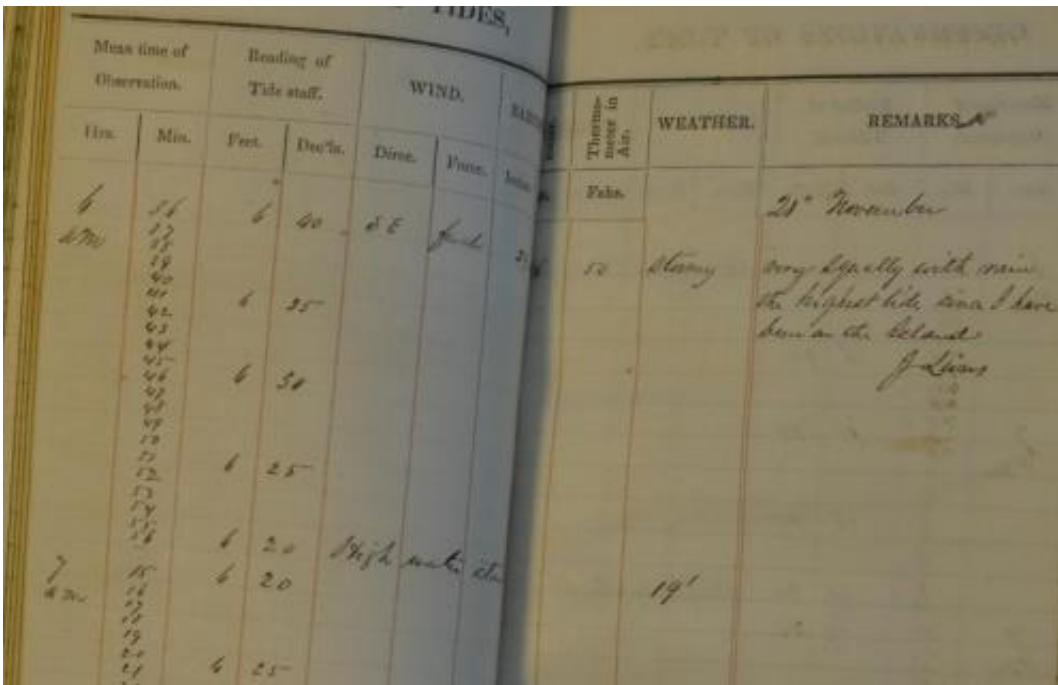


Odds of storm waters overflowing Manhattan seawall up 20-fold, study shows

April 23 2014



Mean time of Observation.		Reading of Tide staff.		WIND.		THERMOMETER in Air.	WEATHER.	REMARKS.
Hrs.	Mins.	Feet.	Dec'ls.	Dirct.	Force.			
6	56	6	40	SE	gent	72	Stormy	21 st November
6	57							
6	58							
6	59							
6	60	6	35					
6	61							
6	62							
6	63							
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This notebook shows water level data for Governors Island in New York in 1851. Before 1853, water level data was directly tabulated into notebooks like this one by tidal observers. Authors of a new study used this handwritten data to investigate storm tide levels for New York harbor back to 1844. Credit: Stefan Talke

Maximum water levels in New York harbor during major storms have risen by nearly two and a half feet since the mid-1800s, making the chances of water overtopping the Manhattan seawall now at least 20

times greater than they were 170 years ago, according to a new study. Whereas sea-level rise, which is occurring globally, has raised water levels along New York harbor by nearly a foot and a half since the mid-19th century, the research shows that the maximum height of the city's "once-in-10-years" storm tide has grown additionally by almost a foot in that same period.

The newly recognized storm-tide increase means that New York is at risk of more frequent and extensive flooding than was expected due to [sea-level rise](#) alone, said Stefan Talke, an assistant professor of civil and environmental engineering at Portland State University in Portland, Ore. He is lead author of the new study accepted for publication in *Geophysical Research Letters*, a journal of the American Geophysical Union. The research also confirms that the New York harbor storm tide produced by Hurricane Sandy was the largest since at least 1821.

Tide gauge data analyzed in the study show that a major, "10-year" storm hitting New York City today causes bigger storm tides and potentially more damage than the identical storm would have in the mid-1800s. Specifically, Talke explained, there's a 10 percent chance today that, in any given year, a storm tide in New York harbor will reach a maximum height of nearly two meters (about six and a half feet), the so-called "10-year storm." In the mid-19th century, however, that maximum height was about 1.7 meters (about 5.6 feet), or nearly a foot lower than it is today, according to tide gauge data going back to 1844, he noted.

"What we are finding is that the 10-year storm tide of your great-, great-grandparents is not the same as the 10-year storm tide of today," Talke said.

To get the data used in the study, Talke and a graduate student photographed hundreds of pages of handwritten hourly and daily tide

includes both the storm surge – the abnormal rise in water generated by the storm above the sea level – and the predicted astronomical tide. The rise in storm tide outlined in the recent study is in addition to the .44 meter (1.44 foot) rise in local sea level that has occurred since the mid-19th century in New York harbor.

