



Coming Soon: Supercomputers vs. Hurricanes, Coastal Erosion

(The following is the second in a series on the 2006 Post-Katrina/Rita Research and Education Forum “Science Recovery and Discovery: The Role of Higher Education in Securing a Sustainable Future,” held April 2-4, 2006 in New Orleans. The forum, which featured national experts, was sponsored by the Board of Regents and Louisiana EPSCoR.)

Wouldn't it be great if we had the expertise to solve the problem of coastal erosion? If we could know where a hurricane's storm surge is going to go when it hits land? If we were able to determine a hurricane's path early on and respond accordingly?

That post-Katrina/Rita future may not be now, but it's well on its way.

For that, we can, in large part, thank LONI—the Louisiana Optical Network Initiative—and the capabilities it will infuse in the computer modeling of the State's university researchers, according to Dr. Edward Seidel, Director, Louisiana State University and A&M College (LSU) Center for Computation and Technology.

“Supercomputers that will give Louisiana unprecedented capabilities—more computer power per capita than every nation in the world except the U.S.—are already being deployed across the State,” he said. “With them, we can harness local and national expertise to develop forecasting models focused on solving such problems as hurricanes and coastal erosion.”

He noted that three of LONI's high performance “grid” computers that will initially interconnect mainframe computers at Louisiana's major research universities are in place at LSU, Louisiana Tech University, and Tulane University. Those earmarked for Southern University and A&M College, University of Louisiana at Lafayette, and University of New Orleans are next in line for delivery.

Looking for Answers in All the Right Places

The number of extreme events in the U.S. increased from less than 50 in 1950 to some 200 in 2000. At the same time, the capacity of ecosystems to act as buffers from extreme events has been reduced through the loss of wetlands and the fact that people are increasingly occupying regions exposed to extreme events.

“The relationship between the degree of exposure and damage is obvious,” points out a scientist who helped create The Millennium Ecosystems Assessment (MA), an international program that provides decision makers and the public with scientific information and options in responding to ecosystem changes.

“It's fascinating to see how you can take the MA model and apply it to New Orleans, where ecosystems connect to everything,” said Dr. Jerry Melillo, Ecosystem Center Co-Director of the Woods Hole Marine Biological Lab in Massachusetts.

“The MA assessment is interdisciplinary, involving natural and social scientists and some, but not enough, engineers,” he said. “It is also multinational, with global representations that include industrial and agricultural economies; its investigations are on the global, regional and local scales.”



Dr. Edward Seidel addressing attendees at the 2006 Post-Katrina/Rita Research and Education Forum in New Orleans.

LONI will also connect the institutions to the National LambdaRail, a grid-computing network for major research universities across the nation that is expected to have the same effect on the nation's technological development as the interstate highway system has had on interstate commerce.

Noting that in prior eras, research was often conducted in isolation, Dr. Seidel, an internationally renowned scientist, stressed the need for researchers to link with one another. “In modeling for hurricanes or coastal erosion we need to build collaborations and *Supercomputers, Continued on pg 2*

It focuses on the consequences of ecosystem change for human well-being, which includes security; adequate livelihoods, sufficient nutritious food, shelter and access to goods; health; good social relations; and freedom of choice and actions.

MA researchers are divided into three working groups addressing the following questions: 1) What are the current condition and historical trends of the ecosystems and services? What were the consequences of past changes in ecosystems for human well-being? 2) Given plausible changes in primary drivers, what will be the consequences to ecosystems, their services, and human well-being? 3) What can we do about it?

Tough Choices

“We can't have everything we want; sometimes tough choices must be made in order to augment the ecosystems to get to where we want to be,” said Dr. Melillo, who was addressing the 300-plus attendees at the Post-Katrina Research and Forum.

“By many measures, we are better off now than ever before. However, gains are being achieved at growing costs; benefits and costs are unequally shared; and emerging problems could

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links with other researchers to help develop, embed and respond to the data as a whole in order to make comprehensive, important predictions. Researchers around the world are very interested in helping solve these problems.”

Examples of national/international collaborative projects of importance to local regions that he suggested to the audience of more than 330 attending the Board of Regents/Louisiana EPSCoR-sponsored Forum, included the Southern California Earthquake Center, Massachusetts Biotechnology Center of Excellence, and the National Hurricane Center in Florida.

As an example of the unintended results of failing to address a disaster as a whole entity—pre-, during, and after—Dr. Seidel cited the 1927 Mississippi Flood, which resulted in levees being built by the federal government that in turn resulted in the loss of Louisiana’s wetlands.

“Behind Katrina, in just two short days, Louisiana lost as much of its coast as it normally does in six months,” said Dr. Seidel. “The interaction of hurricanes and coastal erosion is very complicated. There is a quantitative answer that requires sufficient computer power to make predictions. But if we can model it, we can more reliably predict it.

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substantially diminish the benefits that future generations obtain from ecosystems,” he said.

“And there are trade offs – if you want more food, it’s going to cost you; you must make a choice. It’s a very fundamental issue.”

Cautioning that it is difficult to slow or reduce the impact of society on ecosystems, he warned that MA scenarios of the future do not show substantial abatement of the degradation resulting from the increasingly larger impacts on ecosystems and the benefits people obtain from them. “While there are options to build more favorable trajectories, they will take substantial new actions.

“Current demands of two-thirds of the ecosystems services investigated by MA are unsustainable; some are effectively irreversible – climate change, excessive nutrient supply, desertification and loss of biodiversity,” said Dr. Melillo. “There is also an increasing risk of ‘non-linear’ change that is accelerating, abrupt or hard to fix.

“Hindsight is great but we need to look at the thresholds. Scenarios and ‘What if...’ questions will play an important role in Louisiana’s response to the continued loss of wetlands and other ecosystems.”

“With Katrina, five days in advance, there was almost no clue regarding where it was going to hit. We need to develop longer projections that we know are reliable; we need to correct our models as we receive the data in real time. The kind of waves developed by a hurricane, for instance, depend on what they are going to first hit. With real-time data, we can plan and respond accordingly.

“With our network of supercomputers we will be able to forecast a day of resolution in one hour and run models of all scenarios. Give us the experts and the means to communicate and we can develop world leadership in technology.”

The Forum’s Information Sciences Discussion Group, which agreed with the need to link Louisiana investigators to researchers throughout the State, nation and world, identified LONI as the fundamental enabler that will help anchor collaborations.

A working group was formed, names and e-mails exchanged and plans were made to generate a report that could lead to a white paper and/or a regional/national information technologies center. The dual missions of the proposed center: emergency responses before, during and following an emergency, and comprehensive modeling addressing both short and long-term issues.

Urging Louisiana to develop partners across the country, the Massachusetts scientist said: “Explain the importance of Louisiana using an agreed-upon knowledge base of facts that will serve as the basis on which decisions are made and as an instrument to identify priorities for action.

“It will provide tools for planning and management and foresight concerning the consequences of decisions affecting ecosystems. It will help identify response options to achieve human development and sustainability goals, and build individual and institutional capacity to undertake integrated ecosystem assessments and to act on their findings.”

He also strongly recommended partnerships with professional societies. “The Ecological Society of America, for instance, is developing new partnerships with decision makers in government and business,” said Dr. Melillo.

“Through these partnerships ecologists are seeking to share basic principles of ecology and clarify how they can help share solutions to some of society’s most vexing problems. The goal is to create an agreed-upon knowledge base as a foundation for developing environmental policies to support a transition to sustainability.”



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