

# DEVELOPMENT AND TESTING OF A MODERN CLOUD-BASED WORKFLOW FOR COASTAL HAZARD MODELING

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## INTRODUCTION

Model Modernization, or Model Mod for short, is the colloquial name for implementing the U.S. Army Corps of Engineers (USACE) Research and Development Center Coastal and Hydraulics Lab’s (CHL) Numerical Technology Modernization Strategy (NTMS). Model Mod was initiated in 2022 and involves a public-private partnership between CHL, Woolpert, and Jackson State University (JSU). Taylor Engineering is part of the project as a teammate with Woolpert and the firms have a mentor-protégé arrangement. The project team, through Model Mod efforts, has advanced the NTMS through a range of technical and programmatic actions that this paper will discuss.

## APPROACH

While Model Mod is multi-faceted, this paper will focus on the team’s efforts to develop and test a modern cloud-based workflow for coastal hazard modeling. This cloud-based workflow will achieve many benefits including added functionality, easier use and access, faster generation of results, and increased collaboration (Figure 1). Ultimately, the USACE plans to make the Model Mod platform and tools open-source and cloud-based for accessibility and speed and available to agencies, companies, universities, and the public.



Figure 1 - Model Mod Program Results and Benefits

## DEVELOPMENT AND RESULTS

During Model Mod’s first year, the team designed and implemented a Microsoft Azure cloud environment for the CHL Coastal Storm Risk Management (CSRM) suite of process and consequence models (ADCIRC, STWAVE, CSTORM, Beach-fx, and CSHORE). The Azure site

implemented cloud elasticity workflow steps that allows platform users to create and remove compute environments as needed by the user so that high-performance computing (HPC) charges only accrue while executing a model workflow, which minimizes operational overhead costs. The team tested each model in the Azure environment to validate their implementation using the same suite of models on conventional servers with comparison of results and execution times. Students in a JSU Special Topics Course also applied the cloud-based workflows and JSU interns participated during the summer to develop their skills and support the Model Mod project.

The second year of the Model Mod effort (started in 2023) focuses on finalizing the CSRM workflow and adding additional elements from the NTMS to fully implement both the models and the strategy’s vision. Figure 2 shows a sample project workflow where all model setup, data selection and extraction, model execution, and results processing occurs using on-demand cloud-based computing resources. The project team is actively adding the next suite of models and associated workflows including development of data sharing and access strategies critical to meeting the program’s goals. To promote the goal of increased collaboration and foster community involvement, the project team has initiated partnerships with select universities who will test the platform as part of class instruction and graduate research activities. Year 2 also expands the number of JSU interns, offers a second academic year of the Special Topics Course on Model Mod, and implement priority research with JSU faculty.

## SIGNIFICANCE

The conference presentation and paper will focus on the utility of the Model Mod effort and platform for coastal engineering practitioners. Discussion topics will include platform details and updates related to the coastal engineering models tested, post-processing tools, and future plans.

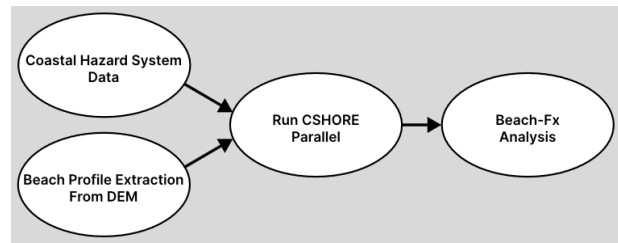


Figure 2 - Sample Model Mod Workflow for Year 2.