

Lost in Translation

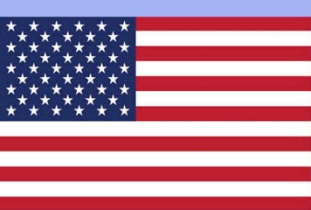
How can science better inform the public about natural hazards

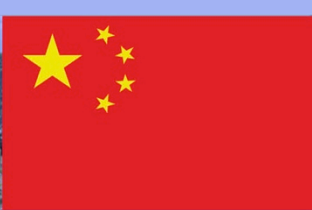
迷失在翻译

如何更好地用科学为公众翻译自然灾害

Michael S. Bruno

**Dean, School of Engineering and Science
Stevens Institute of Technology, Hoboken, NJ**



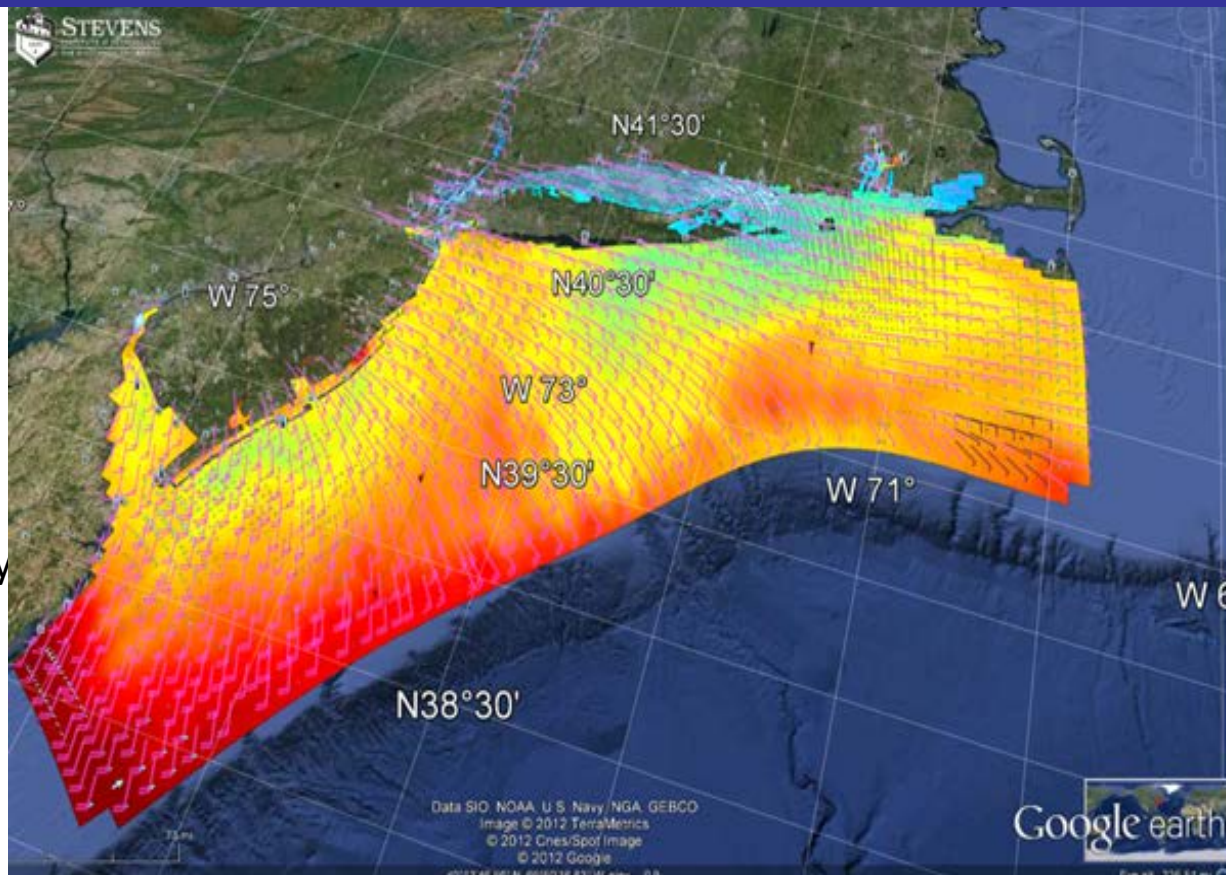


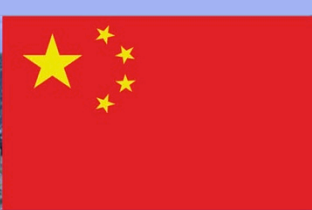
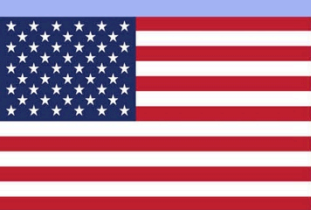
New York Harbor Observing and Prediction System

