US Army Corps of Engineers®
Engineer Research and Development Center

Ongoing Research

CIRP: Waves at Jetties and Breakwaters

Problem

The USACE maintains more than 600 navigation structures in support of federal navigation nationwide. Virtually all design and operation and maintenance activitivities require advanced but convenient-to-use model to calculate waves at jetties and breakwaters in the vicinity of coastal and estuarine navigation channels. Wave interaction with inlet jetties and revetments, including wave reflection, diffraction, transmission, runup, and overtopping must be calculated for accurate estimations of channel infilling and potential structure breaching or flanking. Calculations must be tested for wave propagation across channels and over or through structures where combined diffraction and transmission act simultaneously. Wave simulations must account for broad shallow reefs and narrow, high, and porous structures such as jetties. Run-up and overtopping of structures must be verified in a phase-averaged, engineering approach, including the role of structure roughness. Infra-gravity waves that create seiching and wave asymmetry that create a net sediment transport and cause onshore berm movement must be described. These long-period processes can be the trigger that dislodges jetty stone and begins to unravel a structure. Presently these long-term oscillations are not calculated in USACE wave models.

Objectives

Upgrades are required for the Coastal Modeling System Wave Model (CMS-Wave) to describe shallow reefs, porous structures, variable structure roughness, and simulate infra-gravity waves and wave asymmetry. Functional performance of CMS-Wave can be improved to better calculate storm waves, run-up, overtopping, and transfer these calculations to circulation and sediment transport models in the CMS. Telescoping grid technology can be implemented to provide greater resolution at structures, around complex bathymetry such as scour holes or shoals, and across navigation channels. Laboratory and field measurements are required to validate the model. Automated tool systems are needed to prepare data for input to and validation of CMS-Wave.

Products

(1) Upgrade and verify CMS-Wave for wave asymmetry, infra-gravity waves, nonlinear wave-wave interaction, wave run-up, transmission, and overtopping over or through structures, and (2) Develop an Automated Coastal Data Analysis Tool in the Surface Modeling System (SMS) for wind and wave data analysis to assist the user in developing input and validation data sets for CMS-Wave.

Milestones

10-01	TR: Evaluation of proposed channel, Kawaihae Harbor, HI	Oct 09
10-02	ERDC R&D Conference – CMS-Wave presentation	Nov 09
10-03	11th Annual CIRP Technology Transfer Workshop	Dec 09
10-04	CHETN – CMS-Wave: Part 3. Example application in SMS10.1	Feb 10
10-05	CIRP Mini-Tech-Transfer Workshop (during CWG workshop)	Jun 10
10-06	JP: CMS-Wave: A coastal wave model for inlets and navigation	Jun 10
10-07	CHETN – CMS-Wave: Part 4. Infragravity wave, porous breakwater	Sep 10

Funding

FY10: $600K.

POCs

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