Making storm warnings a more exact science

May 2 2013, by Richard Firstman

At New Dorp Beach, Staten Island: left to ritght: Dr. Alan Benimoff, Interim CSI President Dr. William J. Fritz, Dr. Lacey Sloan, and Dr. Michael Kress.

(Phys.org) —New Yorkers are famous for being unflappable, but in the fall of 2011 William Fritz was worried that the city had taken Hurricane Irene a little too much in stride. Like other climate concerned scientists, Fritz, a geologist at the College of Staten Island, considered Irene a precursor of more powerful and frequent storms in coming years. But

where he saw a heads-up, others saw a worst-case scenario that wasn't so bad.

"Many people thought Irene was as bad a hurricane as we could get in New York," says Fritz. "But it wasn't. We really dodged a bullet."

A Montana native who has since become CSI's interim president, Fritz has spent most of his career specializing in volcanic eruptions and other geological hazards. But in recent years he's turned his attention to idiosyncratic coastlines, like Staten Island's, and what happens when prehistoric geology meets 21st-century climate change. Irene, he says, was "mostly a rain event"— absent the atmospheric conditions that create the real worst-case scenario: a storm surge powerful enough to overwhelm low-lying and minimally protected coastal areas. If New York dodged a bullet with Irene, it could be said that Staten Island dodged a missile.

If you look at a map and imagine a hurricane coming off the ocean, it might seem that the island's broad Atlantic shoreline is like a protected harbor tucked between the shores of Brooklyn and New Jersey. In fact, it's the opposite: the geography creates a funnel effect. And the sea floor near shore is pitched like a ramp that accelerates a storm surge. Staten Island's shorefront communities are like the crumple zone of a car in a head-on collision.

"We don't get hit as often as people in the South," Fritz says, "but when we do get hit we're probably more vulnerable than any place on the entire Eastern seaboard."

As Fritz saw it, CSI was in a unique position to show how much worse storms of the future could be—and to lead the way in making Staten Island a little less vulnerable by making it a bit more prepared. CSI is the home of one of the most powerful mainframe computer systems in the

country, an outgrowth of CUNY's Decade of Science initiative. Fritz and two colleagues—fellow geologist Alan Benimoff and Michael Kress, a computer scientist who is also the college's vice president for information technology—set out to use that computing horsepower to generate scientific data hard enough to make the warnings something more than abstract.

"For people to believe it, we wanted to do a computer simulation to show what could happen if a storm hit with just the right eye track, with the right winds and tides all coinciding at the same time," Fritz says. The goal was precision: a computer model that would project just where the water would go, and how high—neighborhood by neighborhood, block by block—in a storm surge of 12 feet.

Over the next nine months, the CSI scientists fed millions of data points into the supercomputers, turning an admixture of geology, oceanography, climatology and land surveys into a set of highly specific projections. They were invited to present their findings to the annual meeting of the Geological Society of America in North Carolina in November.

And then—just a week before the meeting—Sandy hit. It was the superstorm, the one that put Staten Island on the map of hurricane catastrophes. Twenty-three people died on Staten Island, all but three of them by drowning, the most of any borough. Thousands lost their homes, many CSI students, faculty and staff among them—devastation comparable to Katrina. It was the real worst-case scenario, at least for now.

The day after the storm, Alan Benimoff went out to a low-lying neighborhood just south of the Verrazano Narrows Bridge to look for the highest point of the surge and see how close the CSI computer model came to projecting it. "I went from house to house to see where the

debris field stopped," he says. "The highest was at the house at 256 Sand Lane. FEMA came out later with a map that showed the top surge going right through that house." Most remarkable, though, was how close CSI's computer modeling came to the actual height of the surge at that house—and at many others. On street after street, the computer model predicted flooding to within a foot of the actual surges—far more accurate than previous estimates with less sophisticated methods.

The CSI team was the buzz of the geological meeting. But to Fritz and his colleagues, the study could go only so far on its own. For it to be more than a scientific triumph, they had to turn the results into practical, actionable information for residents in the surge zones. And they had to make the results mean something to the overarching reality of climate change and the question it begs: Sea levels are rising—what do we do about it?

In the wake of Sandy, Fritz, now as CSI's interim president, saw a way for the college to take a critical leadership role in that question, on Staten Island and maybe beyond. It could be a laboratory of sorts, perhaps an exemplar, for the region and even the nation. By making storm surge flooding a little less unpredictable, the study could inform the complicated decisions facing public officials at every level. In that way, Fritz sees the computer modeling as a starting point for much larger discussion. In the months after Sandy, he assembled a diverse team of faculty that extended far beyond science to consider Sandy's impact from many angles. The objective is ambitious if not daunting—to find ways to avoid or mitigate the effects of future storms. It runs the gamut, from rebuilding and engineering decisions to coping with the devastation, physical and emotional. Several CSI faculty members in psychology and social work are carving out a new area of study—natural-disaster recovery on the most personal level.

In March, the college hosted a daylong forum—"Superstorm Sandy: A

Serious Conversation About the Future of Staten Island"—where faculty experts were joined by an array of public officials and civic leaders, people with economic interests and ordinary citizens. One of the participants was John Arena, an assistant professor of sociology, anthropology and social work who had lived through Hurricane Katrina when he was at Tulane University. Having studied the toll of the two most devastating storms of recent decades in the United States, Arena has found that weather is beyond human control but the impact isn't. "Our mantra is there's no such thing as a natural disaster," he says. "At every stage from causes to reconstruction there's a social calculus: Who lives and who dies, who gets to come back and who doesn't, who benefits and who's better off."

Fritz's evolution as a geologist with a broad, humanistic view of the world can be traced to his experience as a leading authority on geological hazards. He worked with governments in the aftermath of the eruptions of Mount St. Helens and volcanos in Colombia. "I found that geologists talk about hazards and then no one listens. It doesn't get any traction. It's the interdisciplinary part that makes the difference." When it comes to rising sea levels, he says, "You have to understand the science of why New York is vulnerable and how surges work, but then you need to include social scientists, mental health counselors, politicians, developers and economists to have a holistic view and make something happen."

Fritz has opened the conversation himself with what he calls a five-point plan—an outline of ways that government can protect Staten Island from future surges. First, protect the existing natural barriers—the beaches and dunes. Second, build them higher. Third, rezone in the flood zone and buy up as many properties as possible in low-lying areas, turning them into parkland. Fourth, be very careful about engineering solutions such as sea barriers because they will not only be expensive but necessarily protect one area at the expense of another. (A sea gate being discussed to protect lower Manhattan would probably be bad for Staten

Island.) And fifth, educate the people: As obvious as it might seem, many people don't know to go up, not down, in a storm surge. And if they evacuate to safety, they might not know where safety is. That's where the computer models come in.

"There was no reason people should have died in Sandy," Fritz says. "We're using the computers to produce a graphic that's hard to ignore. It's not abstract contours on a map. It lets people really visualize what's going to happen."

Provided by The City University of New York