Integrated system of observing sensors and forecast models

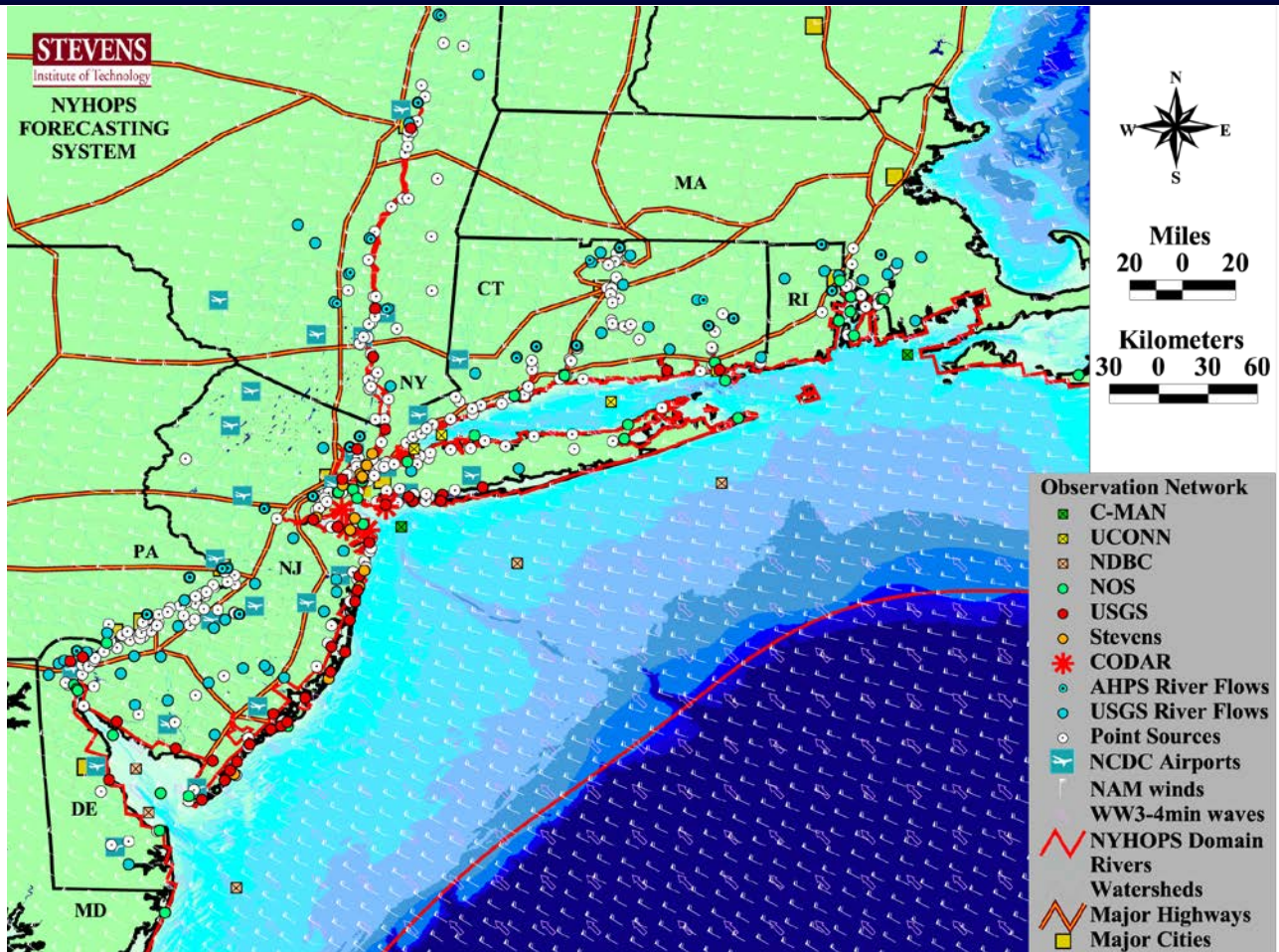
TO OBSERVE
TO PREDICT
TO COMMUNICATE

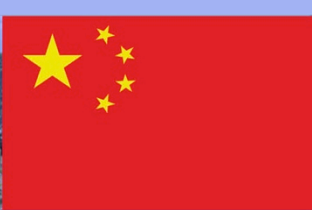
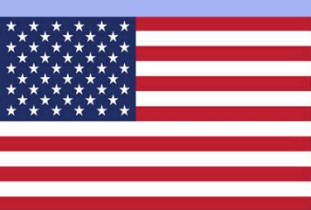
Weather, Currents, Water Level, Salinity
Temperature, Waves



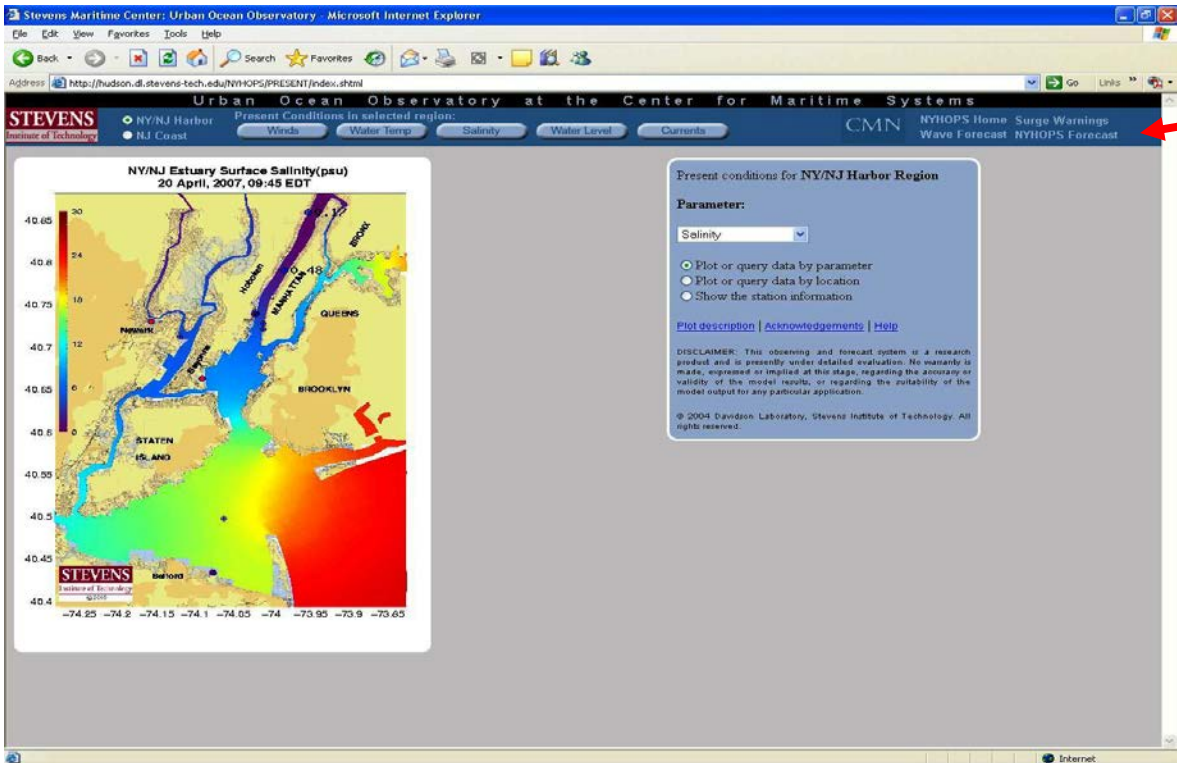


NYHOPS OMDR: Real-Time Data

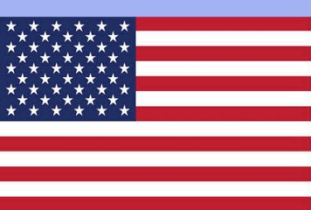




Forecasts out to 48 hours



<http://www.stevens.edu/maritimeforecast>



CMS Storm Surge Warning System

Urban Ocean Observatory at the Center for Maritime Systems

Present Conditions NYHOPS Forecast NJ Coast (CMN) Storm Surge Mobile Stations CMS Partners Data & Time Series STEVENS

Click for Storm Surge Warning System (SSWS) as of 2010-11-05 9:00 AM

Stations below have current or forecast flood levels. Box color indicates current with forecast in parents

- Hudson River below Poughkeepsie NY (Near Flood)
- Hudson River at South Dock at West Point NY (Near Flood)
- Bridgeport CT (Minor Flood)
- The Battery NY (Near Flood)
- Reynolds Channel at Point Lookout NY (Normal)
- Cape May NJ (Minor Flood)
- Lewes DE (Minor Flood)

CMS Storm Surge Warning System
Forecast Period: 2010-11-05 9:00 AM through 2010-11-07 12:00 AM ET

Select Station

Station: Select a Station to Display Time Series Plot

- Major Flood
- Moderate Flood
- Minor Flood
- Near Flood
- Normal Levels
- Blowout

Marker color indicates current water level. Blinking markers indicate predicted flooding.

