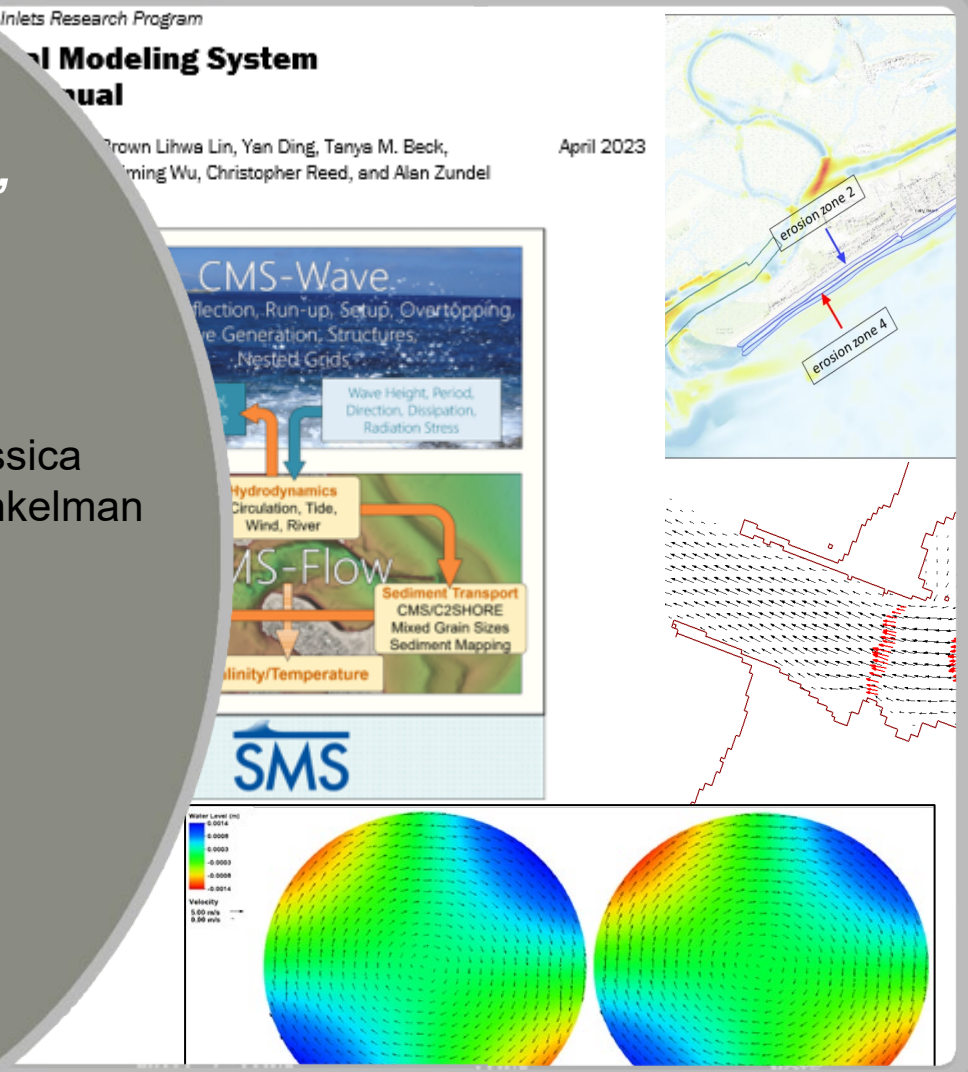
COASTAL MODELING SYSTEM

CMS DEVELOPMENT, V&V, TECH TRANSFER, AND USER SUPPORT



PIs- Honghai Li and Mitchell Brown

Lihwa Lin, Yan Ding, Liz Holzenthal, Chris Reed

District PDT Members

Kevin Hodgens, Rod Moritz, Jessica Podoski, Grace Maze, John Winkelman

COASTAL INLETS RESEARCH PROGRAM

FY22 IN PROGRESS REVIEW

Tiffany Burroughs
HQ Navigation Business Line Manager

Eddie Wiggins
Technical Director, Navigation

Brian McFall
Acting Associate Technical Director, Navigation

CIRP: Mission Support, Technology Transfer, Research & Development

