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## How to keep New York afloat

**With sea levels rising, once-a-century floods may become once-in-20-years events. One solution: huge storm-surge barriers.**

By **Moises Velasquez-Manoff** | Contributor to The Christian Science Monitor

### NEW YORK

Like many New Yorkers, Radley Horton often frets about tomorrow's weather. Unlike many, it's his job. A scientist at NASA's Goddard Institute for Space Studies (GISS) and coauthor of a forthcoming study on the effects of climate change in New York City, he is particularly concerned about an often-overlooked aspect of global warming: bigger, stronger storms.

"It's not a linear relationship," he says on a subway ride to Manhattan's South Ferry station, which would be mostly underwater in a Category 2 hurricane. "A little bit warmer sea surface equals the potential for a lot stronger storm." And feeding off the greater ocean warmth, full-blown hurricanes may arrive at New York City with increasing regularity.

By 2050, stronger storms and rising sea levels may make the flood that previously hit once every 100 years a once-in-20-years event, according to GISS. With a possible three-foot sea level rise by 2100, flooding could occur every four years. "Our old ideas about climate may have to change," he says. "We need to be open to all possibilities."

Even as high-profile politicians like California Gov. Arnold Schwarzenegger and New York Gov. George Pataki pledge to reduce their states' carbon "footprint," cities like New York and London – and entire countries like the Netherlands – are moving to adapt to long-term climate change.

With slogans like, "Why should you worry about a hurricane? It's not like you live on an island" and a tripling of storm shelters since Katrina, New York City's Office of Emergency Management has prepared for at least some of the short-term possibilities.

But even before Katrina, the city's Department of Environmental Protection (DEP), which manages the city's freshwater supply and wastewater – 13,000 miles of pipe, total – formed a task force with GISS to look at the long-term effects of climate change.

Among other things, the DEP was concerned by the damage storm surges might inflict on a city surrounded by water. Although city officials declined to discuss concrete solutions for this article saying they were still in the "assessment" phase, scientists foresee potential fixes ranging from raising key infrastructure and building dikes, to flood gates and temporary seals over tunnel entrances. One group proposes raisable flood barriers large enough to protect all of Manhattan Island.

Sea levels have risen almost a foot in the past century, partly because of ice melt and thermal expansion (warmer water has more volume), and partly because of naturally occurring land subsidence of the Northeast. In the same period, area temperatures have risen nearly 2 degrees F. About two-thirds of that increase occurred in the past 30 years and sea-level rise has accelerated in the past decade. "The core body of knowledge has solidified" on climate change, says Cynthia Rosenzweig, the



### VERRAZANO

**NARROWS:** Under one proposal, the mile-wide channel would be the site of a raisable storm-surge barrier that would rival the Netherlands' 'eighth wonder of the world,' which keeps North Sea storm surges at bay.

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lead GISS scientist on the climate-change task force. "We're moving into a solution phase."

But possible solutions – and how to pay for them – are still "big question marks," says Gary Heath, director of bureau operations and environmental analysis at the DEP. Although antiflooding technologies are basic and well established, implementing them in a city as old and crowded as New York is no simple task.

Elevating roads, for example, sends more runoff into subway grates. Water pumped out of subway tunnels – already some 14 million gallons daily – goes into sewer systems that might be overtaxed by rainwater. "You solve one problem and you create another," says Madan Naik, chief structural engineer of New York City Transit. "It's got to be a collaborative effort, whatever we do."

Much of this city of 8 million, the largest and most densely populated major city in the US, is only 10 feet above sea level. The potential 30-foot storm surge accompanying a Category 3 hurricane would flood large swaths of south Brooklyn, parts of Queens, Staten Island, and Manhattan below Canal Street, including the World Trade Center site – 100 square miles total. As happened during a 1992 northeaster, floodwater might pour into the city's tunnels and subway system, many of whose entrances are but 10 feet above sea level, short-circuiting public transportation and stopping traffic. The city's wastewater treatment plants – all 14 of which lie at the water's edge and have outfalls at mean tide level – could back up, sending raw sewage into basements and bathrooms citywide.

Klaus Jacob, a special research scientist at the Lamont-Doherty Earth Observatory at Columbia University in New York, estimates the cost of such an event up to \$100 billion. That's one-tenth of the \$1 trillion gross regional product of the New York metropolitan area, embracing three states and 22 million people. (Some estimate that Katrina will cost Louisiana and Mississippi up to \$150 billion.)

Rather than individually shoring up the city's many vulnerabilities, the better solution is to use the region's topography, say engineer Douglas Hill and Malcolm Bowman, head of the Storm Surge Research Group at Stony Brook University. Three barriers placed at strategic "choke points" – the Verrazano Narrows, Throgs Neck, and the Arthur Kill – would protect all of Manhattan and half the entire flood-prone area, they say.

Similar smaller barriers already protect Providence, R.I., New Bedford, Mass., and Stamford, Conn. Completed at a cost of £535 million in 1982 (\$2.1 billion in today's dollars), the Thames River Barrier, about the size of the one proposed for the Arthur Kill, has been raised more than 90 times. Italy plans to finish its MOSE project, a series of inflatable pontoons to protect the Venice Lagoon, by 2011.

And then there's the Netherlands: Half the nation is below sea level. Its colossal Eastern Scheldt barrier, nearly two miles long and often called the "eighth wonder of the world," most resembles the one proposed for the mile-wide Verrazano Narrows.

Human nature being what it is, Mr. Bowman doesn't see construction beginning any time soon. Without exception, the aforementioned barriers were built after – not before – major floods. The British and Dutch barriers were built after a 1953 North Sea storm caused major loss of life in both countries. The New England barriers rose after the "Long Island Express" hurricane of 1938.

In fact, in the 1960s the Army Corps of Engineers proposed something similar to block storm surges from Lake Pontchartrain, which abuts New Orleans. Never built, the barriers "might have made enough of a difference" during hurricane Katrina, says Bruce Swiren, a mitigation specialist at the Federal Emergency Management Agency. The disaster has led him to reconsider Bowman's idea. "I used to think that it was a complete pie in the sky," he says. "After Katrina, I'm starting to think maybe it's not such a crazy idea after all."

But Klaus Jacob, author of several papers on New York's vulnerability to flooding, opposes such large-scale solutions not on engineering but on philosophical grounds. They lend an "illusion of protection" that will only prove



**WATER MEN:** Douglas Hill and Malcolm Bowman (l. and c.) of Stony Brook University propose massive storm-surge barriers to protect New York City. The New York Sea Grant Program's Jay Tanski (r.) is an advisor for the project.  
MOISES VELASQUEZ-MANOFF

catastrophic in the end, he says. "The higher the defenses, the deeper the floods that will follow," he says.

Commonsensical preparations such as raising houses; putting electrical infrastructure in the attic, not the basement; and formulating clear contingency plans will go much further. In the end, however, Jacob sees only one viable, long-term option: Retreat from low-lying areas.

"That's the lesson learned," he says, the "price to be paid for pumping CO2 into the atmosphere."



SOURCE: NYC.GOV; SCOTT WALLACE - STAFF

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