

Title: Coastal Storm Modeling – System Integration

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Abstract:

Realistic coastal storm modeling requires the integration of several complex and sophisticated numerical modeling systems. The US Army Corps of Engineers MOdeling Relevant PHysics Of Systems (MORPHOS) project applies the following systems, a tropical planetary boundary layer model, MORPHOS-PBL, to generate the cyclone wind and pressure fields, an ocean hydrodynamic model, ADCIRC, to generate the surge field, and both regional and nearshore ocean wave models, WAM and STWAVE, to generate the wave fields. In addition to these models that simulate the oceans response to a storm in the form of waves and surge, a bed morphology model, such as C2SHORE, is needed to simulate landscape changes due to the surge and wave effects.

In order to gain a more complete representation of the response to the storm, these systems need to be tightly coupled. Until recently, these modeling systems were present in a scripted work flow where individual models were loosely coupled via file input/output only. This old work flow system had been successfully applied to many Corps projects. However, the entire system remained cumbersome to configure and costly to compute due to the loose coupling methodology which required multiple applications of some models in order to get feed back response from other models.

We will present a new work flow developed under MORPHOS that is easy to configure with the aid of graphical user interfaces in the Surface Modeling System (SMS). The new work flow also has tightly coupled models, where appropriate, using the Earth System Modeling Framework (ESMF). The tight coupling of models enabled by ESMF, allows for timely feedback responses into each model for improved physical responses and do so without the need to re-run a model which reduces the over all cost of execution of the work flow. For our purposes the cost of the work flow is measured by both the computational effort and the required time to solution. In addition to improved physical responses, using ESMF allows for an almost plug-n-play capability for models so that different models can be used within the present system and the system can be expanded to include new capabilities, such as environmental models, for future applications. This new work flow system with GUI's and tightly coupled models represents an enabling technology for more comprehensive studies on flood and shore protection and sediment management.

Bio: Chris Massey received his PhD in Mathematics from Virginia Tech where he specialized in finite element methods and a posteriori error estimates. He held a National Research Council postdoc at the Naval Research Laboratory where he was later employed within the Oceanography Division. He currently works for the US Army Corps of Engineers at the ERDC for the Coastal and Hydraulic Laboratory and specializes in the development and application of coastal and riverine numerical models, model coupling and system integration.