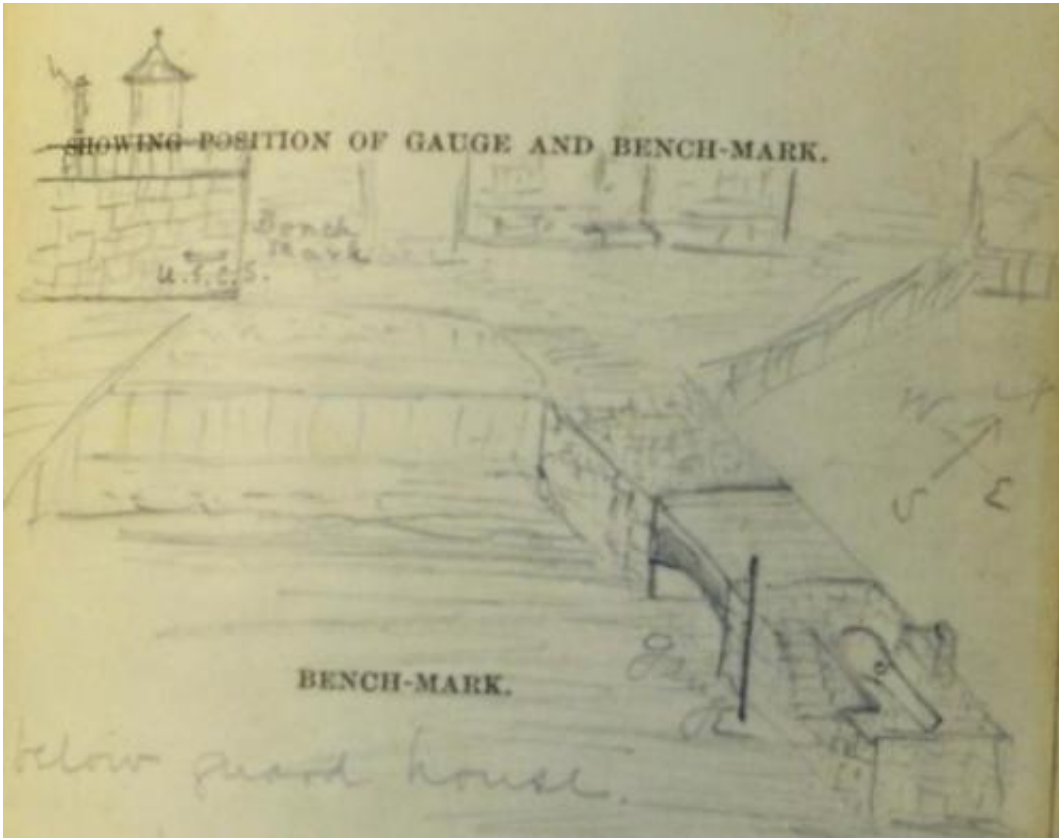
Combining the newly calculated rise in storm tide with the rise in sea level that has taken place since the mid-1800s, the researchers found that today, waters can be expected to overtop the lower Manhattan seawall – 1.75 meters (5.74 feet) high—once every four to five years. In the 19th century, when both sea levels and storm tides were lower, water was expected to overtop the Manhattan seawall only once every 100 to 400 years, according to the paper.

Scientists have studied the question of increasing storm tides in the area before, but none have gone back as far as the current study, Talke said. Hourly storm tide records for New York harbor that are kept by federal agencies, like NOAA, only go back to the 1920s, he said.

In the paper, Talke and his colleagues suggest that the variability in storm tides in New York harbor over the past 170 years could be a result of multiple factors. About half of long-term change could be attributed to decades-long variations in the North Atlantic Oscillation, an irregular fluctuation of atmospheric pressure over the North Atlantic Ocean that has a strong effect on winter weather in Europe, Greenland, northeastern North America, North Africa, and northern Asia.

Longer-term trends could also be influencing the increase in storm tides over the past two centuries, according to the paper. The authors speculate that climate change and increasing global temperatures could be contributing to the increase in storm tides. There could also be local factors, like deepening of shipping channels around New York harbor, that could have affected storm tides in the area over the past 170 years,

Talke said.



This sketch from a hydrographic survey notebook in 1884 shows the position of the Governors Island tide staff (labeled 'gauge') and the 'benchmark' 17 feet above the zero mark of the tide staff. Credit: Stefan Talke

The study's findings may indicate that "storm surges' interaction with New York harbor has gotten larger so that in addition to sea level rise, the storm surges may have been enhanced," said Chris Zervas, a scientist at NOAA's Center for Operational Oceanographic Products and Services in Silver Spring, Md., who was not involved in the study. "For the latter part of the 1900s, [it shows] that the possibility of overtopping the seawall has increased quite a bit in addition" to [sea-level](#) rise, he added.

Having this long, continuous set of data enabled the scientists to tease out decades-long cycles and long-term increases that they may not be able to see with shorter data sets, Zervas and Talke said. Knowing that there has been an increase in storm tides and figuring out why the increase occurred could help scientists better predict what will happen in the coming decades and help cities mitigate future problems, Talke said.

"If it turns out to be a local reason, as has been suggested in some cases, there could be local solutions as well," Talke said. "In some cases, we may be able to turn back the clock on that a bit."

More information: "Increasing Storm Tides in New York Harbor, 1844-2013" [onlinelibrary.wiley.com/doi/10 ... 014GL059574/abstract](https://onlinelibrary.wiley.com/doi/10.1029/2014GL059574/abstract)

Provided by American Geophysical Union

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