WORKING WITH CAFUNWAVE

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WHO AM I?

- Sophomore physics and computer science major at University of Maryland
- Always been interested in computers
WHAT’S CAFUNWAVE?

• CaFunwave is a computational fluid dynamics application for Cactus, a parallel simulation framework.

• Models the Boussinesq Equations, which are 2D approximations of 3D fluids. The lower dimension is critical for efficiency.

• Based on Funwave-TVD, a program by Fengyan Shi at the University of Delaware.

Irregular Wave in Cafunwave
THE PROCESS

• **Step 1: Learning.** I built a 1-dimensional solver in Java using many of the same methods as CaFunwave. I then rebuilt this solver in Cactus to parallelize it.

• **Step 2: Building the Tests.** The goal was to compare CaFunwave to Funwave-TVD on as close terms as possible to check for consistency and unimplemented features.

• **Step 3: Debugging.** I ran the tests, and fixed any problems I could find.
JAVA SOLVER

Features

• Able to solve any 1-dimensional partial differential equation
• Calculates error using known solutions

Challenges

• Making the program flexible enough to work with different equations
• Visualizing the data in real time.
TEST HARNESS

What it does

• “Translates” Funwave-TVD input files to Cactus parameter files
• Uses Funwave-TVD as a benchmark; it has a more complete feature-set and has been tested more extensively
• Can compare with actual experimental data

Challenges

• Learning new languages (Perl, regex)
• Working with the hundreds of parameters required by each program, as well as the large data-sets
IMPACTS OF RESEARCH

For Me

• My first large-scale computer project, and first research project
• Experience with high-performance computing

For Science

• CaFunwave has applications for coastal modeling, which is important in Louisiana
• Test harness can be reused in the future