To register for email flooding notifications, or to update registration information, enter your primary e-mail and click the Manage button.

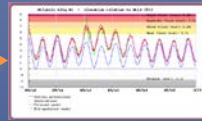
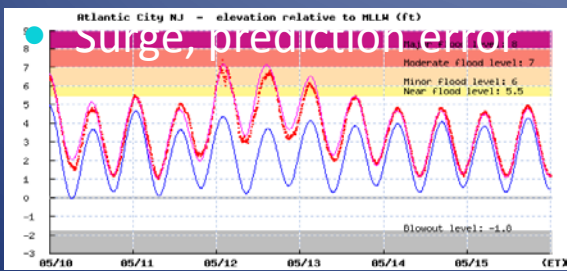
Manage Email Notifications

If you have questions or comments, please contact [the NOAA team](#).

Latest News about SSWS as of August 12, 2010
[SSWS: A Presentation of How it Works!](#)

- Color Coded Flood Levels
- Vertical datum selection
- Units selection
- Download data option

Storm Surge Warning System



Event

Phonebook



Warning

<http://www.stevens.edu/maritimeforecast>



Hurricane Sandy

2:PM EDT Mon Oct 29 2012

Position 38.3 N 73.1 W

Maximum Winds 90 mph

Gusts 115 mph

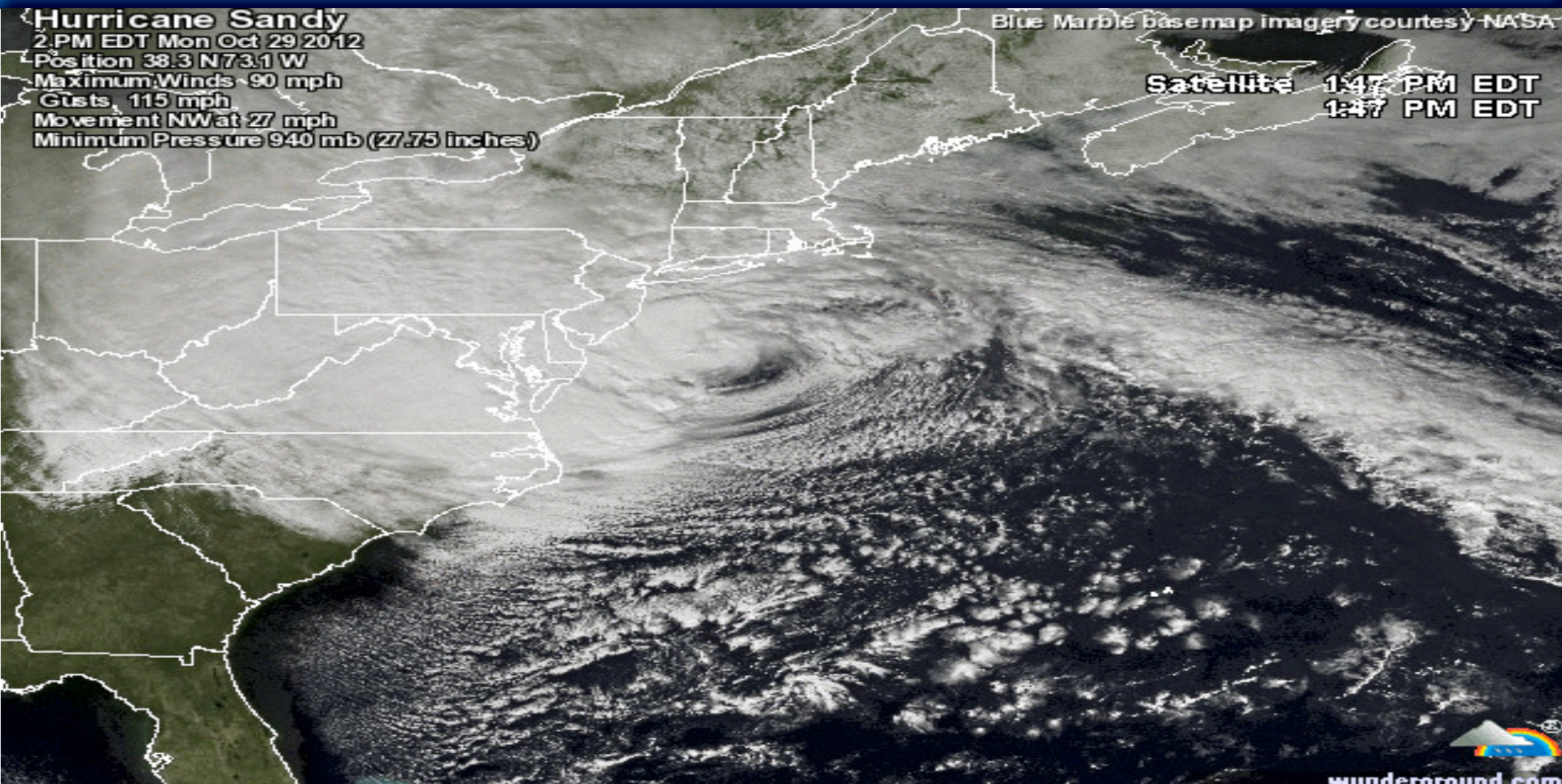
Movement NW at 27 mph

Minimum Pressure 940 mb (27.75 inches)

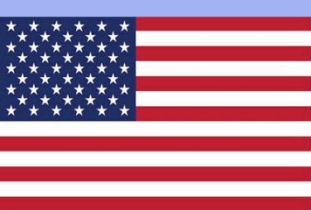
Blue Marble basemap imagery courtesy NASA

