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Engineer Research and Development Center

Coastal Inlets Research Program

Inlet Geomorphology Evolution Work Unit

Description

The Inlet Geomorphology Evolution work unit of the CIRP develops methods and provides geomorphic perspective on federal navigation and coastal projects. It connects existing databases, models, traditional and remote sensing measurements, and USACE projects to create valuable guidance that address geomorphic questions. The present focus of the work unit is a common alternative considered for placement of sediment dredged from navigation channels, in the form of mounds or shore-linear features in the nearshore area adjacent to inlets. However, there is little guidance available for design and anticipated temporal and spatial scales of evolution of these nearshore placements. In addition, for mixed-sized dredged material including fine-grained sediment, there are environmental concerns about transport and burial of fines over sensitive submerged aquatic habitat areas. Present primary activities are directed towards addressing these nearshore placement challenges. Additional activities include application of the Coastal Modeling System (CMS) to long-term evolution of inlets and the development of the Sediment Analysis GeoApp (SAGA) tool.

Issue Addressed

The greatest nearshore placement challenges identified are the need to develop guidance for (a) siting placement options, (b) evaluating the temporal and spatial scales of sediment movement from the placement site, and (c) predicting the final morphologic response.

Products

Presently, the primary tool of the Inlet Geomorphology Evolution work unit is the Sediment Mobility Tool (SMT), which allows the user to determine frequency of sediment mobility and general transport direction of transport for sediment placed in the nearshore. The tool is available in the form of Matlab code, however, in the future it will be available as a web application. Another product of the work unit is a Depth of Closure (DOC) database, available on the CIRP website (http://cirp.usace.army.mil/products/depth-of-closure.php) as well as in the USACE GeoPlatform (https://geoplatform.usace.army.mil/home/webmap/viewer.html). The DOC is useful for engineers as it provides a depth at which seaward there is little to no sediment transport, and is important to consider in the design of nearshore berms. In outyears, the DOC data will be available as part of the SMT web application. Background information on the SMT and DOC database including calculation methods are available in two technical notes. Several nearshore berm placements have been monitored and their morphologic evolution and sediment characteristics documented in a series of technical notes and reports; all documentation is available on the CIRP website. Ongoing work includes preparation of a full scale experiment at the USACE Field Research Facility in Duck, North Carolina in coming years.

In collaboration with the CMS work unit, an analysis of long-term inlet morphology change has been completed using the CMS wave and flow models. Nine idealized inlets were modeled to illustrate possible inlet morphology over 100 years for the three coastlines of the United States. Future work will include the calculations with mixed sediments, and erodible channel walls and bay shorelines.

The SAGA tool has been developed to create a database for users to download and upload sediment data from projects across the country. Included are sediment size distributions, core logs, and seismic data available for download. Users are encouraged to upload data as well to allow others to use in their projects.

Figure 1. Swash zone berm being built at Perdido Key, Florida in 2012 (Photo provided by SAM).

Application of Products

The DOC, SMT, and SAGA tools have been used by many Districts including SAJ, SAW, SAS, SWG, and NAE, as well as state agencies.

Projected Benefits

The tools and information developed by this work unit will allow managers and District engineers to develop plans for placement of sediment in the nearshore and evaluate the likely long-term evolution, estimate the benefits of the placement in reducing wave impacts on the subaerial beach and/or migrating onshore, and answer resource agency questions. Procedures and tools developed in this work unit can be included in future software to simplify nearshore berm design, placement, and evaluation. Additionally, the work unit strives to determine better ways to communicate and evaluate the expected behavior and benefits of nearshore placement.

Documentation

Nearshore placement studies have been documented in two journal papers, one technical report, and four Coastal and Hydraulics Engineering Technical Notes (CHETN), and two draft CHETNs, one CHELR, one thesis and one dissertation, as documented on the CIRP website: http://cirp.usace.army.mil.

Points of Contact

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CIRP Website

- Please see the CIRP website to download documentation: http://www.erdc.usace.army.mil/Missions/WaterResources/CIRP/Publications.aspx
- View archived webinars: http://www.erdc.usace.army.mil/Missions/WaterResources/CIRP/TechTransfer.aspx and
- Review guidance documented on the CIRP wiki: http://cirpwiki.info/wiki/Main_Page .