PERFORMANCE OF CMS WITH CROSS-SHORE PROCESSES IN NEARSHORE PLACEMENTS (CMS/C2SHORE)

CMS WORK UNIT

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COASTAL INLETS RESEARCH PROGRAM

FY20 IN PROGRESS REVIEW

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Mission Support
Technology Transfer
CIRP
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Problem Statement

- **The development of the nearshore modules incorporated in CMS (C2SHORE and LUND-CIRP) is based on lab experiments that may not be appropriate across the range of field conditions, and is not sufficiently tested.**

- **Evaluate the implementation of and improve accuracy of the present C2SHORE implementation and existing LUND-CIRP module in modeling littoral transport and predicting nearshore morphology change.**

Navigation Statements of Need
- 2019-1355: Nearshore Processes Research and Development
- 2019-1370: Testing and Evaluation of USACE Coastal Numerical Models

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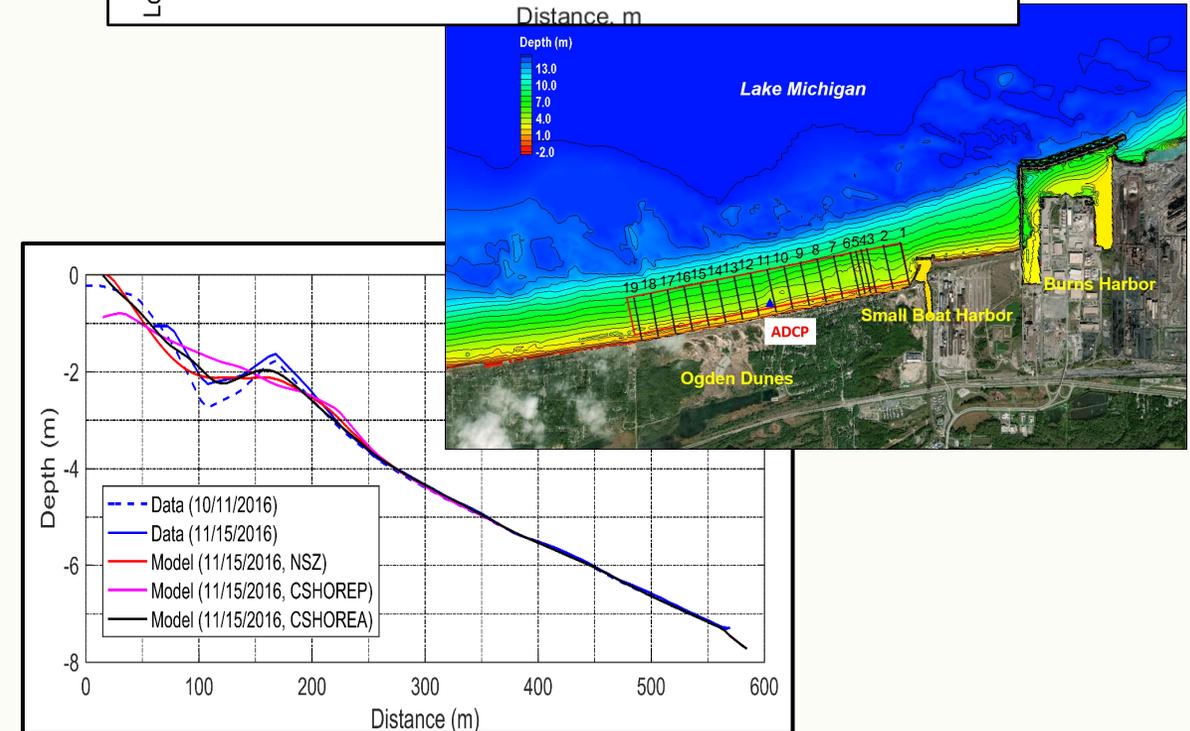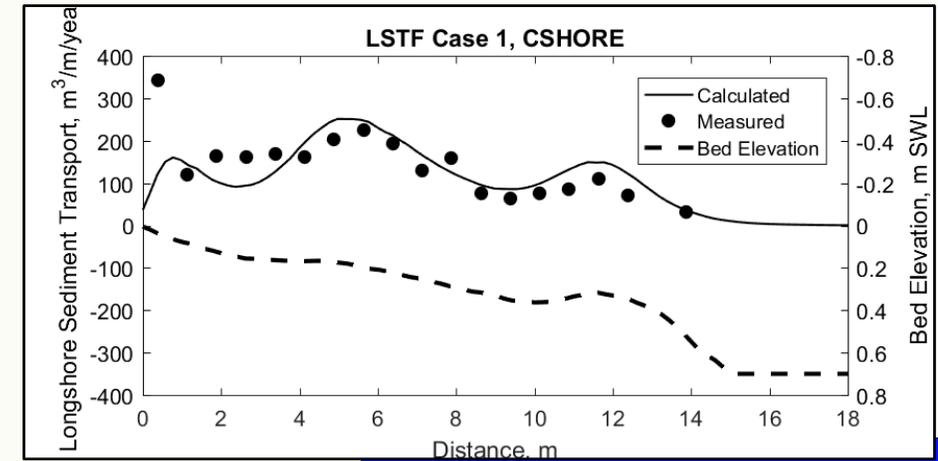
Capability and Strategic Impact Statement