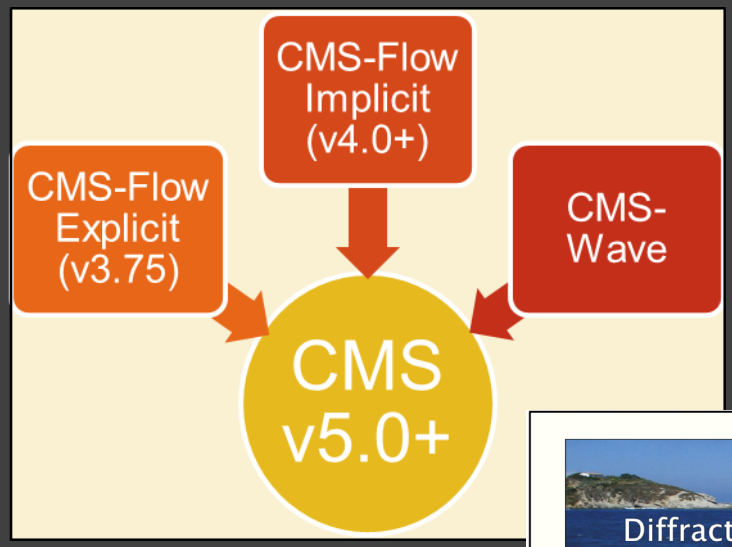
US Army Corps of Engineers

CHL COASTAL & HYDRAULICS LABORATORY

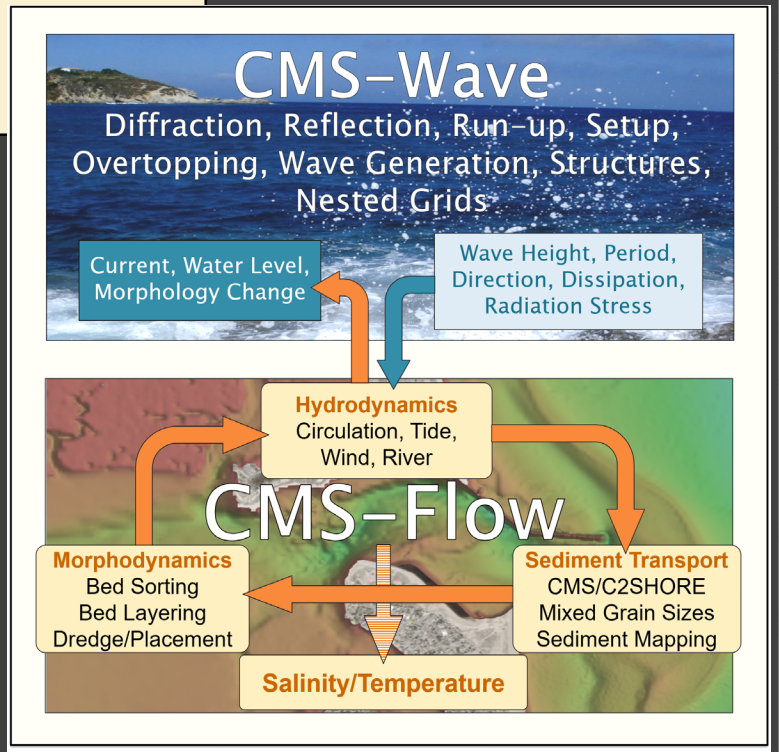
ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

Problem Statement

- The Coastal Modeling System has evolved from three separate models into one merged code (presently CMS 5.3):
  - A model user guide is necessary for USACE-wide tech transfer and user support.
  - Merged Code debugging, testing, and streamlining
  - GUI releases – SMS 11.x to SMS 13.2 (dynamic interface)
  - Training via workshops/webinars.



