Scalability of Unstructured Grid Based Hurricane Storm Surge Model

S. Tanaka[1], J.J. Westerink[1], C. Dawson[2], and R.A. Luettich, Jr.[3]

[1]Department of Civil Engineering and Geological Sciences
University of Notre Dame
Notre Dame, Indiana 46556
stanaka@nd.edu, jjw@nd.edu

[2]Institute for Computational Engineering and Sciences
University of Texas at Austin
Austin, Texas 78712
clint@ices.utexas.edu

[3]Institute of Marine Sciences
University of North Carolina at Chapel Hill
Morehead City, North Carolina 28557
rick_luettich@unc.edu

The simulation of hurricane storm surge is a powerful tool used to evaluate inundation risk, design of hurricane protection systems, analyze the physics of storms, and plan evacuations. However, realistic solutions require the use of high resolution computational grids that express complicated domain shapes, detailed topography, geographical features, bathymetry and flow structures. High resolution grids require significant memory and computational time. The rapid development of multi-CPU/core parallel architectures with fast networks has dramatically improved the potential for large scale simulations. In order to take advantage of these parallel computational platforms, it is critical that the computations be scalable. As we increase the number of cores, we must consider both the time of the computation and the time required for managing and processing the necessary output files.

We present the scalability of unstructured grid based ADCIRC when computing tides and storm surge using large high resolution grids. We measure parallel scalability on different resolution grids, and evaluate the costs of outputting the very large requisite result files. It was necessary to designate specialized writer cores which are dedicated to writing output. In order to handle the latency of the disk storage system, we implemented these writer cores in sequential batches which can simultaneously write different types of output files at various solution times.

References

S. Tanaka, J.J. Westerink, C. Dawson and R.A. Luettich, Jr., "Scalability of an unstructured grid continuous Galerkin based hurricane storm surge model", *Journal of Scientific Computing*, In Review, 2010.