

Use of Ray Tracing Techniques on Tsunami Simulation Data with the PlayStation® 3

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Visualization plays an important role in interpreting and understanding scientific data. Unfortunately, visualization is limited by the power of the machines that researchers use. Yet new techniques and architectures are developed for researchers and by researchers to erase these limitations. The PlayStation® 3 provides 204 GFLOPS of single precision floating point performance with its 3.2 GHz Cell processor and its 6 3.2 GHz Synergistic Processing Elements at a cost of only \$600 US. This poster will discuss how we have used the PlayStation® 3's cell processor to implement and employ parallelized visualization, through the form of ray tracing techniques, on tsunami data. By adapting Eric Rollins' ray tracing package¹, we were able to

implement his ray casting techniques on triangles. This allowed us to triangulate our tsunami datasets, stored as [x, y, height] data, and feed the triangulated data into the program. We rendered 4000 triangle objects from the data and applied a colormap based on each triangle's height value. Finally, we displayed the generated image. Our code uses algorithms specifically developed for the Cell's multicore vector based processor, which is where further speed increases will arise from. Our poster will discuss this belief, as well as how to expand the techniques we have used on simple 3-dimensional tsunami dataset to more complicated multi-dimensional datasets such as mantle convection.

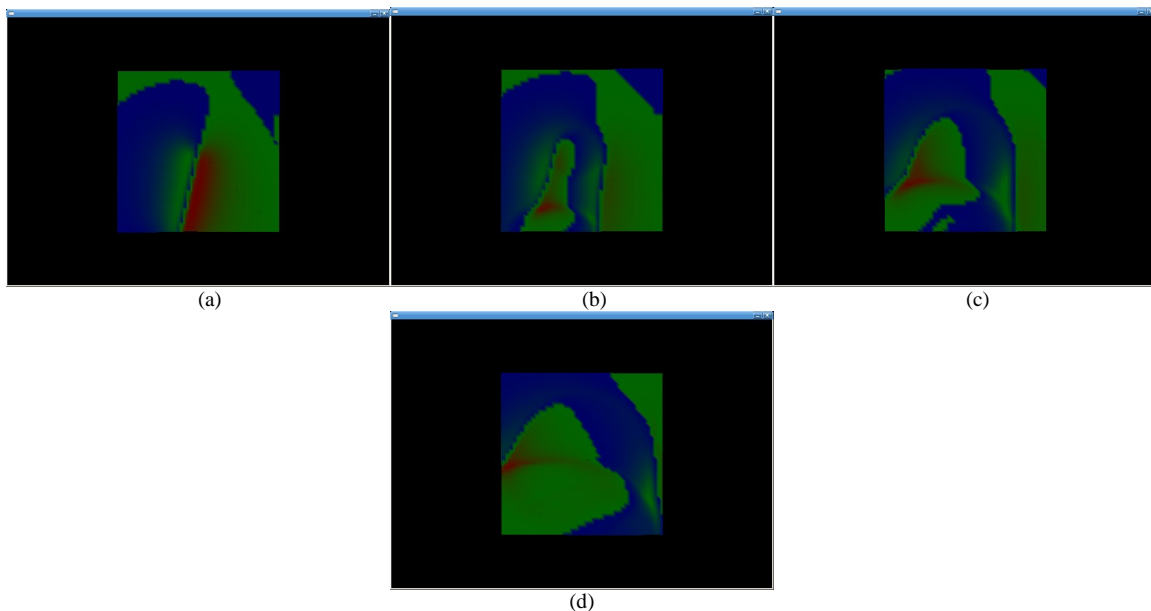


Figure 1. Series of Tsunami Data, from nonlinear shallow-water equations describing tsunami waves over the South China Sea, visualized on the PlayStation® 3. Timesteps of (a) 60, (b) 1560, (c) 3060, and (d) 4560 seconds. Blue colors indicates values above sea level and red colors indicate values below sea level.

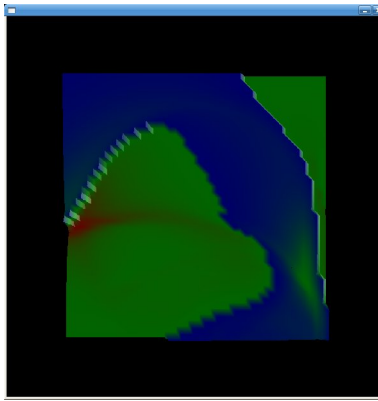


Figure 2. Visualization of tsunami data with ray casting techniques applied. Simple lighting is used to provide better depth perception.

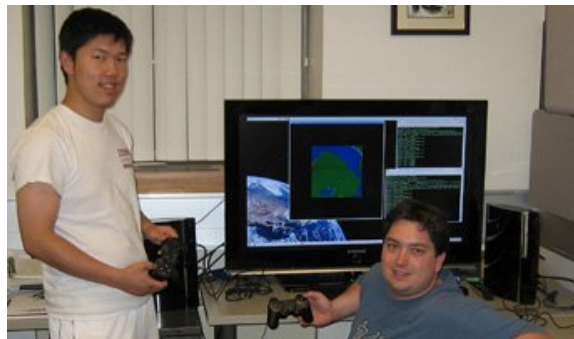


Figure 3. Our PlayStation® 3 development environment. The two PS3s are to both sides of the monitor and the tsunami panel is in the center of the screen.

ⁱ http://eric_rollins.home.mindspring.com/ray/ray.tar - The basic package contains 10 spheres and one light source. It is packaged with a PS3 specific build and a generic linux build. More information on the package is available at <http://marina.geo.umn.edu/ps3-wiki>.