Computational Hydraulics Lab Acquires New Cluster

DEVELOPING MODELS TO BETTER FORECAST HURRICANES, STORM SURGES AND COASTAL FLOODING

Just over 10 years ago, the United States experienced one of the most damaging hurricanes in U.S. history, Hurricane Katrina. According to the National Oceanic and Atmospheric Administration (NOAA), Katrina claimed 1,833 lives, cost over $100 billion in damages and, as stated in a U.S. Census Bureau report, displaced over 400,000 people living in and around New Orleans and the Mississippi Golf Coast. More recently, Hurricane Sandy tore along the east coast of the U.S. in 2012, causing an estimated 147 deaths and over $50 billion in damages, as mentioned in a 2013 NOAA Service Assessment.

Hurricanes and coastal floods have left life altering wreckage in their wake long before Katrina and Sandy, and they will continue to pound into the coasts long after. These natural disasters cannot be thwarted, but the work of one research group at the University of Notre Dame is making a difference in being able to better prepare for these situations by modeling the physics of the coastal ocean to forecast coastal storms. The Computational Hydraulics Laboratory (CHL) devotes their time to developing high performance codes and coastal circulation models to advance hurricane hazard modeling to help protect people, infrastructures, and plan for
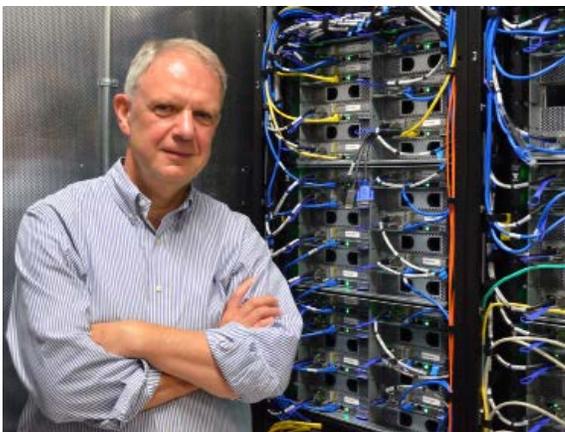

The Computational Hydraulics Laboratory research group and members of the CRC High Performance Computing team at Union Station Technology Center downtown South Bend.

future construction. Developing next generation codes that are more flexible and efficient is a continual effort of the CHL. Improving the accuracy of codes and minimizing computational costs helps in the effort to make these technologies more widely available.

The CHL is led by Joannes Westerink, Joseph and Nona Ahearn Professor of Computational Engineering and Science and the Henry J. Massman Chairman of Civil and Environmental Engineering and Earth Sciences. Developing models of the coastal ocean requires many computational hours. Westerink and the CHL team recently celebrated the acquisition of their new computer cluster. Housed at Union Station Technology Center downtown South Bend and

maintained by the CRC, the Lenovo Intel Xeon E5-2680 cluster adds a total of 1,512 cores on the front end, increasing CHL cores to 3,000. The typical runtime of a hurricane event simulating 20 days real time on 2,000 cores is approximately four hours, assuming five simulation days per hour. With the chip speed improvement of the newly acquired cores, the CHL is quadrupling their capacity. "Exponentially expanding our computer horsepower allows us to delve deeper and deeper into the physics of the coastal ocean." says Westerink.

The hurricane modeling process begins with the development of codes to simulate the equations that describe the physics of the coastal ocean environment. The code most widely used by government, universities, and for consulting, is ADCIRC+SWAN. This model has been used for the FEMA Great Lakes Flood Insurance Study, the East Coast Flood Insurance Study, the Gulf Coast Flood Insurance Study, and by the Nuclear Regulatory Commission. ADCIRC, a coastal ocean circulation code, is the leading modeling technology in evaluating coastal flood risk and was co-developed by the CHL with the University of North Carolina at Chapel Hill and the University of Texas at Austin.

Joannes Westerink in front of the Computational Hydraulics Laboratory's newly acquired cluster.

"Exponentially expanding our computer horsepower allows us to delve deeper and deeper into the physics of the coastal ocean."
Joannes Westerink

CHL Cluster Acquisition (continued)

MODELS TO BETTER FORECAST HURRICANES, STORM SURGES AND COASTAL FLOODING

Once the code is developed, a grid is created to figure out the geometry and hydrodynamic flow characteristics of the region being studied. Once the code and grid have been generated, they are combined with metadata in a high performance, massively parallel computing environment. Results are compared to multiple data sets from previous events to validate whether the process was captured correctly.

Currently, the CHL is working on projects for NSF to advance code development, and is partnering with AON, FMGlobal, Office of Naval Research (ONR), NOAA, Arcadis, Baker, and SURA on projects to model the coastal ocean and shoreline environments of the New York Harbor, Western Alaska, Puerto Rico, and the western North Pacific. These models will help measure the risk and vulnerabilities of flooding and storm surges that could cause major damage to the ecosystems of these coasts.

Westerink, the CHL team, and the CRC's HPC team gathered for the blessing of the new cluster given by Reverend James A. Bracke, C.S.C. on August 11, 2015 at Union Station Technology Center.

Allocations on Blue Waters HPC Sytems

CALL FOR PROPOSALS

The Great Lakes Consortium for Petascale Computation (GLCPC) has been allocated 3.5 million node hours (equivalent to approximately 50 million core hours) annually as part of the Blue Waters Project. This allocation provides the GLCPC member institutions with an unprecedented opportunity to advance their programs in computation, data, and visualization intensive research and education. The submission deadline for proposals is November 16, 2015.

