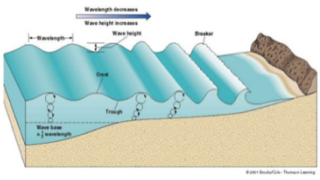
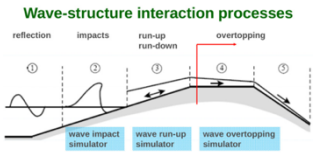
US Army Corps of Engineers
Engineer Research and Development Center

FUNWAVE – A Phase-Resolving Nearshore Numerical Wave Model

Need



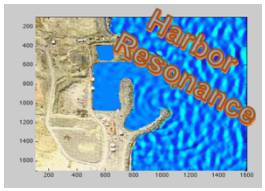


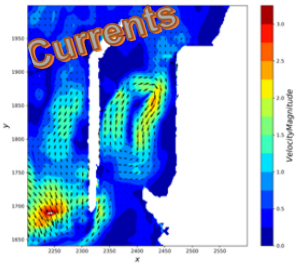
Modeling of nonlinear coastal wave processes, such as inundation, wave breaking with **runup** & **overtopping of structures**, bore propagation, tsunami propagation, **harbor resonance**, **ship wakes**, and **infragravity (IG) waves**, requires efficient and accurate computing of the evolution of highlynonlinear time-dependent, three-dimensional surface wave fields in various coastal environments. This is a challenging hydrodynamic problem. Most models commonly used for describing nonlinear surface waves are far from being complete. They rely on ad-hoc models for the physical processes involved, such as nonlinear wave-wave interactions, energy dissipation due to wave breaking, or interplay between waves and currents.

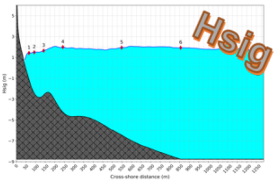
The U.S. Army Corps of Engineers has a pressing need for a robust and computationally efficient phase-resolving numerical wave model. With improvements in High Performance Computing (HPC), phase-resolving Boussinesq wave models like FUNWAVE are becoming more practical to apply.

Approach

The phase-resolving numerical wave model FUNWAVE can be utilized in all stages of the project life cycle, from planning to after-action evaluation. Districts gaining access to FUNWAVE through the HPC Portal web-based deployment on hundreds and thousands of processors will be able to properly resolve most of the nearshore processes in question, without sacrificing the required level of fidelity.







Some of these processes and applications include:

- ✓ nearshore wave propagation & transformation with refraction, diffraction & shoaling
- ✓ bottom friction, wave-induced current and nonlinear wave-wave/current interactions
- ✓ partially absorbing/reflecting inner-boundary structures (e.g., breakwaters, levees, seawalls, groins, jetties)
- ✓ harbor resonance and infragravity (IG) waves
- ✓ vessel-generated waves (both recreational and container-type vessels)
- ✓ cohesive/non-cohesive sediment transport and morphological evolution
- ✓ adaptive mesh refinement (AMR) module – multi-grid nesting
- ✓ FUNWAVE will soon be available as an application at the HPC Portal. (July 2019)

Outcome

The advancement of the state of practice in phase-resolving numerical wave modeling for the USACE HH&C will be realized, along with strengthening of USACE's credibility as base of both the technical expertise in nearshore wave modeling and shoreline/environmental stewardship.

More Information

FUNWAVE has a comprehensive Wiki page with source code access via a version-controlled online repository and an extensive suite of test cases at https://chl.erdc.dren.mil/funwave-tvd

New research needs are continually submitted by USACE FRM Communities of Practice to focus future research investigations and products. Statements of Need can be submitted by USACE on the R&D Gateway (https://gateway.erdc.dren.mil/son/index.cfm?Cop=Flood&Option=Start).

For more information on FRM R&D, see the ERDC FRM wiki: https://wiki.erdc.dren.mil/Flood_and_Coastal_Storm_Damage_Reduction_Research_Program

POC:

Dr. Matt Malej
matt.malej@erdc.dren.mil
603-646-4455

Ms. Gabriela Salgado-Domínguez
gabriela.salgado-dominguez@erdc.dren.mil
601-634-2099