U.S.ARMY

EVALUATING METHODS FOR ESTIMATING NEARSHORE BERM DEFLATION RATES

INLET GEOMORPHOLOGY WORK UNIT

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COASTAL INLETS RESEARCH PROGRAM

FY21 IN PROGRESS REVIEW

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Can bulk longshore and/or cross-shore transport equations be used to predict deflation rates of sediment placed in the nearshore?

- **Existing predictive methods tend to emphasize the likelihood of sediment motion, but they do not calculate the rate of sediment removal from a placement site**
  - *e.g.*, McLellan *et al.* (1990), Hands and Allison (1991), Ahrens and Hands (1998); McFall *et al.* (2016); Priestas *et al.* (2019)

- **Recent progress towards cross-shore deflation rate prediction by Hudson et al. (2021).**

- **Objective is to develop a computationally-efficient method of generating order-of-magnitude nearshore berm deflation rates using combined longshore and cross-shore transport equations.**

Statements of Need:

2020-N-1564: Increasing Beach Nourishment Lifespan with Nearshore Nourishments

2020-N-1481: Improving scoping level estimates of the lifespans and deflation rates of nearshore nourishments

2019-N-1386 Strategic Nearshore Placement of Dredged Material to Sustain Coastal Beach & Dune Resilience

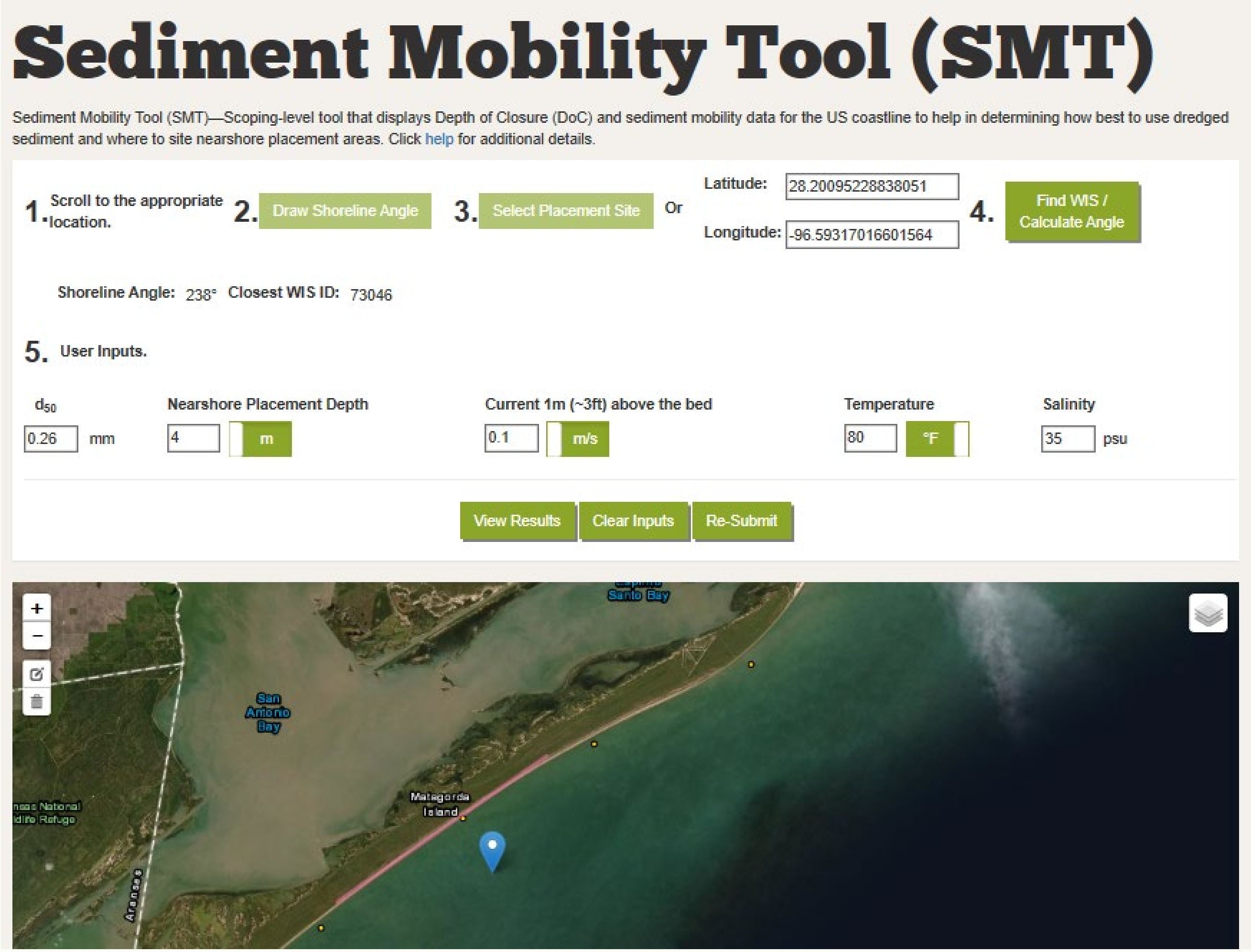
2017-N-70 Analysis of Shoreline Response to Nearshore Placement Geometry