HH&C CoP Preferred



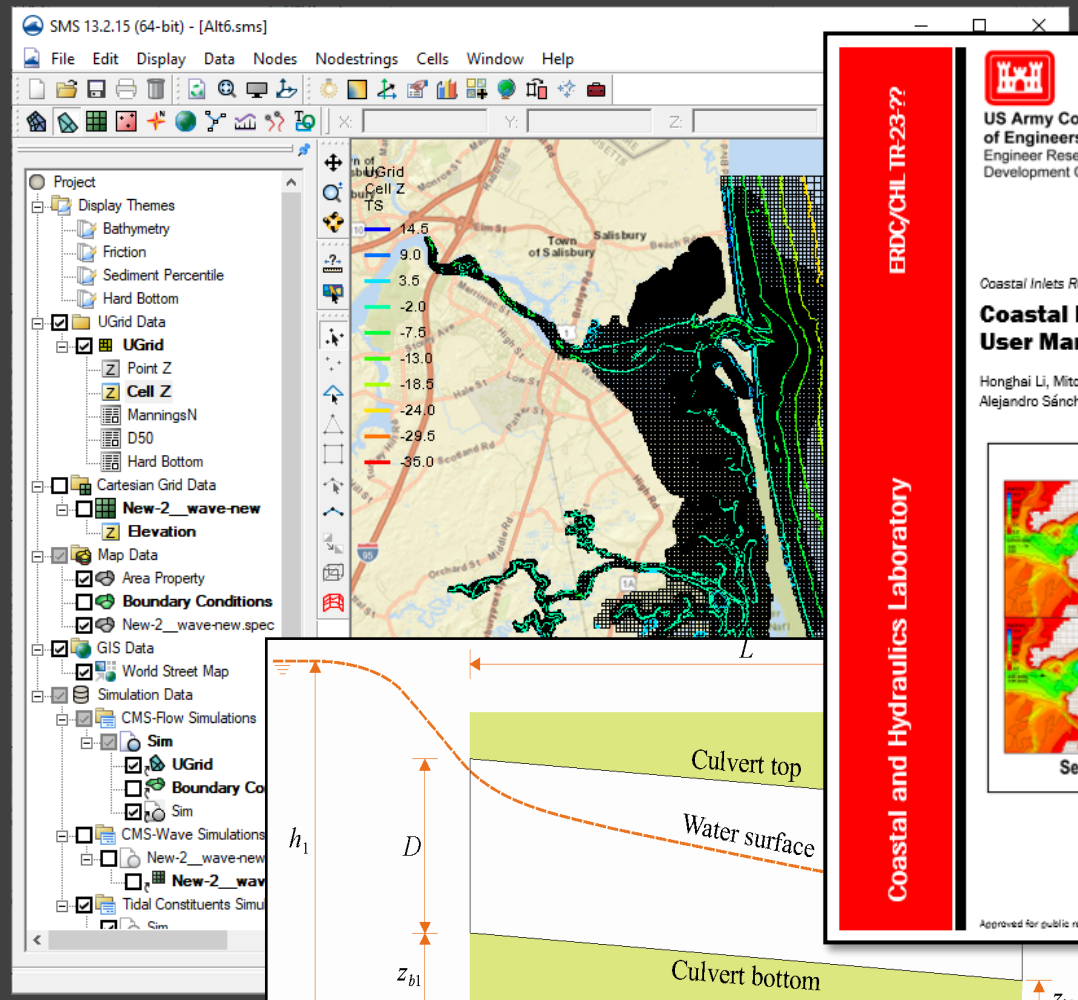
CMS Framework

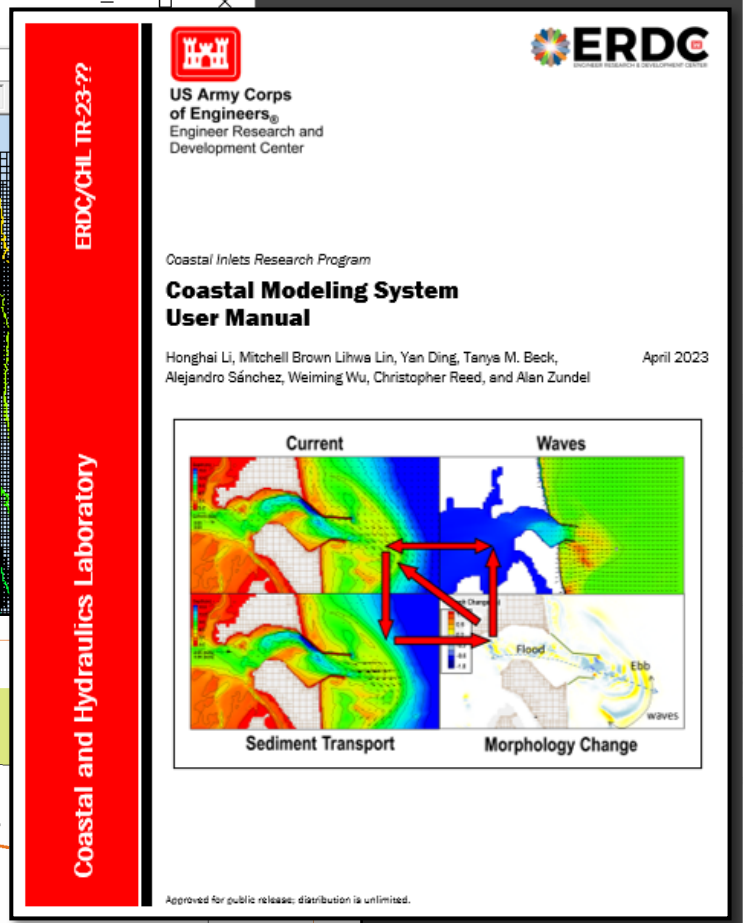
Navigation Statements of Need

- 2019-N-1370: Testing and Evaluation of USACE Coastal Numerical Models.

CMS User Guide

- Hydrodynamics, wave transformation, sediment transport and bed changes
- Governing equations and numerical methods
- Graphical user interface for model setup and result post-processing with SMS 13.2
- Features
