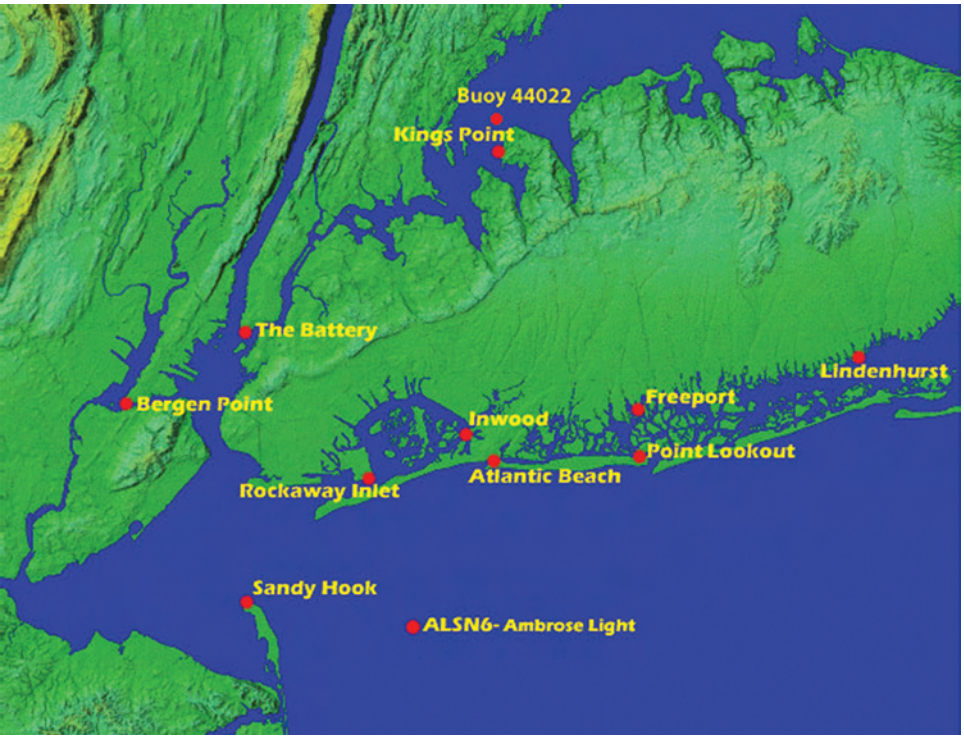
IMPROVING STORM SURGE FORECASTS FOR METRO NY

Research team makes advances in high-resolution modeling

If a category-3 hurricane hit New York City, the Army Corps of Engineers estimates that nearly 30 percent of the southern tip of Manhattan would be flooded. Accurate flood forecasts are crucial to emergency managers planning for impending storms, especially in a city with more than 18 million residents and billions of dollars of infrastructure.

A report in the June '08 issue of the Bulletin of the American Meteorological Society by **Dr. Brian Colle** and his colleagues at the School of Marine and Atmospheric Science at Stony Brook University (SoMAS) offers hope that a new high-resolution storm surge modeling system will better be able to predict flood levels and when flooding will occur. The report also warns that flooding is dependent not just upon the intensity of the tropical storm, hurricane, or nor'easter, but also on the local phase of the tide at the time of the storm.

Several members of the Stony Brook Storm Surge Team (from left to right), Drs. Roger Flood, Malcolm Bowman and Brian Colle flank NYSG Acting Director Ms. Cornelia Schlenk at Stony Brook University's 50th Anniversary Time Capsule celebration. A copy of the teams' recent report was added to the Time Capsule, to be opened in 50 years. Photo by Barbara A. Branca



This screen capture from the Stony Brook Storm Surge Team's Website (http://stormy.msrc.sunysb.edu) shows observation stations in the NY metro area. The data from these stations aids in accuracy of the storm surge model.

In a project funded by New York Sea Grant, the research team tested the utility of coupling a state-of the art atmospheric model with an ocean model from the Stony Brook Storm Surge (SBSS) system in order to predict storm surges for the NYC metropolitan region. "Ultimately, the goal is to provide emergency managers with a range of possibilities as to what may happen as the result of a storm, and this approach shows great promise," says Dr. Colle.

Colle and colleagues tested their combined model against Tropical Storm Floyd and a nor'easter from December 1992, and found the model predicted peak water levels comparable (within 10 percent) to those measured during the storms at several water level gauges around the region.

The modelers also performed simulations to assess the impact of parameters such as local tide level and wind intensity on flooding severity. Model simulations showed that if Tropical Storm Floyd had arrived in New York City a week earlier, coinciding with a spring high tide, water levels would likely have been high enough for minor flooding to occur.

Another simulation, which used wind levels of a category-1 hurricane timed to arrive at spring high tide, predicted water levels likely to have caused significant flooding. These results suggest that the New York City metropolitan region was spared from flooding during Tropical Storm Floyd only because the storm's winds had weakened before reaching the region and because the strongest winds luckily occurred during local low tide.

"We're playing Russian roulette in some sense with these storms coming up the coast," says Colle. "If we have a high tide or spring high tide when we have one of these events, then we're in trouble."

