

SAFL SEMINAR SERIES

WEDNESDAY, JANUARY 18, 2012, 3:30PM
ST. ANTHONY FALLS LABORATORY ~ AUDITORIUM

Coupled Modeling System of the Spectral Wave and 3D Hydrodynamic Models: Implementation and Verification



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Abstract: In this research, a state-of-the-art parallel programming tools have been utilized to develop a coupled wave and circulation modeling framework which takes into account most of the important physical interaction mechanisms (e.g. surface waves turbulence effects, surface rollers, bottom boundary layer , etc.). The dynamically coupled system includes a three-dimensional coastal circulation model, the General Estuarine Transport Model (GETM), and a third generation wind wave model, the Simulating Wave Near-shore (SWAN). The coupled system components have been connected by model coupling toolkit (MCT) which is the coupler engine of the Community Climate System Model (CCSM). This model provides a high operational flexibility by combining several MPI models to operate simultaneously with different number of processes by different domain decompositions. The main goal of the research was to include the effects of surface waves in deep and shallow parts of the ocean contributing to momentum and energy exchange between the atmosphere and ocean. One of the main concerns was dedicated to implementation of the Vortex Force (VF) and dissipated wave momentum as driving forces together with the Generalized Lagrangian Method (GLM) as wave averaging operator following Ardhuin, 2008. This approach would enable us to perform an efficient simulation of three-dimensional structure of hydrodynamics of wave-current interaction in the surf zone and coastal waters. The coupled modeling system was validated against both the laboratory- and field-scale. Later the developed Modeling approach will be employed to investigate climate change and on going transformation processes due to surface wave and current interactions in the framework of RADOST (Regional Adaptation Strategies for the German Baltic Coast) project as well as setting up a high resolution test case to study three dimensional structure of highly variable tidal environment in the Wadden Sea.