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DISCUSSION



Hurricane Flood Protection in NYC—Now Is Not the Time for Multiple Surge Barriers. Discussion of: Hill, D., 2012. The Lessons of Katrina, Learned and Unlearned. *Journal of Coastal Research*, 28(2), 324–331.

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INTRODUCTION

The article by Douglas Hill (2012) advocates the building of multiple storm barriers across New York Harbor to control storm and hurricane flooding. He includes a detailed critique of the New York City Panel on Climatic Change (NPCC) report based on their “dismissal” of the storm surge barrier concept. He suggests (p. 328) that the topic was overlooked “because of the makeup of the NPCC” (the absence of civil engineers). He then comments on the possibility of hurricane strikes on New York City (NYC) and their consequences

His article has several major problems with omission of the consequences of building the barriers, alternative measures to limit flooding damage, and the most serious is his description of the consequences of a hurricane strike on New York City. The readers of this journal should realize that “editorials” are not fact-checked or peer-reviewed. My purpose in writing this discussion is to correct misperceptions and incorrect inferences, based on my research in this area.

I first warned New York City Officials about the consequences of a major hurricane strike hitting New York in the mid-1990s. Since that time, I have been an advisor to both the NYC and NYS Emergency Management Organizations and have given hurricane seminars for all the counties in southern New York. I have also researched the hurricane damage potential in the State of New Jersey (Coch, 1999a). My conclusions have been presented in many media presentations and in numerous publications. Douglas Hill has totally ignored these research findings and has not followed proper attribution standards in not citing those works. He has mixed up and given inaccurate data about past hurricanes hitting New York City. His actions will cause needless worry to New Yorkers as he has ignored the progress made in handling hurricane emergencies in the past few years. A notable example of improved emergency management is how the City of New York handled Hurricane Irene in 2011.

Any discussion about surge barriers in New York Harbor must consider the oceanographic conditions, and not just the

water levels, there. I have spent 30 years studying the Hudson River from Albany to Sandy Hook. Published studies, and studies being completed now, show that water movements in the Upper and Lower Bays of New York Harbor are very complex (Coch, 1987). Water quality and sediment patterns are controlled by complex tidal flows, including net nontidal drift, flow separation, and flow segregation. Understanding these tidal complexities is vital in evaluating the consequences of building these barriers in New York Harbor.

NEW YORK IS NOT NEW ORLEANS

Building barriers and flood gates in New Orleans is essential. That city is largely *below* sea level. Building barriers in Venice and London is proper because those are low-lying metropolitan areas.

New York City is a very different configuration. The first high topography along the Atlantic Coast appears in New York City. High topography, developed on bedrock and glacial moraines, make up the “spines” of all five boroughs. Evacuation in areas on the coastal plains to the south of New York may involve car trips of 100 km or more. In New York City, inhabitants in low-lying areas need evacuate inland only a few kilometers until they reach altitudes far above the “worst case scenario” (Hill, 2012). Evacuation is needed only for those people living below altitudes of 10 m. In Hurricane Irene, New York City utilized evacuation zones labeled A, B, and C. Evacuation was mandatory in Zone A. Evacuation is aided by a first-rate rapid transit system, extensive bus routes, and arterial highways reaching virtually all of the city’s coastal areas.

SURGE BARRIERS IN NEW YORK HARBOR?

In principle, I believe that surge barriers may be necessary in the future because rising sea levels will place presently situated structures in peril. I have no doubt that surge barriers can be built properly and could have minimal effect *as long as oceanographic studies (biological and chemical) are carried out beforehand*. I have read the studies by the Stony Brook physical oceanographers (Bowman et al, 2004) and feel they have made valid flood predictions. However, there have been no studies

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about how these barriers would affect marine traffic, the flow segregation at the southern part of the Lower Bay, and the dissolved oxygen levels in the harbor.

Barriers should have the highest priority in a perfect *fiscal* world. The question is should the barriers be built at this time? The cost will be astronomic for the three sets of barriers. City, state and Federal budgets are presently strained to the limits with other commitments. Priorities must be given to present problems.

Perhaps the members of the New York City Panel on Climatic Change were thinking about the cost of the barriers, how often the barriers would be used and how well they would be maintained. Any New Yorker notes the deteriorating condition of our bridges, roads and other infrastructure. Rehabilitation is being carried out, but on a rotating basis. What priority could be given in the future to an infrequently used barrier in a place where inhabitants believe that major hurricanes do not make a landfall? I can visualize that rusting surge barrier now.

WILL HURRICANES STRIKE NEW YORK CITY?

Douglas Hill has not stated his profession, professional or academic credentials, or affiliations. Thus it is hard to infer his expertise. Most likely he is an engineer, based on his citations and total support of the surge barrier idea. The efficacy of surge barriers is not at question here. The question is when should they be built, how will they be maintained, and what are their environmental consequences?

It is in this section of the article that Hill makes the most serious mistakes and deviates from the basic principles of scientific writing. In science, we expect discussion of the most recent work along with earliest studies. attribution of sources, and *correct* facts (with citations).

Following is a quote from p. 329. I have inserted markers for further discussion.