  - Surf zone process (longshore, cross-shore sediment transport)
  - Salinity/temperature calculations
  - Coastal structures (rubble mound, culvert, weir, tidal gate)
  - Sediment mapping (Eulerian sediment tracer simulation)
  - Sea level change
  - Dredge/placement module





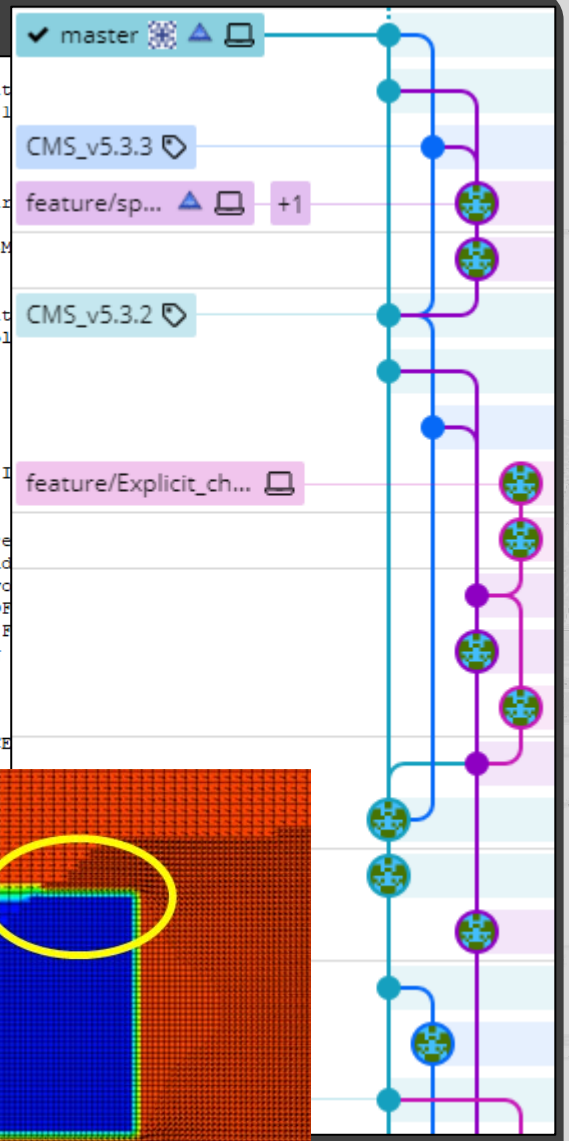
$$\frac{\partial(hV_i)}{\partial t}+\frac{\partial(hV_jV_i)}{\partial x_j}-\varepsilon_{ij}f_chV_j=-gh\frac{\partial\bar{\eta}}{\partial x_i}-\frac{h}{\rho}\frac{\partial p_a}{\partial x_i}$$