Increase CMS' capability to simulate waves, hydrodynamics, sediment transport, and morphodynamics in nearshore zone.

Address problems related to shoreline erosion, to design and assess nearshore placement of dredged sediment material and beach nourishment projects, and to predict seasonal onshore-offshore bar migration.

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Wave-Induced Nearshore Transport

- ## LUND-CIRP

Suspended Transport

$$q_{su} = \frac{U_m C_R \varepsilon}{w_s}\left[1 - \exp\left[-\frac{w_s}{\varepsilon}d_t\right]\right]$$

$$q_{sb} = \frac{U_b C_R \varepsilon}{w_s}\exp\left[-\frac{w_s}{\varepsilon}d_t\right] * 2 * \sinh\left[\frac{Hw_s}{2\varepsilon}\right]$$

Bed Load Transport

$$q_{ba} = a_w\sqrt{\frac{f_w}{2}}\,d_{50}\hat{u}K_a\theta_{cw,m}\exp\left[-b\frac{\theta_{cr}}{\theta_{cw}}\right]$$

$$q_{bu} = a_c\sqrt{\frac{f_c}{2}}\,d_{50}U_m\theta_{cw,m}\exp\left[-b\frac{\theta_{cr}}{\theta_{cw}}\right]$$
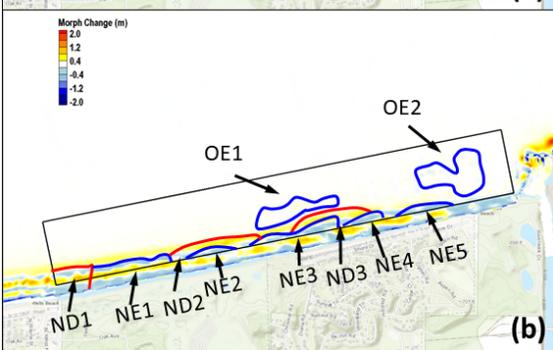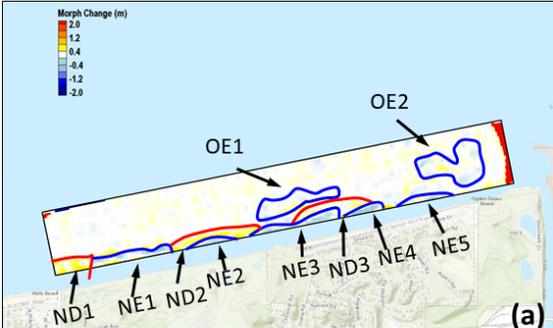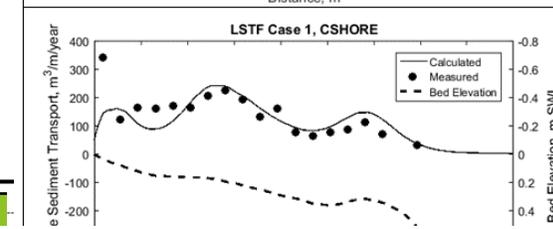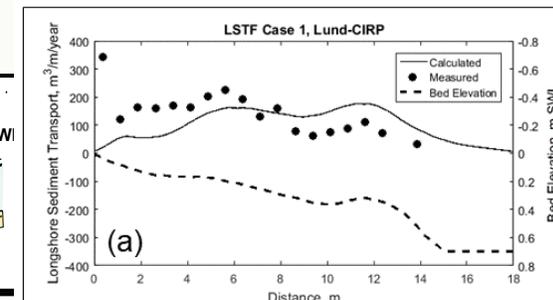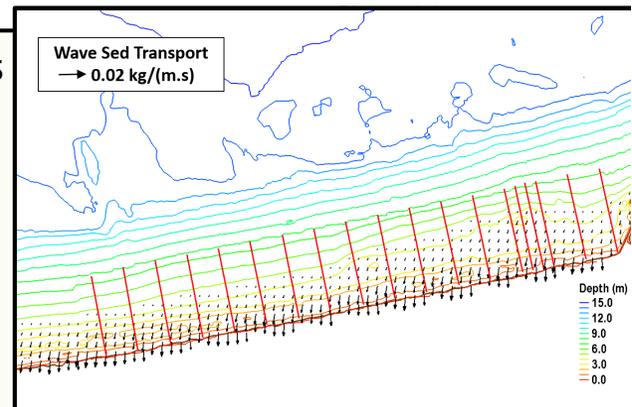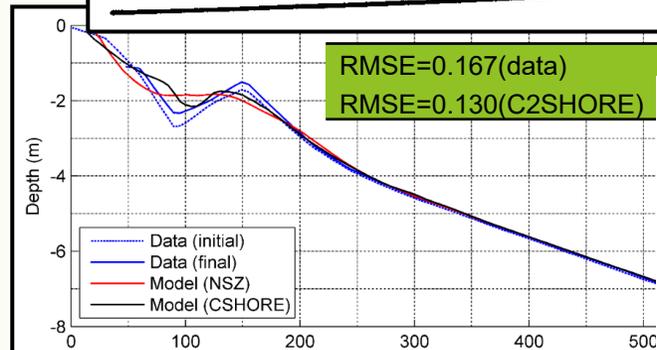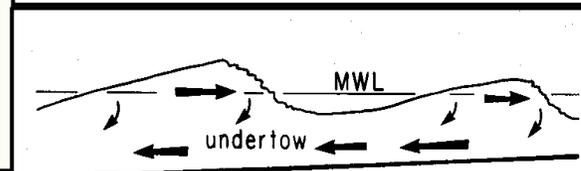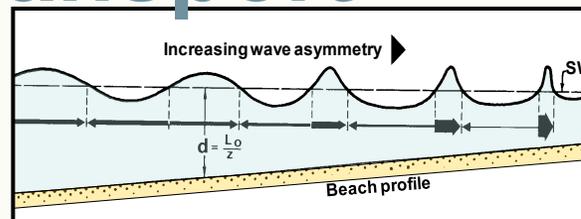
