Using Adaptive Mesh Refinement to Model Ocean Flows

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Many oceanic flows require the use of methods that can resolve many order of spatial and temporal scales but often these resolution requirements change in time and space. One way to take advantage of these dynamic processes is to employ adaptive mesh refinement which uses various aspects of the flow to determine the current required mesh refinement. This allows for a significant savings in computation and can lead to the ability to refine further in regions of interest.

We have developed a code named GeoClaw which uses adaptive mesh refinement to solve depth averaged equations over complex bathymetry. It is based on the Clawpack software (Conservation Laws Package, `www.clawpack.org`), designed for solving general nonlinear hyperbolic systems using high-resolution shock-capturing finite volume methods on logically rectangular grids. We will also include some sample demonstrations of the software as applied to tsunami propagation and storm surges.

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