“In the past, epic (A) hurricanes have struck the city. In the 1815 (B) hurricane, according to the historical record (C) sea level rose 13 feet/hr, flooding everything south of Canal Street (D). In the 1893 hurricane, a 30-foot storm surge swept across southern Brooklyn and Queens (E). Hog Island south of the Rockaway Peninsula was obliterated (F).”

- (A) What Saffir-Simpson Categories were these “epic” storms?
- (B) No, this was in *the 1821 hurricane* that hit NYC directly. The 1815 hurricane hit the Hamptons with little effect in New York City.
- (C) Citation for this statement?
- (D) The area south of Canal Street was not flooded, but the East River met the Hudson for 3 hours by flooding *along low-lying Canal Street*.
- (E) The storm surge was only 10.5 feet (Coch and Jarvinen, 2000). Water levels reached up to higher levels close to the coast. The water damage was limited to the coast (Coch, 2006) and not “across southern Brooklyn and Queens” (Hill, 2012).
- (F) The discovery of the obliteration of Hog Island was by me (Coch, 1998). Details were published in every major NYC

newspaper and in the National edition of the New York Times (New York Times, 1997), as well as in media presentations and at scientific conferences.

In short, an *accurate* picture of past damage is scary enough. We do not need misuse of the facts to create a worse scenario and scare the millions of inhabitants of New York City.

I agree with Max Mayfield’s quote (“It is not a question of *if* a major hurricane will strike the New York area, but *when*”). Historical studies indicate that a recurrence is probable in the coming decades. Recent ocean warming may hasten the date. However, plans are underway to protect populations and reduce property damage.

CAN NOTHING BE DONE TO PROTECT THE REGION FROM COASTAL STORM DAMAGE?

Douglas Hill presents the surge barriers as the savior of New York City. Perhaps they would be if we had *the fiscal ability to build them and maintain them*. A massive reallocation of resources may be needed to construct surge barriers in the future if the combination of sea level rise and possible increases in hurricane frequency and intensity occurs in the future.

New York City is not defenseless in the meantime. A professional emergency management system is in force. The city has a detailed hurricane plan in force and it responded well in Hurricane Irene. Evacuation zone maps are published and evacuation was effective in Hurricane Irene. At maximum, only about 30% of the population (in areas below 10m in altitude) will have to be evacuated. Additionally, they will only have to be moved a few kilometers inland to high bedrock and glacial moraine areas.

The most hysterical scenarios involve people being “trapped” in Manhattan. A hurricane landfall is not like an earthquake. The storm is monitored for days beforehand. The core city will be isolated by limiting access to Manhattan the day before. Bridges will be closed when the surface winds reach gale force. For example, when the winds reach gale force on the Belt Parkway below, they will be hurricane force 81 m above on the Verrazano Bridge Roadway. Threatened inhabitants of Manhattan will be moved to the high bedrock areas of the island. This minimizes the problem of loss of life in the eventual hurricane. Property loss is another problem.

A category 2 hurricane hitting New York City will inflict major damage on the city. The 1821 hurricane inflicted major damage to a far less populated and developed city (Coch, 1999b). A Category 3 hurricane would bring catastrophic property damage. The Category 3 hurricane cited by Hill (“the 1938 Long Island Express”) has been re-examined by Brian Jarvinen, (National Hurricane Center, retired). He stated (personal communication) that it was a Category 4 hurricane just before landfall. A warming ocean could enable a Category 4 storm to hit Long Island in the future. That would be an apocalyptic event if landfall was near NYC.

Waterfront development on landfill is extensive in NYC. Some idea of the degree of filling of waterways and wetlands can be seen by comparing colonial maps (Sanderson 2009) with modern ones. Minimal flood protection (site elevation, flood-

walls, etc.) are rarely found in these recent business and residential developments. For example, power plants in the East River were flooded in the second surge phase of the 1938 hurricane (Coch, 1994). This resulted in a 3-hour power loss in Upper Manhattan and the Bronx. Flood protection for those vital facilities is still inadequate. *There is no excuse for the absence of mandated flood protection in NYC zoning laws.* Extensive flood protection is something that can be accomplished under present-day fiscal conditions.

How can the city businesses survive a hurricane landfall? In talks to numerous major corporations, I have suggested the following:

- (1) Establish smaller core facilities in New Jersey or on Long Island capable of carrying out basic corporate functions.
- (2) Floodproof the lower floor of their headquarters building in Manhattan and move emergency generators out of basements onto upper floors if their building is below 10 m in altitude.
- (3) Put key operations in the central cores of the upper floors to minimize wind damage.
- (4) Have a small core of emergency managers, fully supported (food, water, power, etc.) and trained to ride out the storm and maintain the company's operations.
- (5) Create a "disaster fund" to pay for damage not covered by insurance.

Nothing is perfect. I found out that one major corporation established a satellite facility in New Jersey. They were proud that they were located tens of kilometers from NYC in a peaceful site along the banks of a major river! Perhaps they should have included a geologist along with the engineers and architects that planned that facility!

Eventually, NYC will be the landfall of a major hurricane. I feel that the loss of life and injury will be minimized by our *evolving* emergency management planning. On the other hand, property damage will be staggering. It is essential that extensive flood protection measures be followed by NYC.

Eventually, we may have to build an expensive surge barrier system, regardless of the cost and any possible environmental consequences. However, now is not the time

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