Coastal Resilience Project:
The purpose of the Coastal Resilience project is to provide communities with easy access to information to assist in coastal planning, zoning, acquisition, and other management decisions regarding resources at risk from sea level rise (SLR) and coastal hazards. One of the principal products of the project is a spatially explicit web mapping tool that provides forecasts of inundation on the south shore of Long Island under different sea level rise and storm surge scenarios. This web mapping tool is intended to assist local participatory stakeholder processes in towns and villages on Long Island in order to garner awareness and guide decision makers on climate change issues. Specifically this application tries to identify explicit relationships between ecological, social and economic indicators and thereby provide a comprehensive platform for decision making.

Category: Flood Scenarios

General Description:
Storm surge flooding scenarios were generated for the Coastal Resilience project by faculty from the Columbia University Center for Climate Systems Research (CCSR) and NASA Goddard Institute for Space Studies, and NOAA Coastal Services Center based on the best available tide gauge information and the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model. SLOSH output was then used in conjunction with elevation data to generate spatially-explicit inundation projections.

Source:
- LiDAR data, Suffolk County Information Services
- Tide data, Battery and Montauk gauges - NOAA
- SLOSH model - NOAA

Caveats and Limitations:
For the high recurrence flooding we obtained the observed 1 in 5 year storm surges at both the Battery and Montauk tide gages. We evaluated existing SLOSH model outputs and looked at the storms that would give us those storm surge values at those locations. Ideally we would have a longer period of tide gage records (specifically for Montauk) and more observational stations to truth the model output. For any of the SLOSH model runs the accuracy is quoted as being within 20% of the observed storm surges; no further explanation is given. Additionally SLOSH does not incorporate waves or precipitation and is generally considered to be at a coarse, regional scale.

We mapped storm surges from SLOSH output called Maximum Envelopes of Water, or MEOWs. They represent maximum storm surge values obtained from a series of parallel model runs over the life of the simulated hurricane. Thus in effect it is as if every location has taken a direct hit from the storm at the same time, which although not realistic, is useful in preparing for a worst-case scenario.

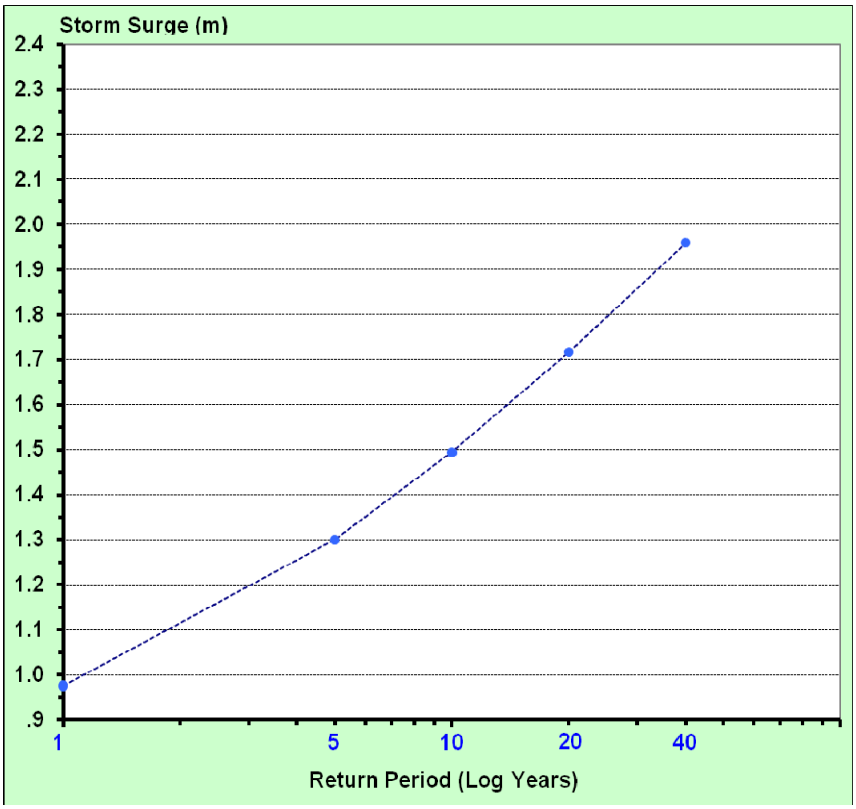
Although northeasters are widely considered the type of high impact storm to hit Long Island, we did not model nor'easters (other than what is implicitly in the tide gauge observations), which tend to be less intense than hurricanes but affect areas for longer periods of time.

It is important to note that storm surge is an episodic event and does not typically cause permanent inundation as does sea level rise.

Process:
The elevation data used for mapping sea level rise, a LiDAR-based digital elevation model (DEM) of the county provided by Suffolk County Information Services' GIS, was also used to map high recurrence and storm-related flooding.

Floods
Historic tide data and the most current storm surge tidal hydrodynamic data were used to develop flood recurrence curves for 1, 2, 5, 10, 15, 20 and 40-year flood events for the study area. Tide data at the Battery and at Montauk gauges were used to estimate recurrence periods of high water and surges. Hourly historical water levels and predicted tides for the Battery, NY were downloaded from NOAA's Tides and Currents website for the period 1959 through 2007. Only years with complete sets of hourly data were used. The Battery gauge has 40 years of complete daily records, and these were used to estimate storm surge probabilities up to 1 in 40.

Return periods for Daily Maximum Storm Surge - The Battery, New York



Return Period (Yrs)	Storm Surge (m)
1	.976
5	1.300
10	1.494
20	1.716
40	1.959

Base period = 1959-2007

These flood recurrence curves would be similar to the surges at Fire Island (FI); surges in the Great South Bay (GSB) would be lower. The fall-off of surge can be estimated by taking SLOSH storms for these frequencies. Using this approach, the surge in GSB would be about 40% of the surge at FI for the 10 year recurrence surge. For the 1-year recurrence interval, the fall-off would be somewhat less, because the storm waters are more readily able to get through the inlets in a smaller storm, but 40% can be used as a first approximation. Nor'easters do not have the same drop-off differential, since they come over longer periods of time than hurricanes.

To understand the spatial relationship between high recurrence flooding and inundation caused by storms, we mapped the 5-year surge flood in the Future Scenario Mapper.

Modeling Storms

Work on this phase of the project relied heavily on predictions from the National Hurricane Center's SLOSH model, which "estimate[s] storm surge heights and winds resulting from historical, hypothetical, or predicted hurricanes by taking into account pressure, size, forward speed, track, and winds."

We mapped Maximum Envelopes of Water (MEOWs) from the SLOSH model. MEOWs portray what could happen when a specific storm makes landfall and are used to plan for specific types of storms. MEOW Category 2 and 3 Hurricanes, corresponding to storm surges with a 40 and 70 year return period, respectively, were chosen for the Future Scenario Mapper and were combined with Goddard sea level rise projections. Specifically, the two MEOWs which were exported as shapefiles out of the SLOSH display program were:

- Category 2 MEOW, moving 40 mph North Northeast with landfall at high tide
- Category 3 MEOW, moving 60 mph North with landfall at mean tide (termed "catastrophic storm" in the Future Scenarios Mapper)