2016-N-04 Quantifying wave and current driven sediment transport at nearshore dredge disposal sites

Capability and Strategic Impact Statement

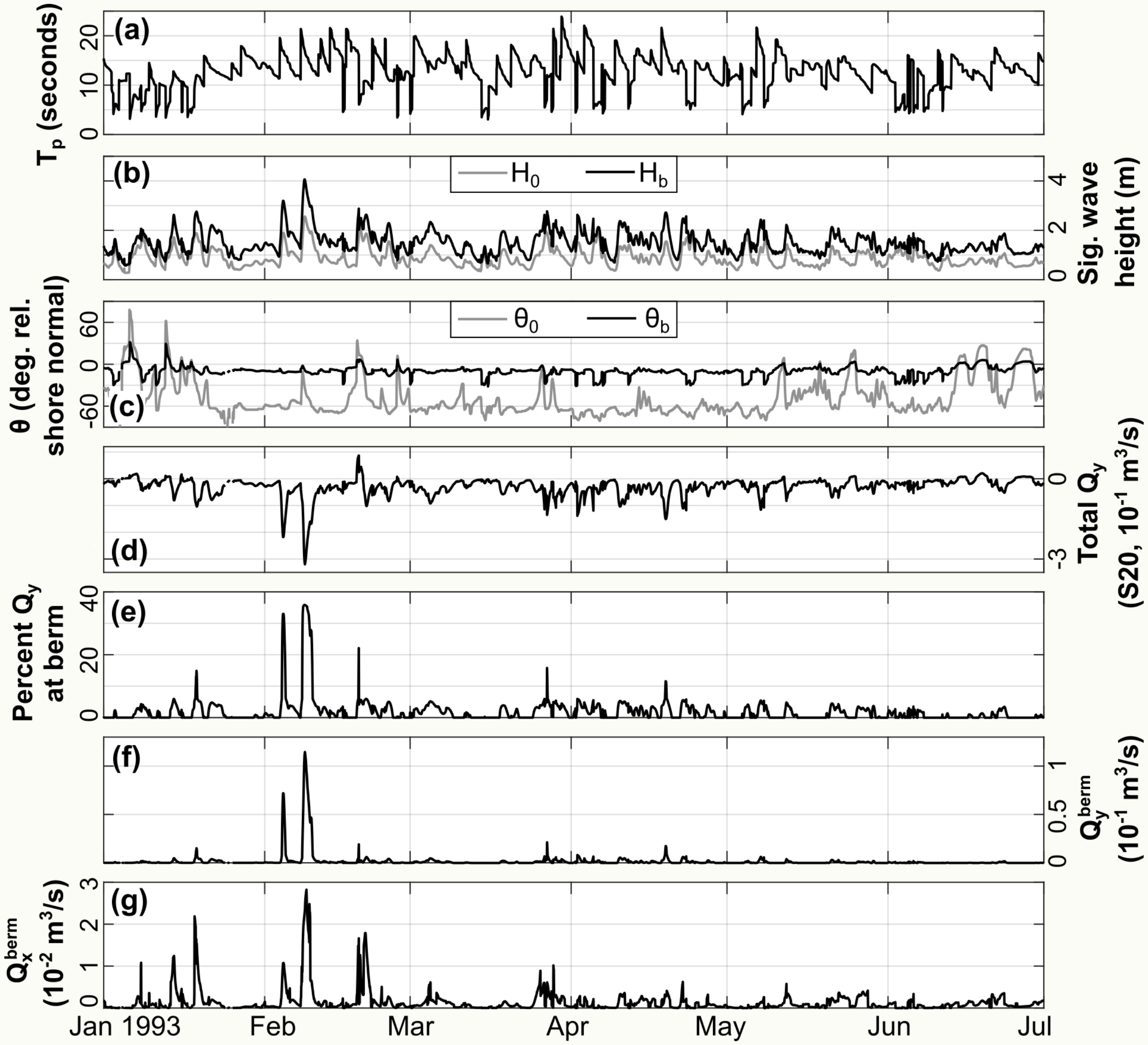
An algorithm for estimating nearshore berm deflation rates using published longshore and cross-shore transport equations will provide valuable information for placement design and re-nourishment planning.