Storm surge flooding could threaten billions of dollars of property and have a grave impact on the lives of the millions of people who live in New York City. During the December 1992 nor'easter, storm tides over-topped some of the region's seawalls for only a few hours, but managed to flood the NYC subway and the PATH train systems at the train station in Hoboken, New Jersey, shutting down these transportation systems for several days.

As sea level rises, New York City becomes even more vulnerable to storm surge flooding. It takes high water levels of only 5 to 5.75 feet above mean sea level to cause flooding over some of the southern Manhattan Island seawalls. "Storm tides have exceeded 5.5 feet eleven times since 1980 according to tide gauge records at the Battery," says **Jay Tanski**, New York Sea Grant Coastal Processes Extension Specialist. Global warming is expected to increase the rate at which sea level rises from approximately one foot per century to 1.64 – 2.46 feet per century. However, this rise is only going to be adding incrementally to an existing problem. "The highest recorded storm tide is about 7.5 feet above mean sea level which occurred during Hurricane Donna in 1960. Studies indicate the 100 year storm (a storm with a one percent chance of occurring in a given year) could raise the water to 15 feet if waves are included," adds Tanski.

"The vulnerability of the area speaks for itself as we've already had cases of flooding," says Colle. "When coupled with sea level rise, it's not going to take much of a storm to cause flooding as we go into the coming decades, so we are working to provide better forecasting of these events in the future."

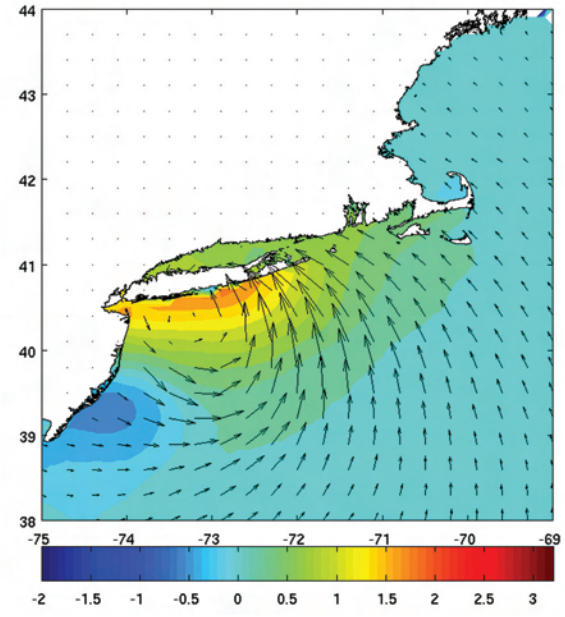
These forecasts will be of great use to the managers and emergency planners such as the Port Authority of New York and New Jersey. Says Chief Engineer **Frank Lombardi**, "As the Port Authority moves forward in developing adaptive strategies to climate change, it is clear that tools such as the storm surge modeling system developed by the Stony Brook Team are invaluable to planners, designers and policy makers responsible for public transportation infrastructure."

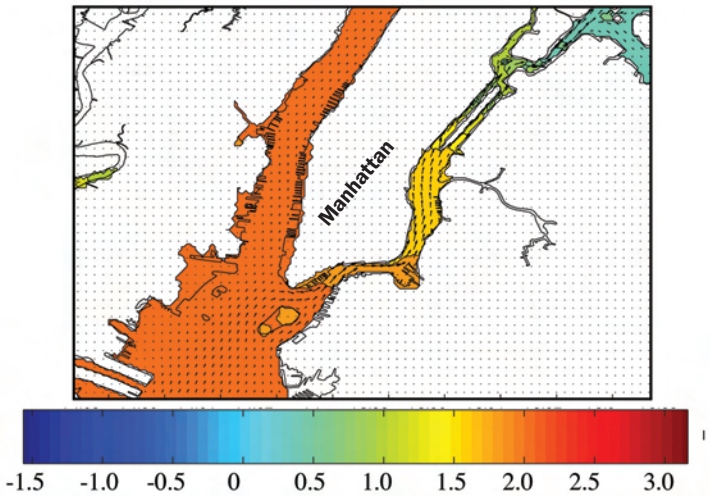
— Leslie Taylor and Barbara A. Branca

Stony Brook Storm Surge Team

The faculty and students that make up the team include: Malcolm Bowman, Frank Buonaiuto, Thomas Di Liberto, Roger Flood, Douglas Hill, Robert Hunter, Alexander Mintz, Katherine Rojowsky and Robert E. Wilson. Some of the results of the team's findings will be presented at the American Meteorological Society meeting in early 2009. See page 9 for related story.

... for more on storm surge prediction





The Stony Brook team simulated Hurricane Gloria, the destructive hurricane of September 1985 and created a 42-hour "hindcast" of its landfall over Long Island. This advanced circulation model (ADCIRC) simulation of the hurricane (left) shows the height of the storm surge indicated in meters by color. It also shows the surface wind vectors. The map on the right shows (in orange) how the Stony Brook model correctly predicted flooding around the tip of Manhattan (white) during the December 1992 nor'easter. For both the hurricane and nor'easter, the models present simulations very close to the reported data of the actual storm events.

Graphics courtesy of Brian Colle