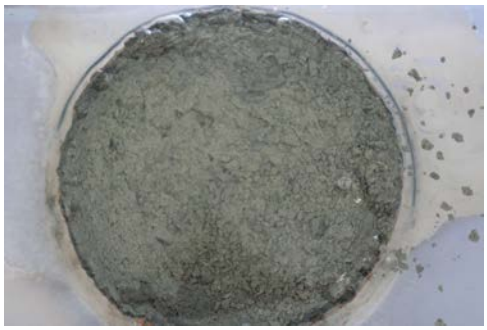
Physical Properties & Settling Velocities of Eroded Aggregates

Dredging Operations Environmental Research (DOER) Program

U.S. ARMY CORPS OF ENGINEERS BUILDING STRONG®

Problem



Current tools and models used for predicting the transport of dredged material rely on bulk properties of sediment and do not account for site-specific physical parameters such as aggregate size and settling velocity. Improvements to current sediment transport models depend on new process descriptions, which require advanced, cost-effective methods for site-specific parameterization of new transport algorithms. Little information is known about the processes that produce aggregate erosion or their initial physical properties immediately after mobilization. In order for future sediment transport models to be able to accommodate aggregate erosion processes, inputs for these parameters are required.

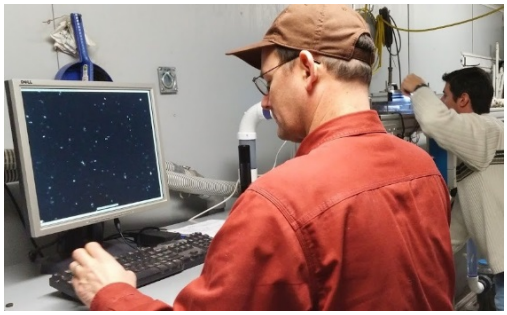
Study Description

ERDC- Coastal and Hydraulics Laboratory (CHL) is currently developing methodologies that will allow for the collection and analysis of aggregates resulting from erosion testing with the Sediment Erosion with Depth flume (Sedflume) (McNeil et al. 1996). Techniques utilizing the Particle Imaging Camera System (PICS) (Smith and Friedrichs, 2010) and a newly designed in channel viewing system will allow for size distribution and settling velocity measurements of eroded particles to be made. Further, an in-line sieving system has been designed to allow for the retention of these aggregates for durability testing. To evaluate the presence and importance of aggregates in areas where dredging is a frequent management issue, field studies are being conducted within the James River, VA. By coupling the results of aggregate erosion testing with sediment transport models, such as LTFATE, we hope to gain insight into the impact aggregates have on the transport behavior and ultimate fate of sediments moving in the system. Additionally, data from erosion experiments conducted on natural sediments collected from various settings such as Hamilton Wetlands, CA, the Florida Everglades, and Galveston, TX may also be utilize to parametrize the size distribution and concentration of eroded bed aggregates over a range of sediment types and energy regimes.

Products

Multiple peer-reviewed reports discussing the methods and results of the research will be produced as a result of this RT. Technical reports generated by this RT will discuss the results of aggregate data collected in both laboratory and field settings. Journal papers will discuss the methods and findings of this work in terms that expand beyond the specific field sites. Additionally, the results of this research will be utilized by other ongoing research tasks that are investigating the durability of eroded aggregates and developing frameworks that will allow aggregate processes to be incorporated into mathematical sediment transport models.

Summary



Recent flume studies conducted at CHL, investigating the erosion processes involving cohesive (mud) and heterogeneous (mud and sand) sediments, have observed that erosion frequently occurs as aggregates of sediment, as opposed to discrete particles. The larger size of aggregated particles can have settling velocities several orders of magnitude greater than disaggregated sediment, and thus reduce their transport time within the water column. The aggregation of sediment may also significantly impact the mode of transport of material (i.e. bedload vs suspended load). By measuring and parameterizing these aggregate erosion properties and processes new algorithms can be developed that will allow for the improvement of current cohesive sediment transport models.

Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

16-02

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