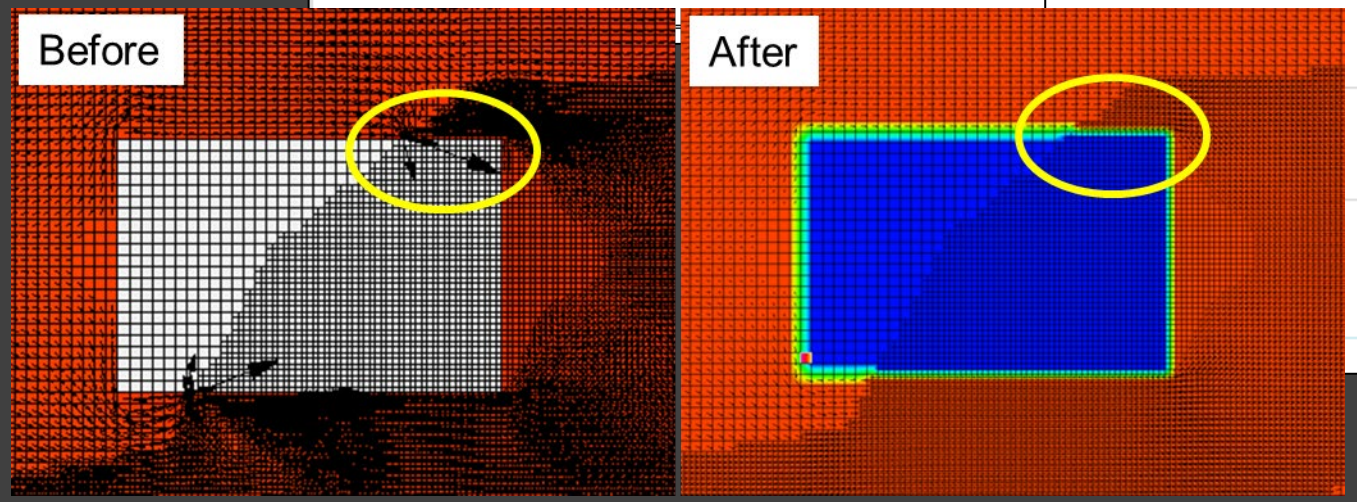
$$+\frac{\partial}{\partial x_j}\left(\nu_t h\frac{\partial V_i}{\partial x_j}\right)-\frac{1}{\rho}\frac{\partial}{\partial x_j}\left(S_{ij}+R_{ij}-\rho hU_{wi}U_{wj}\right)+\frac{\tau_{si}}{\rho}-m_b\frac{\tau_{bi}}{\rho}$$

CMS: Coding changes

- Release of CMS v5.3 for working with SMS 13.2 interface.
- Numerous edits for bug-fixes or improved features (Brown, Li)
- Bug fixes relating to the explicit solution scheme (Reed)
- Integrated C2Shore sediment algorithms into master CMS code (Johnson)
- Major change for inline steering correcting behavior of the wave model integration (Lin)
- Maintain CMS code in Git repository for accessing and interacting within and coworkers outside the group

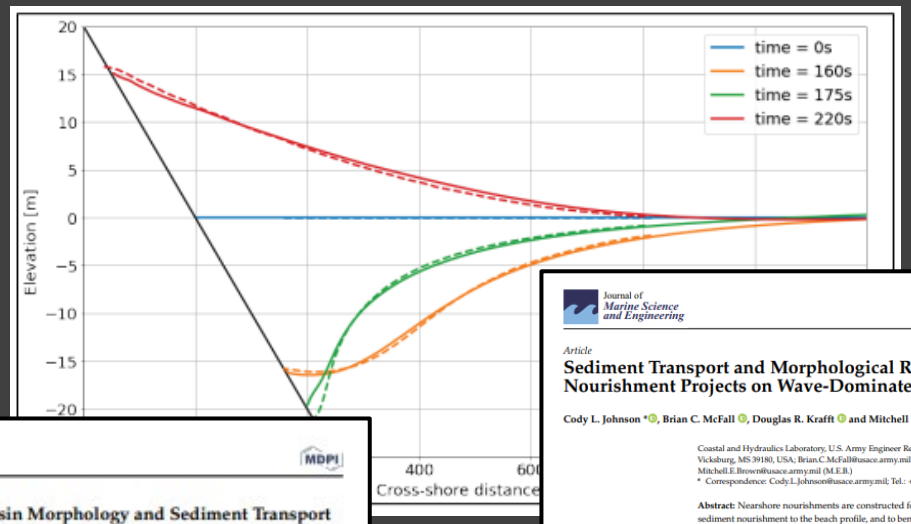
```
== Version 5.3.3 (04/07/2023) ==
* Split third-party code (spatial transformations) out as separat
* Implemented two new ADCIRC tidal databases (EC2015 and ENPAC201

== Version 5.3.2 (08/11/2022) ==
* Minor change to reading parameter file for Explicit scheme.
* Bug fix when choosing multi-sediment with D35,D50,D90. Fixed ar
* Bug fix in one lookup-table, 'bs_init' routine.
* Bug fix in Tools (Option 4) when merging datasets written by SM

== Version 5.3.1 (07/07/2022) ==
* Minor change to Weir Structure specification cards for integrat
** Add option to specify Cell IDs in the same manner as for Rubbl
* Updated the array upper limit for several CMS-Wave variables.

== Version 5.3.0 (05/16/2022) ==
* Initial version of CMS to be released with SMS version 13.2
* Change cardnames and documentation from 'CSHORE' to 'C2SHORE'.
** C2SHORE is a new option for Cross-shore sediment transport.  I

== Version 5.2.18 (04/29/2022) ==
* Bug fix for DREDGE_RATE card in the dredging module. Was not re
* Bug fix for divide by zero in WVBRK_Inline - rewrote using cond
* Bug fix for using Initial Condition file outside the current wo
* New card 'EXTEND_DURATION_RUN_FOR_HOTSTART' with value 'ON'|'OF
* Minor - force user to associate datasets with their choice of F
* Minor - added better diagnostic output for Dredge Rate showing

== Version 5.2.17 (03/29/2022) ==
* Bug fix for Wave structures
* Bug fix for Dredge/Placement where no cards exist between PLACE
```