- ## C2SHORE

Suspended Volume

$$V_s = P_s\frac{e_B D_r + e_f D_f}{\rho g(s-1)w_f}\left(1 + S_{bx}^2\right)^{0.5}\left(1 + S_{by}^2\right)^{0.5}$$

Suspended Transport

$$q_{sx} = a_x\bar{U}V_s \qquad q_{sy} = \bar{V}V_s$$

Bed Load Transport

$$q_b = \frac{bP_b}{g(s-1)}\sigma_T^3$$

RMSE=0.167(data)
RMSE=0.130(C2SHORE)

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Summary

FY20 Major Advances in Capability

- **Incorporated C2SHORE module in the CMS to calculate surf zone sediment transport.**
- **Tested LUND-CIRP and C2SHORE modules in the lab case and the field case.**

FY20 Major Products & Collaborations

- **1 TN: Numerical Modeling of Cross Shore Processes (draft)**
- **1 JP: Transport of Placed Dredged Material in Surf and Nearshore Zone (peer review)**
- **1 CIRP TD: Performance of CMS with Cross-shore Processes in a Field Study**

FY21 Products/Advances

- **Further CMS test against wave, current, and sediment data at FRF site.**
- **Sum up the results of lab experiments, FRF, and field application.**
- **Publish a TR.**

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