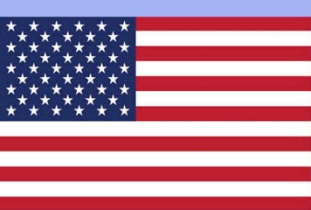
Satellite 1:47 PM EDT

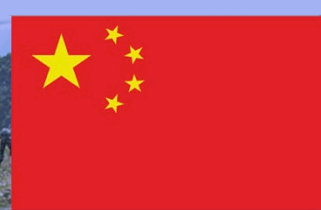
1:47 PM EDT





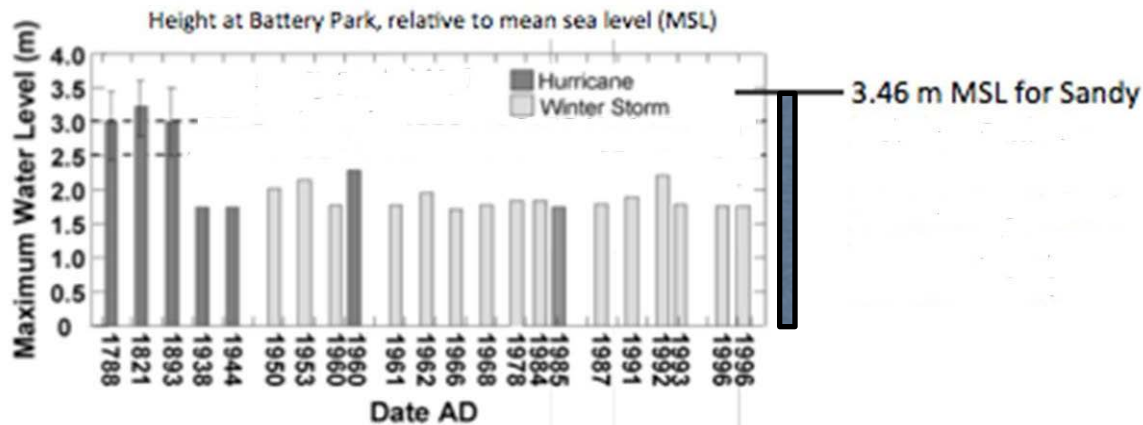






Storm Surge Height at Lower Manhattan

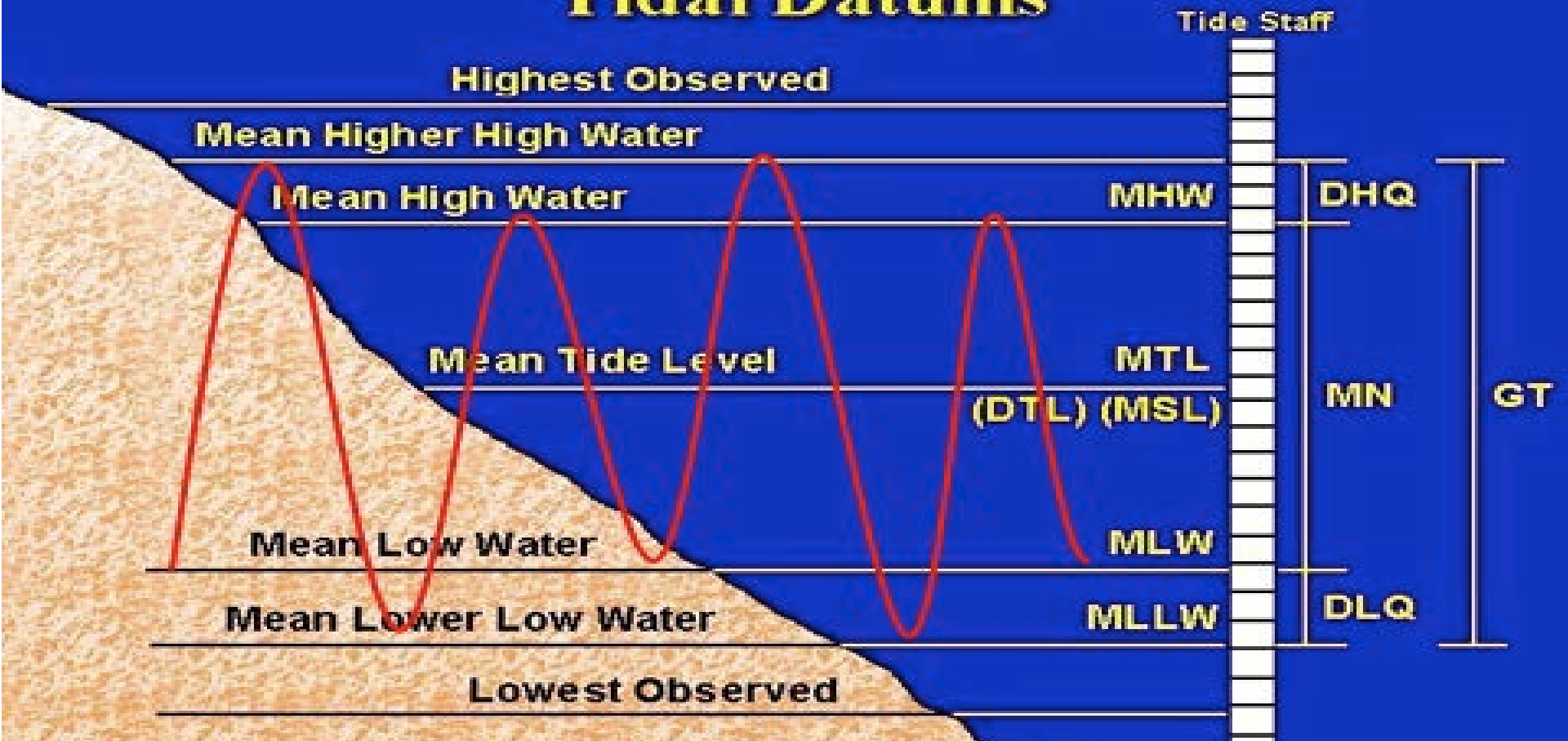
Adapted from: Scilleppi and Donnelly, *Geochemistry, Geophysics, Geosystems*, 2007