More information and proposal guidelines

GE Open Innovation Challenge for Students

INDUSTRIAL REMIX CHALLENGE

General Electric (GE) has opened this challenge to college students to mix and match GE technologies to design fun, game changing solutions to enhance the college experience or to create a new industry. The best entry wins an all-expense-paid trip for two and tickets to New York City for the "Fallonventions" episode of "The Tonight Show Starring Jimmy Fallon". Entry submission deadline is November 9, 2015.

More information and entry guidelines

CRC Quick Tip

The CRC is beta testing Jupyter, a web-based frontend for interactive R and Python sessions. Email crcsupport@nd.edu if you would like access to this feature!

CRC is Heading to Supercomputing 15

HIGHLIGHTING RESEARCH ON CAMPUS

The CRC is traveling to Austin, Texas in two weeks for the 27th annual Supercomputing Conference, SC15. The conference and exhibit floor draw an audience of over 10,000 people and as in years past, the CRC booth will showcase research on campus using high performance computing resources. If you would like to send a poster, slides, or video clips representing your research, please email Kallie O'Connell at koconne8@nd.edu.

NOTRE DAME RESEARCH

Inaugural Faculty Research Award at the Rome Global Gateway

CALL FOR APPLICATIONS

Notre Dame Research, together with Notre Dame International, invite faculty in all Colleges and Schools to apply for the inaugural Rome Global Gateway Faculty Research Award.

Grants for any amount up to $50,000 USD of total funding for the period of up to one year are available through this program.

Funding can be used in a variety of purposes, including, for example, for postdoctoral research appointments intended to sees international collaborations, for travel and living expenses of individual faculty researchers working on projects of international significance in Rome, for conference and meeting expenses, or in numerous other ways.

All applications are due by Sunday, November 15, 2015 11:59pm EST. Awards will be announced by Tuesday, December 1, 2015. Additional award information

Upcoming CRC Seminars

THURSDAY, NOVEMBER 5

3:30pm-4:30pm
109 Pasquerilla/ROTC

Dennis Harding
Senior Software Engineer
Institute for Disease Modeling

CONSTRUCTING AND MANAGING CUSTOM DATA SET FOR DISEASE MODELING

Below is an outline of this presentation:
- Introduction to Institute for Disease Modeling
- Modeling Workflow: Parameter collection, modeling and analysis
- The Problems
  - Data Design: SQL vs. NoSQL
  - Grouping and Location of thing
  - Dealing with Terabytes and Petabytes when you only need Megabytes
  - Provenance

Dennis Harding has over twenty years in software and engineering expertise, with a Bachelor of Science degree in Electrical Engineering from San Jose State University as well as two years of graduate work in Computer Science from Santa Clara University. Dennis' past work has included microwave communications as well as computer science, and he has two patents to his credit, as well as five more patents still pending for his work. Dennis is a member of the IEEE, a SCRUM master, and is experienced with Agile development.

Dennis' IDM work is focused on large data, and he leads IDM's development efforts related to Large Data, including the generation of, management of, and storage issues related to extremely large data sets, such as those required for accurate simulation modeling.

FRIDAY, NOVEMBER 13

2:00pm-3:00pm
114 Pasquerilla/ROTC

Oliver Gutsche
Staff Scientist and Assistant Head
Scientific Computing Division
Fermilab

EXASCALE AND EXABYTES: FUTURE DIRECTIONS IN HEP SOFTWARE AND COMPUTING

Current and future HEP experiments will record and simulate larger and larger volumes of data, some going well beyond the petabyte scale. To succeed, analysts will need to master modern software and computing technologies to extract physics results from these large datasets. Gutsche will review current trends for HEP software and computing and show possible future directions for data analysis in the exabyte era.

Oliver Gutsche received his PhD in Experimental Particle Physics at the University of Hamburg in 2005 working on electron-proton collisions with the ZEUS experiment at Hera, DESY. He joined Fermilab and the CMS experiment at the LHC soon after as a PostDoc. Since 2014, Oliver has been a staff scientist at Fermilab and shares his time between his new position as Assistant Head of the Scientific Computing Division and studying Standard Model and Beyond the Standard Model physics at the LHC with CMS.

Top 10 Computation Users

	CPU Hours	%Total	Department
Min Zhu	880258.0	10.2	Electrical Engineering
Patrick Louden	596198.4	6.9	Chemistry & Biochemistry
Clyde Daly	509837.8	5.9	Chemistry & Biochemistry
Byung Jin Byun	352707.7	4.1	Chemistry & Biochemistry
Eitan Tzelgov	294360.3	3.4	Political Science
David Mitchell	242466.0	2.8	Electrical Engineering
Yiting Wang	238416.7	2.8	Political Science
Vikramjit Rathee	193593.6	2.3	Chemical & Biomolecular Eng
Prateek Mehta	181635.0	2.1	Chemical & Biomolecular Eng
Francisco Herrera	176374.0	2.1	Aerospace & Mechanical Engineering

* Based on CPU hour usage of CRC resources.

CRC User Survey

Time for the Annual CRC User Survey! This survey provides you the opportunity to rate your satisfaction with CRC services and recommend improvements. We appreciate you taking the time to complete this survey. We will randomly select 4 completed surveys to win a $75 shopping spree at the Notre Dame Bookstore. This year's survey is phone and tablet friendly and should take about 15 minutes to complete. The deadline to complete the survey is midnight on Friday, November 6. Thank you so much for taking the time to provide your feedback.

The survey is linked below.

CRC 2015 User Support Survey