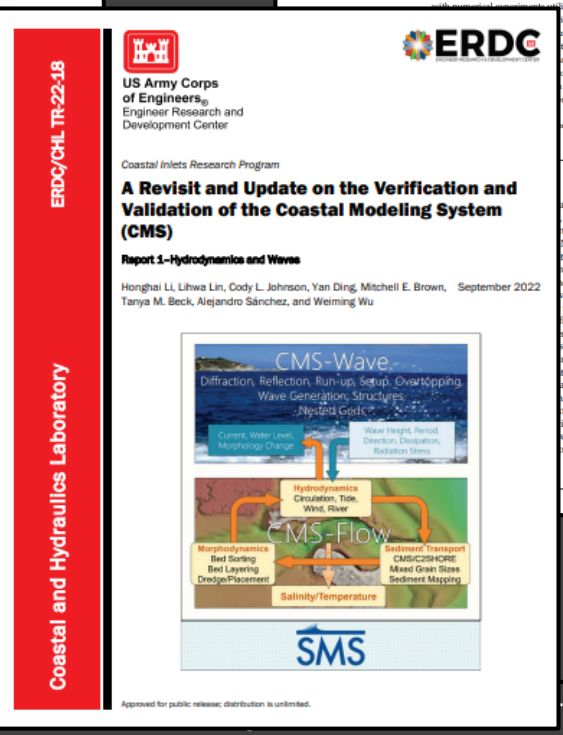
CMS: Tech Transfer

- Assist USACE users in CMS applications
- Support districts in projects on sediment management, dredge/placement operations, beach nourishment, coastal structure design (NAE, NAN, NAP, NAB, NAO,SAW, SAJ, NWS, SPN, SWG, LRB, LRE)
- Start migration of WaveNet tools to the WIS Portal
- Updated several key CIRP Wiki pages with latest information
- Documentation (tech reports, tech note, letter report, JP, SOWs)




Journal of Marine Science and Engineering
MDPI
Article
Feedback between Basin Morphology and Sediment Transport at Tidal Inlets: Implications for Channel Shoaling
Douglas R. Krafft *, Richard Styles and Mitchell E. Brown


Journal of Marine Science and Engineering
MDPI
Article
Sediment Transport and Morphological Response to Nearshore Nourishment Projects on Wave-Dominated Coasts
Cody L. Johnson *, Brian C. McFall, Douglas R. Krafft and Mitchell E. Brown