The algorithm will be implemented within the Sediment Mobility Tool to facilitate usage.



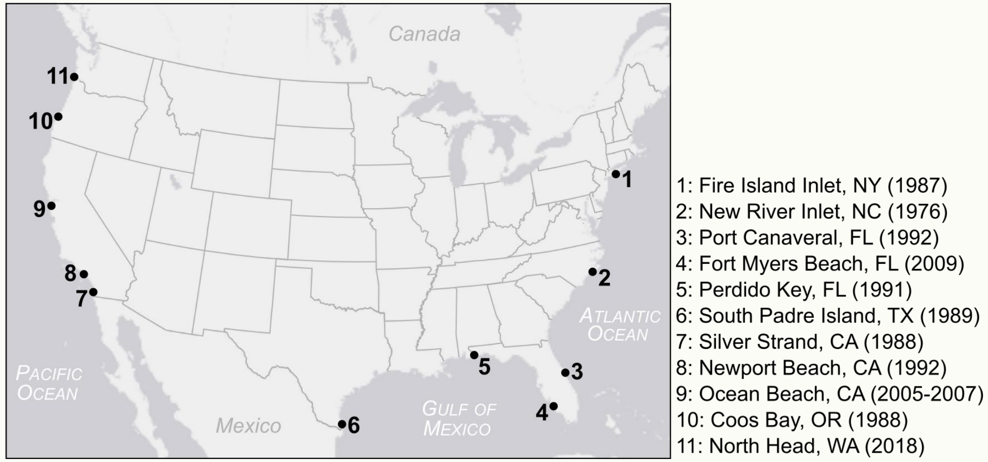
Algorithm overview

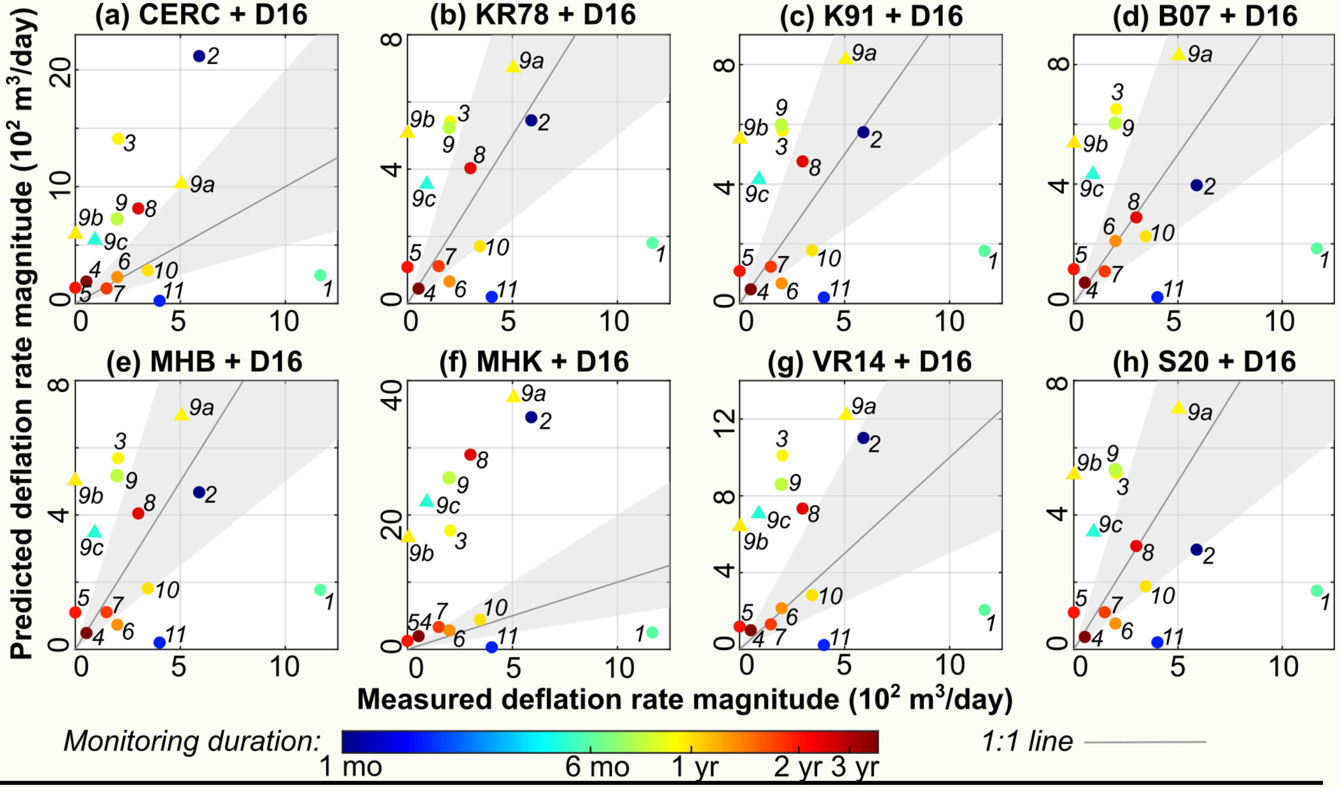
- Longshore and cross-shore transport rates are independently calculated and then superimposed to generate a total deflation rate.
- Parameters include nearshore berm position, geometry, and grain size, along with wave height, direction, and period from the most proximal WIS station.
- Percentage of longshore transport contributing to deflation is based on experimental data.



Validation

- Eight longshore transport formulations were evaluated for relative performance.
- Cross-shore transport was calculated using the method of Dronkers (2016) as implemented by Hudson et al. (2021).
- Error between measured and calculated deflation rates was determined for 11 historical nearshore berm sites.
- Best-performing method applies the longshore transport formula of Shaeri et al. (2020) and the cross-shore transport formula of Dronkers (2016; abbreviated S20+D16 at right).
  - Maximum |percent error| of 167%
  - Average |percent error| of 72%.
  - Low sensitivity to grain size uncertainty.
  - Low sensitivity to beach slope uncertainty.





Summary

FY21 Major Advances in Capability

- Cross-shore transport added to longshore-based method developed in FY20.
- Significant increase in scope of validation.
- Methods documented in detail and available to the public.

FY21 Major Products & Collaborations

- 1 journal article published in *Journal of Waterway, Port, Coastal, and Ocean Engineering.*
- 1 CIRP TD in May 2021.

FY22 Products/Advances

- Methodology will be implemented within Sediment Mobility Tool (SMT).