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Accelerated shallow water modeling

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ln this talk we will describe our ongoing developments in accelerated numerical methods for modeling tsunamis, and oceanic fluid flows using two dimensional shallow water model and/or three dimensional incompressible Navier Stokes model discretized with high order discontinuous Galerkin methods.

High order discontinuous Galerkin methods can be computationally demanding, requiring extensive computational time to simulate real time events on traditional CPU architectures. However, recent advances in computing architectures and hardware aware algorithms make it possible to reduce simulation time and provide accurate predictions in a timely manner. Hence we tailor these algorithms to take advantage of single instruction multiple data (SIMD) architecture that is seen in modern many core compute devices such as GPUs.

We will discuss our unified and extensive many-core programming library OCCA that alleviates the need to completely re-design the solvers to keep up with constantly evolving parallel programming models and hardware architectures. We will present performance results for the flow simulations demonstrating performance leveraging multiple different multi-threading APIs on GPU and CPU targets.