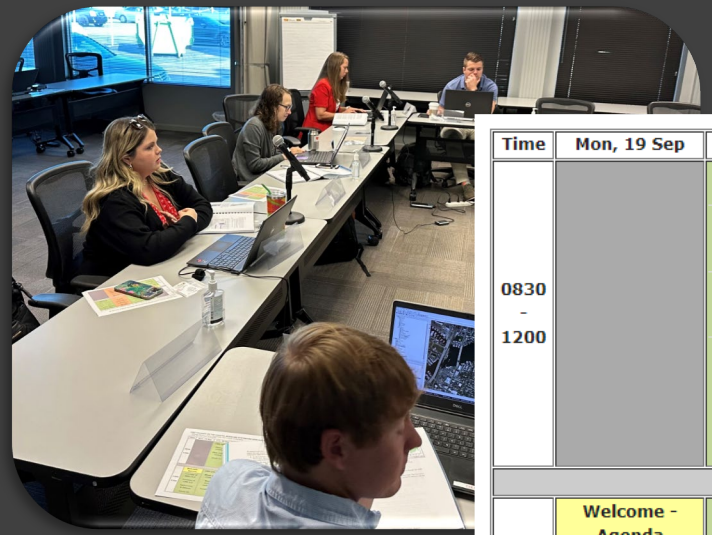
CMS: Tech Transfer

CIRP Technology-Transfer Workshop

CMS/GenCade Workshop

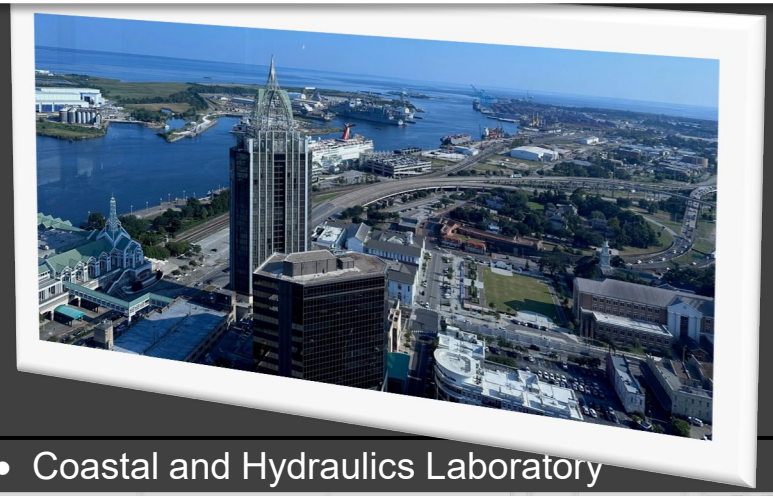
USACE Mobile District, Mobile, AL

19-23 September, 2022



Time	Mon, 19 Sep	Tue, 20 Sep	Wed, 21 Sep	Thu, 22 Sep	Fri, 23 Sep
0830 - 1200		**CMS (v5.2)** **Flow** grid creation **Flow** model control hands-on	**CMS (v5.2)** Steering Post-processing Hydro-validation hands-on	**GenCade (v1.1.8)** Introduction to GenCade Simple Example Walk-Thru hands-on	**CMS (v5.2)** Multiple Sediment Grain Sizes Advanced Topics SMS 13.2 demo Final Questions **Workshop Concludes**
Lunch on your own					
1300 - 1700	**Welcome - Agenda** Overview of **SMS 13.1** Overview of **CMS 5.2** Bathymetry & Datums hands-on	**CMS (v5.2)** **Wave** grid creation **Wave** model control hands-on	**CMS (v5.2)** Sediment Transport Morphology Change hands-on	**GenCade (v1.1.8)** hands-on **New topics:** Cross-shore Monte Carlo Q&A session	

- Leveraged SAD/CIRP funds for the 5-day hands-on workshop
- Gives training for those working on new and existing Coastal Storm Risk Management (CSRM) and Navigation (NAV) projects.
- 16 USACE attendees from SAM, NAE, SAJ, SWG, and ERDC (5 in-person, 11 virtual)