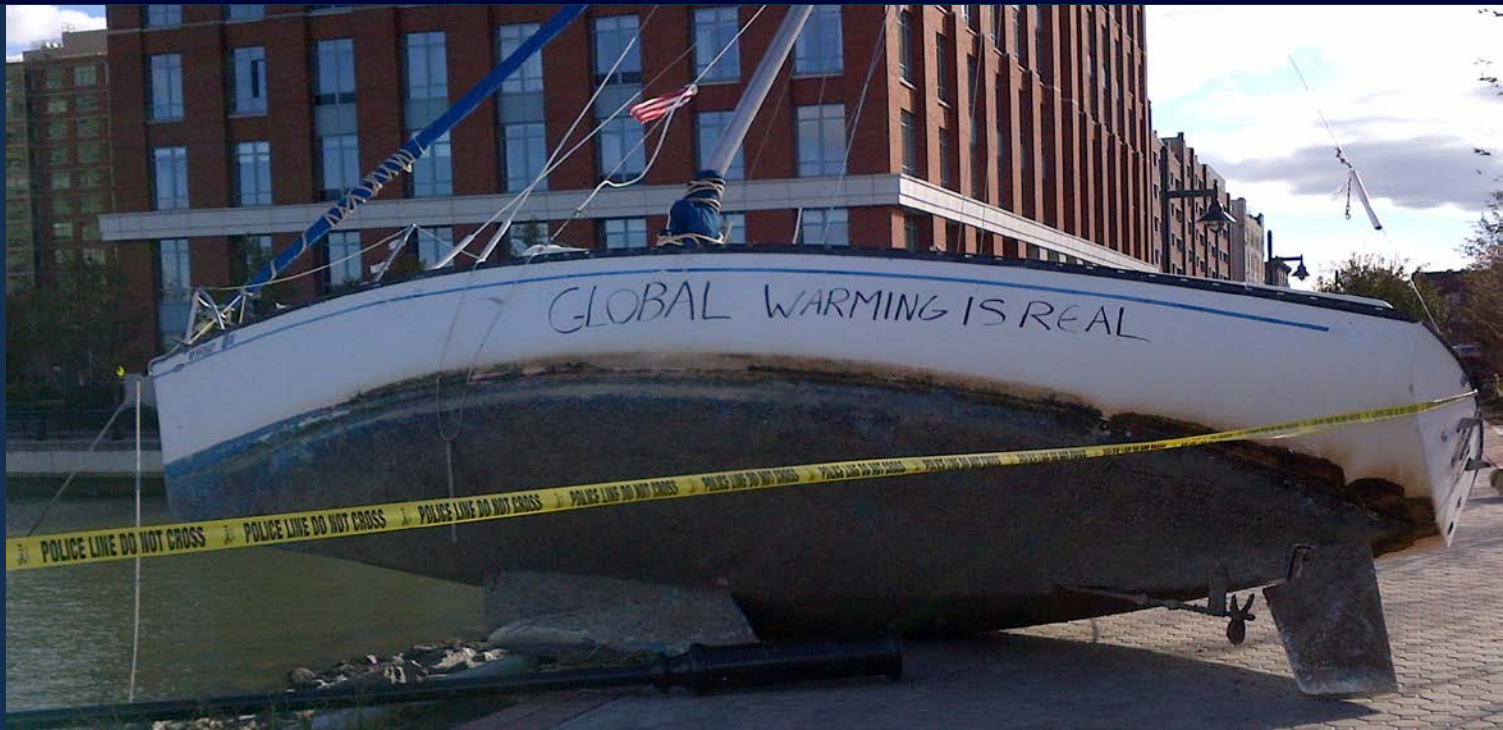
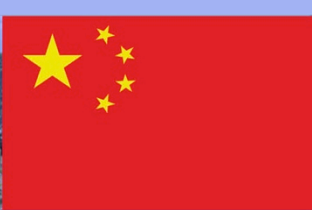
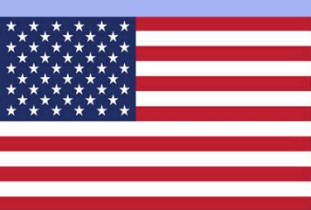


- Prior hurricanes:
 - The city is believed to have been **directly hit** by hurricanes in 1788, 1821 and 1893
 - 1821 was worst in NYC's history – 4 m surge, "a wall of water" rising in less than one hour (peaked at low tide), total water level of ~3.25 m

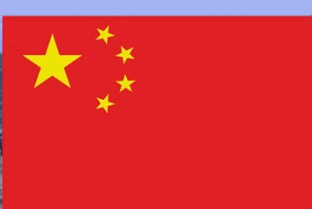


Tidal Datums





Hoboken, October 31, 2012



Data Retrieval

http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=8518750%20The%20Battery,%20NY&type=Tide+Data

Google



Search

Home Products Programs Partnerships Education Help

Station Home Page

Station Information

Tide / Water Level Data

Tide Predictions

Current Data

Meteorological Observations

Conductivity

PORTS

Operational Forecast System

Bench Mark Sheets

Datums

Harmonic Constituents

Sea Level Trends

Measurement Specifications

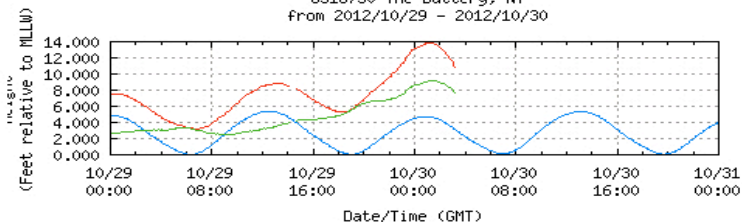
The Battery, NY - [Data Disclaimer](#)

Station ID: 8518750

The Battery, NY: [Data Inventory](#)
[Page Help](#)

Tide Data

NOAA/NOS/CO-OPS
Preliminary Water Level (B1:2) vs. Predicted Plot
8518750 The Battery, NY
from 2012/10/29 - 2012/10/30



Predicted Tide — Observed WL — (Obs-Pred)

[Retrieve data from 20121028 through 20121029](#)

[Retrieve data from 20121030 through 20121031](#)

Nearby Stations

- [Verrazano-Narrows](#)
- [Bayonne Bridge Air](#)
- [Bergen Point West](#)
- [Kings Point, NY](#)
- [Sandy Hook, NJ](#)
- [Bridgeport, CT](#)
- [Newbold, PA](#)
- [Burlington, Delawa](#)
- [New Haven, CT](#)
- [Tacony-Palmyra Bri](#)
- [Philadelphia, PA](#)
- [Atlantic City, NJ](#)
- [Marcus Hook, PA](#)

[Click here for larger plot](#)

Check to plot backup data (if available)

Begin Date:

Oct 29 2012

End Date:

Oct 30 2012

Datum:

MLLW

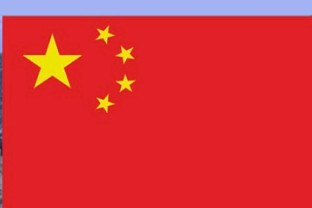
Data Units:

Feet
 Meters

Time Zone:

