion trend.
- Calculations show net annual southward transport throughout the region also with strong seasonal variations in longshore sediment transport direction.



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Thank You!