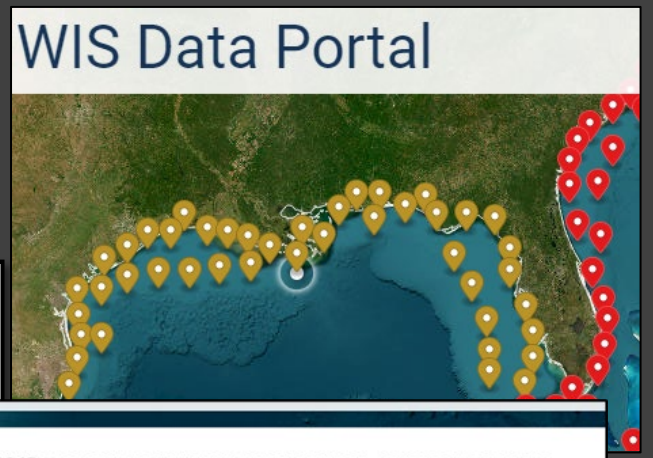


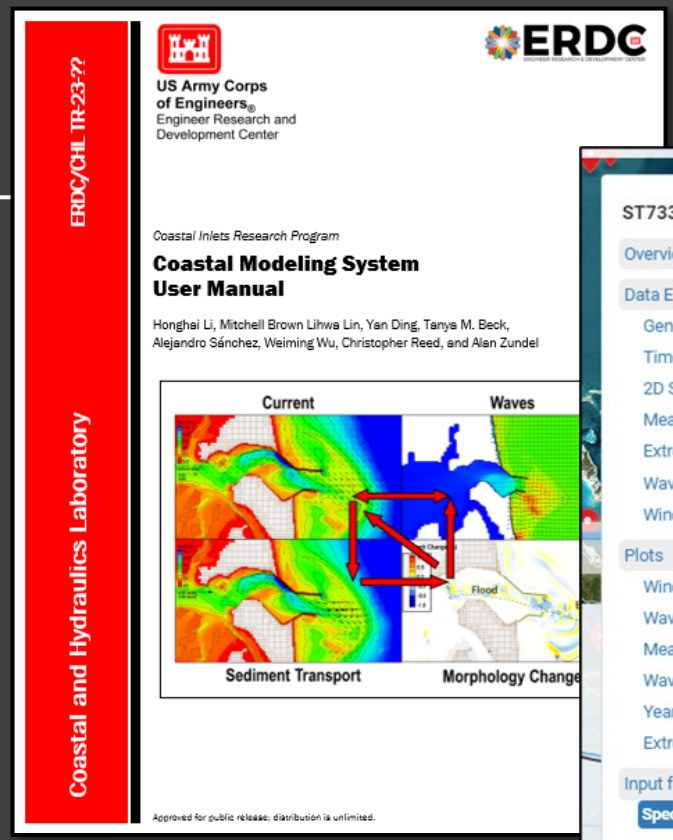
Summary

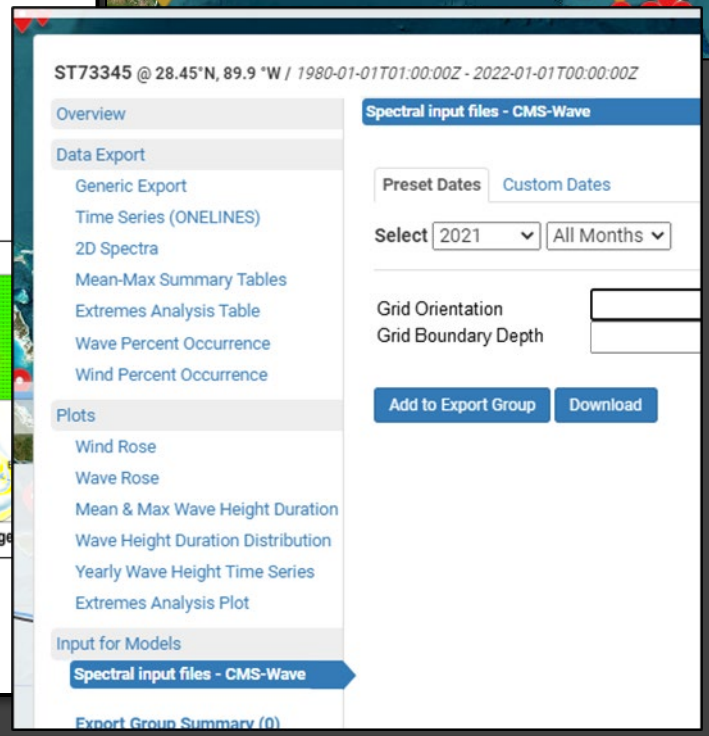
- FY22 Major Advances in Capability
  - Several improvements to CMS code (better results from inline wave model and explicit solution scheme
  - CMS User Guide updated for SMS 13.2 interface and new features
  - Tech transfer for CMS/GenCade for East Coast/Gulf Districts in Mobile, AL

- Coming in FY23
  - Initial efforts by summer student to prepare for VVUQ Part II: Sediment Transport and Morphology Change in FY24
  - Publish final version of CMS User Guide
  - Additional CMS review/enhancements (investigate tidal boundary conditions, add tide potential terms, and more)
  - WaveNet tool availability within WIS Portal
  - 5-day workshop on CMS/GenCade for West Coast and Pacific Districts

- FY22 Major Products & Collaborations
  - Journal Pubs (JMSE)
  - Tech reports
  - SOWs
  - EWN Toolkit







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