Local (LST/LDT)
 GMT
 LST

View Plot View Data Reset



Storm Surge Warning System

http://hudson.dl.stevens-tech.edu/SSWS/d/index.shtml?station=N017

Google

Urban Ocean Observatory at the Center for Maritime Systems



Present Conditions

NYHOPS Forecast

NJ Coast (CMN)

Storm Surge

Mobile Stations

CMS Partners

Data & Time Series



STEVENS INSTITUTE OF TECHNOLOGY THE INNOVATION UNIVERSITY

Storm Surge Warning System

Plot Series or Download Data

Station:

Stations are listed from North to South

Start Date:

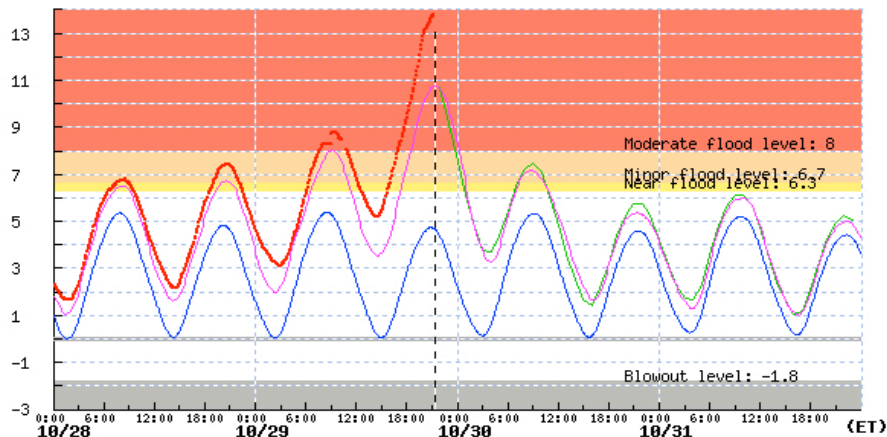
End Date:

Datum:

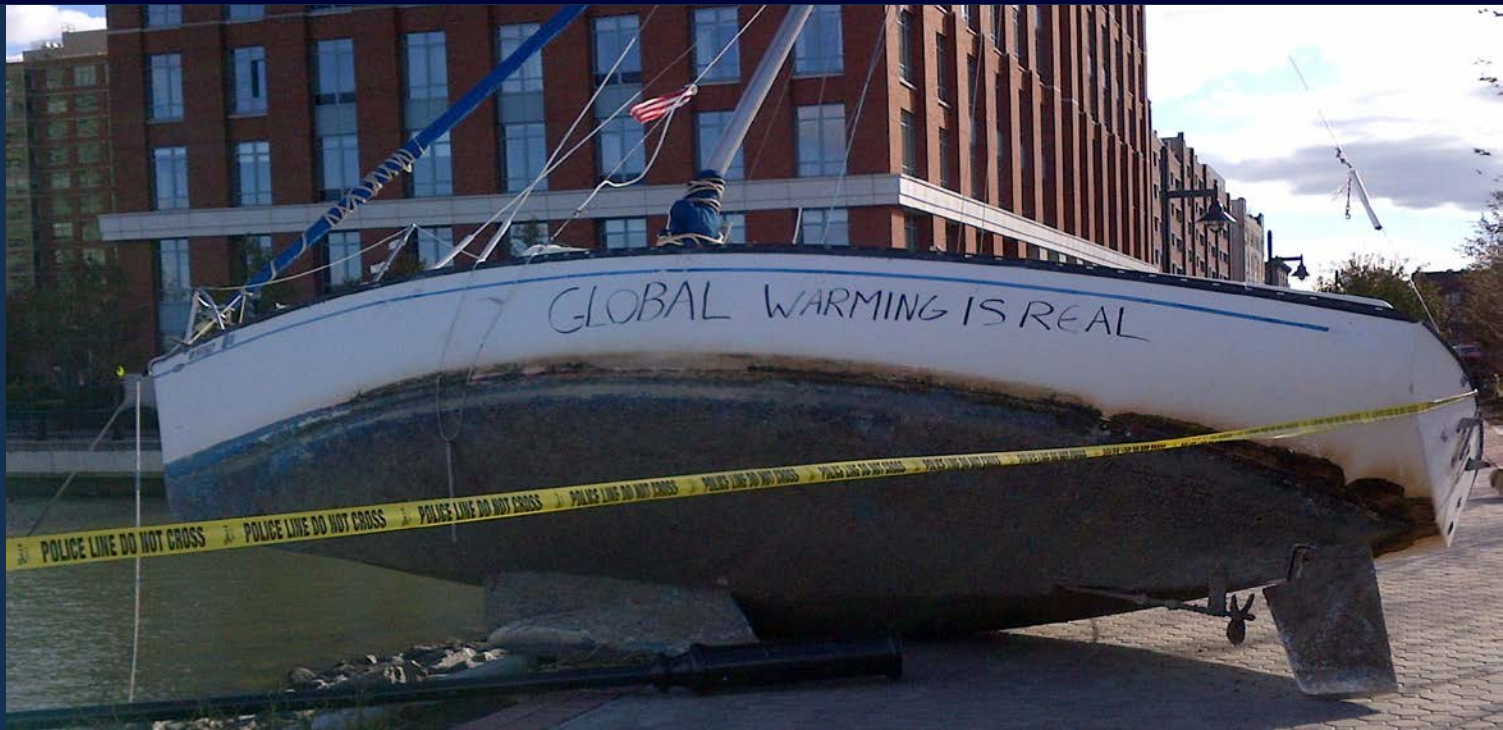
Units:

Time Zone:

