Response Summary:

The Corps Shoaling Analysis Tool[1] (CSAT) is a suite of computational routines for evaluating historical shoaling trends and forecasting future maintenance requirements in USACE navigation channels. Pulling from hydrographic survey data in the USACE eHydro database,[2] CSAT provides computationally efficient methods for quantifying shoaling at spatial scales ranging from a single reach up to the entire USACE channel portfolio. In response to a DOTS request from Detroit District, ERDC's CSAT development team hosted a virtual training to provide new users with guidance on how to run the tool. The district's overarching motivation is to incorporate CSAT into navigation channel maintenance planning by quantifying the physical mechanisms driving shoaling in the Great Lakes region.

During the training sessions, participants were introduced to the underlying theory of the CSAT algorithm, including its internal workflow for ingesting hydrographic survey data, identifying dredging, calculating shoaling rates across irregular observation horizons, and combining the historical observations into a forecast of future bed elevations (Figure 1). Interactive demonstrations then helped participants build the skillset required to run CSAT in default and custom configurations which can be tailored to specific project needs.

Figure 1. Illustration of the Corps Shoaling Analysis Tool (CSAT) workflow, as presented to Detroit District in May 2025.

At each pixel, a shoaling rate (m_{ij}) is calculated for all valid pairs of bed elevation measurements. The paired shoaling rates are then averaged to determine a representative shoaling rate ($\bar{m}$), which is used to forecast future bed elevations.

$$m_{ij} = \frac{z_j - z_i}{t_j - t_i}$$

Period of Performance:

The training was held from May 12-14, 2025.

Benefits of the Response to the USACE Dredging/Navigation Program:

This DOTS response benefits the USACE Dredging and Navigation Program by transfering ERDC-developed capabilities to district practitioners, who will use these tools to implement data-driven solutions for navigation channel management.

Deliverable:

The training was attended by 19 engineers and scientists from Detroit District who are interested in using CSAT to evaluate shoaling trends in Great Lakes navigation channels. Prior to the training, the team created three new slide decks with modernized visualizations complementing the newly-published CSAT user guide.[3] These updated presentation materials enabled more effective communication of the CSAT workflow to training participants.
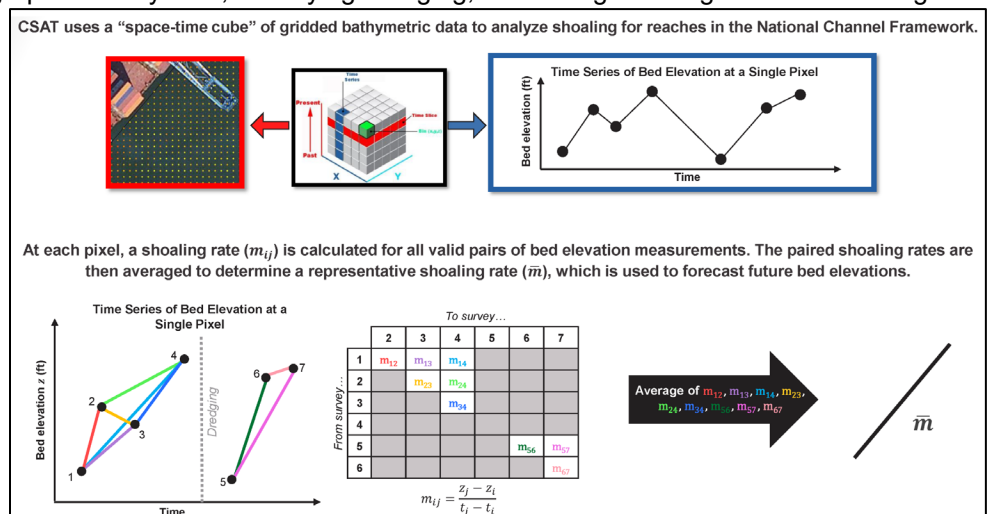
---

[1] https://cirp.usace.army.mil/products/csat.php
[2] https://www.sam.usace.army.mil/Missions/Spatial-Data-Branch/eHYDRO/
[3] Bain, R., M. Hartman, A.D. Godfrey, C. Sylvester, and K. Smith. (2025). *Corps Shoaling Analysis Tool (CSAT) User Guide*. Vicksburg, MS: U.S. Army Corps of Engineers. https://dx.doi.org/10.21079/11681/49716

Providing environmental and engineering technical support to the U.S. Army Corps of Engineers Operations and Maintenance navigation and dredging missions

Dr. Michael Hartman
Coastal and Hydraulics Laboratory ● Michael.A.Hartman@usace.army.mil   **DOTS 25-R197**