Jun 26th, 3:40 PM - 5:00 PM

# Enabling High-Performance Heterogeneous Computing for Component-Based Integrated Water Modeling Frameworks

Caleb A. Buahin
caleb.buahin@usu.edu

Jeffery S. Horsburgh
*Utah State University*, jeff.horsburgh@usu.edu

Bethany T. Neilson
*Utah State University*, bethany.neilson@usu.edu

iEMSs International Congress on Environmental Modelling and Software

*9th International Congress on Environmental Modelling and Software*
*Fort Collins, Colorado, USA, Mazdak Arabi, Olaf David, Jack Carlson, Daniel P. Ames (Eds.)*
*https://scholarsarchive.byu.edu/iemssconference/2018/*

# Enabling High-Performance Heterogeneous Computing for Component-Based Integrated Water Modeling Frameworks

**Caleb A. Buahin[a], Jeffery S. Horsburgh[a], and Bethany T. Neilson[a]**
[a] *Utah Water Research Laboratory, Utah State University (caleb.buahin@usu.edu, jeff.horbsurgh@usu.edu, bethany.neilson@usu.edu)*

**Abstract:** Transitioning from the traditional approach of executing water resources models on single desktop computers to increasingly ubiquitous High Performance Heterogeneous Computing (HPC) infrastructure introduces efficiencies that could help advance the degree of fidelity of models to the underlying physical processes they simulate. For example, model developers may be able to incorporate more physically-based formulations, perform computations over finer spatial and temporal scales, and perform simulations that span long time periods with reasonable execution times. Additionally, computationally expensive simulations including parameter estimation, uncertainty assessment, multi-scenario evaluations, etc. may become more tractable. The use of HPC for executing these types of simulations within component-based modelling frameworks is an approach that is still largely underutilized in the water resources modeling arena. In this abstract, we describe advancements that we have implemented in the HydroCouple component-based modeling framework to allow water model developers to take advantage of heterogeneous, multi-accelerator clusters. HydroCouple largely employs the OpenMI interface definitions but adds new interfaces to better support standardized geo-temporal data structures, customizable coupled model data exchange workflows, and distributed computations on HPC infrastructure. We also describe how some of these advancements have been used to develop coupled models for two applications: 1) coupling of a one-dimensional storm sewer model with a high resolution, two-dimensional, and overland riverine model for an urban stormwater conveyance system, and 2) coupling of a series of model components being developed to simulate heat transport in heterogeneous rivers with significant longitudinal flow variability.

***Keywords**:* Component-Based Integrated Water Modeling; Model Calibration, High-Performance Computing; Cross-Platform Modeling Frameworks.