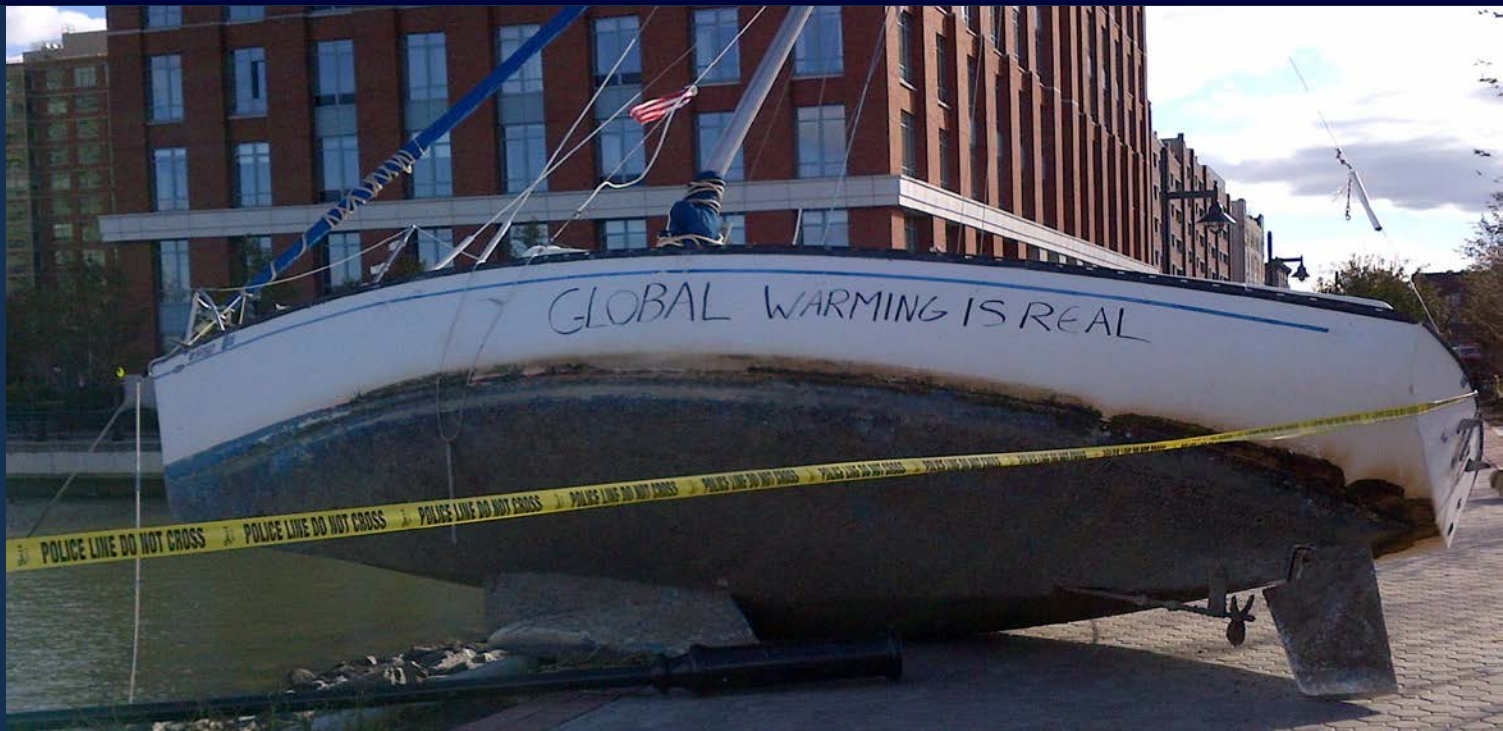
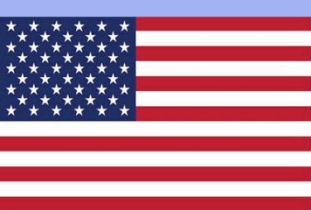
The Battery NY - Water level relative to MLLW (ft)



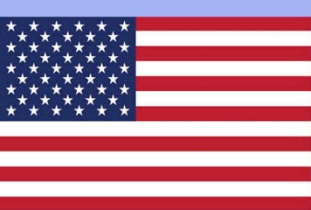
- Astron. predictions
- Observations (where available)
- NYHOPS Forecast model
- NOAA Forecast model (where available)



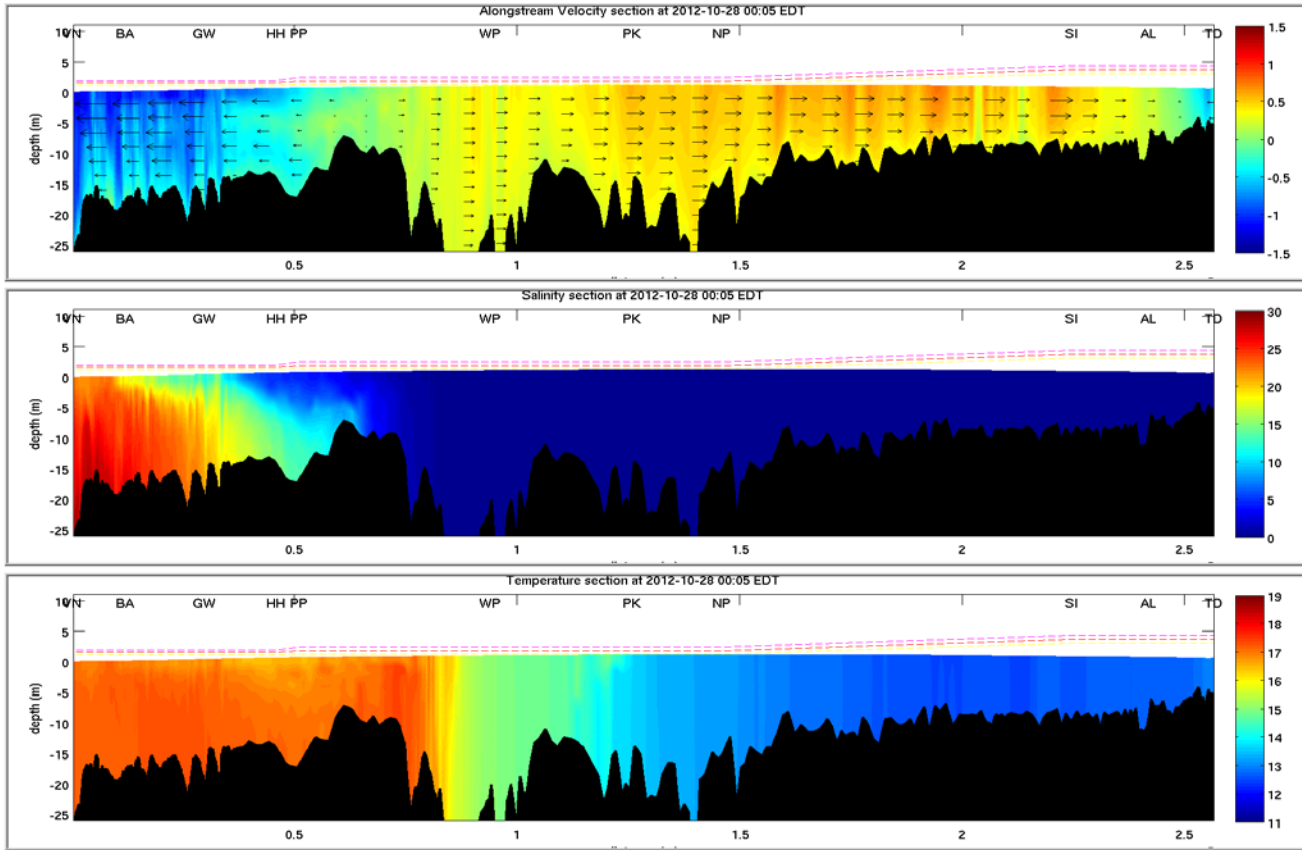
The owner didn't know – and didn't care – whether the storm surge was going to be 9.5 feet, or the water level was going to be 14 feet MLLW. What he/she wanted to know was where was the water going to be relative to the dry land surrounding the boat?

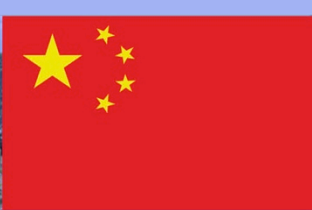


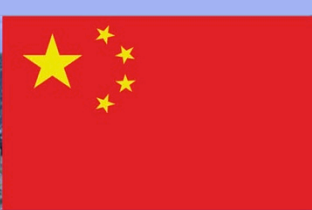
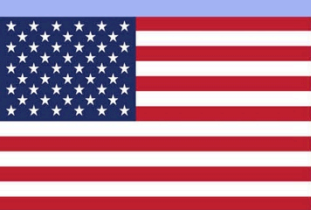
船主不知道—也不想知道—是否风暴潮会达9.5英尺，或水位会至平均较低低潮位之上14英尺。他/她只想知道，以船附近的干地作参考，水会涨到哪里？

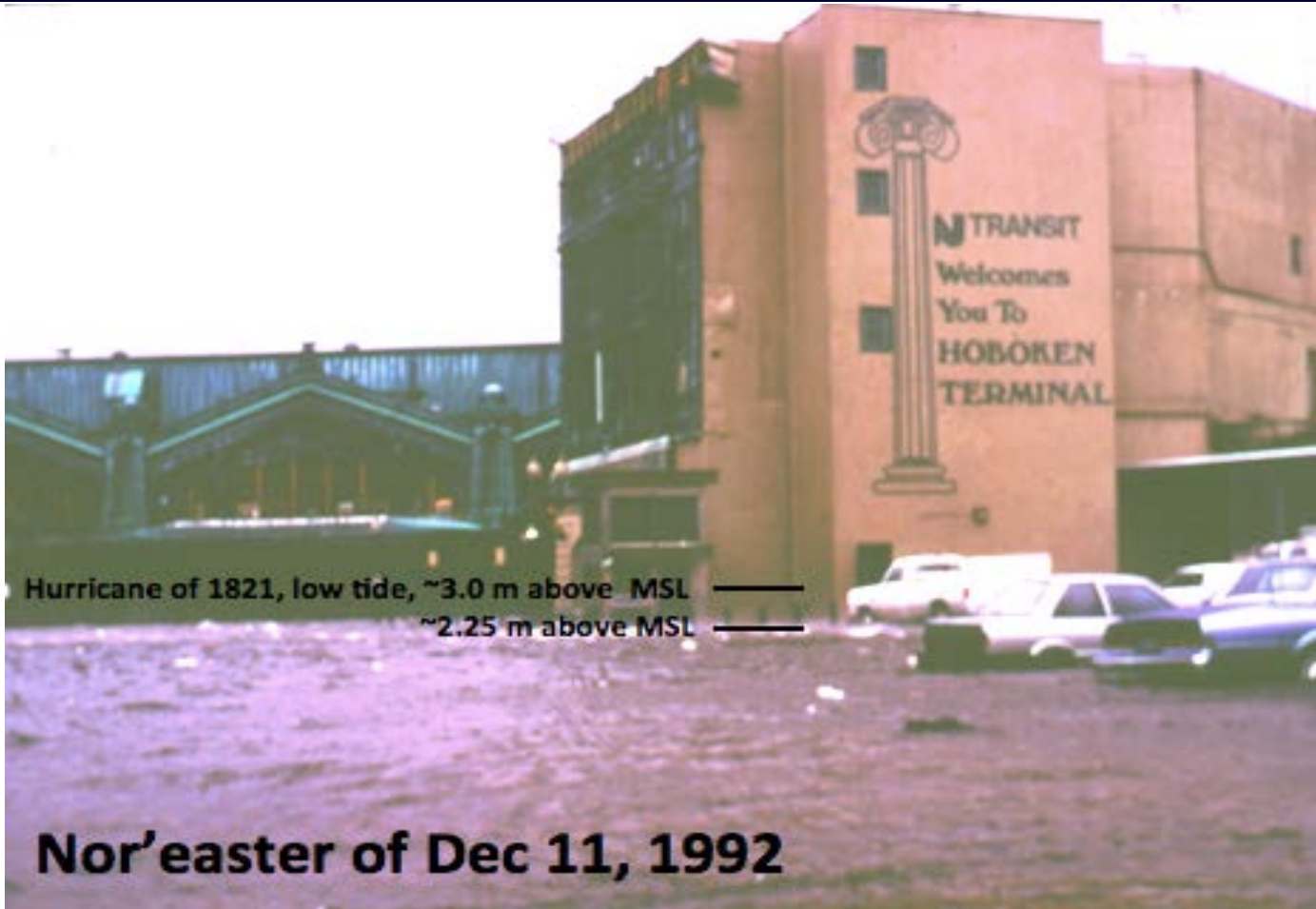
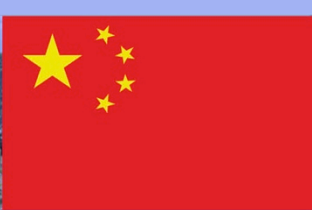
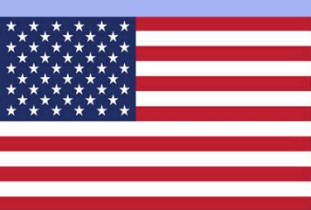


NYHOPS - Sandy - HRE: Verrazano Narrows to Troy



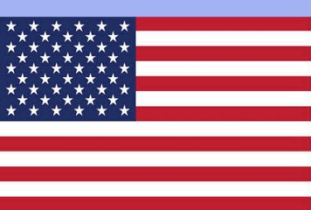






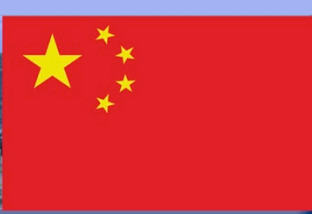
Hurricane of 1821, low tide, ~3.0 m above MSL ———
~2.25 m above MSL ———

Nor'easter of Dec 11, 1992



Is Street-Level Forecasting and Visualization the answer?



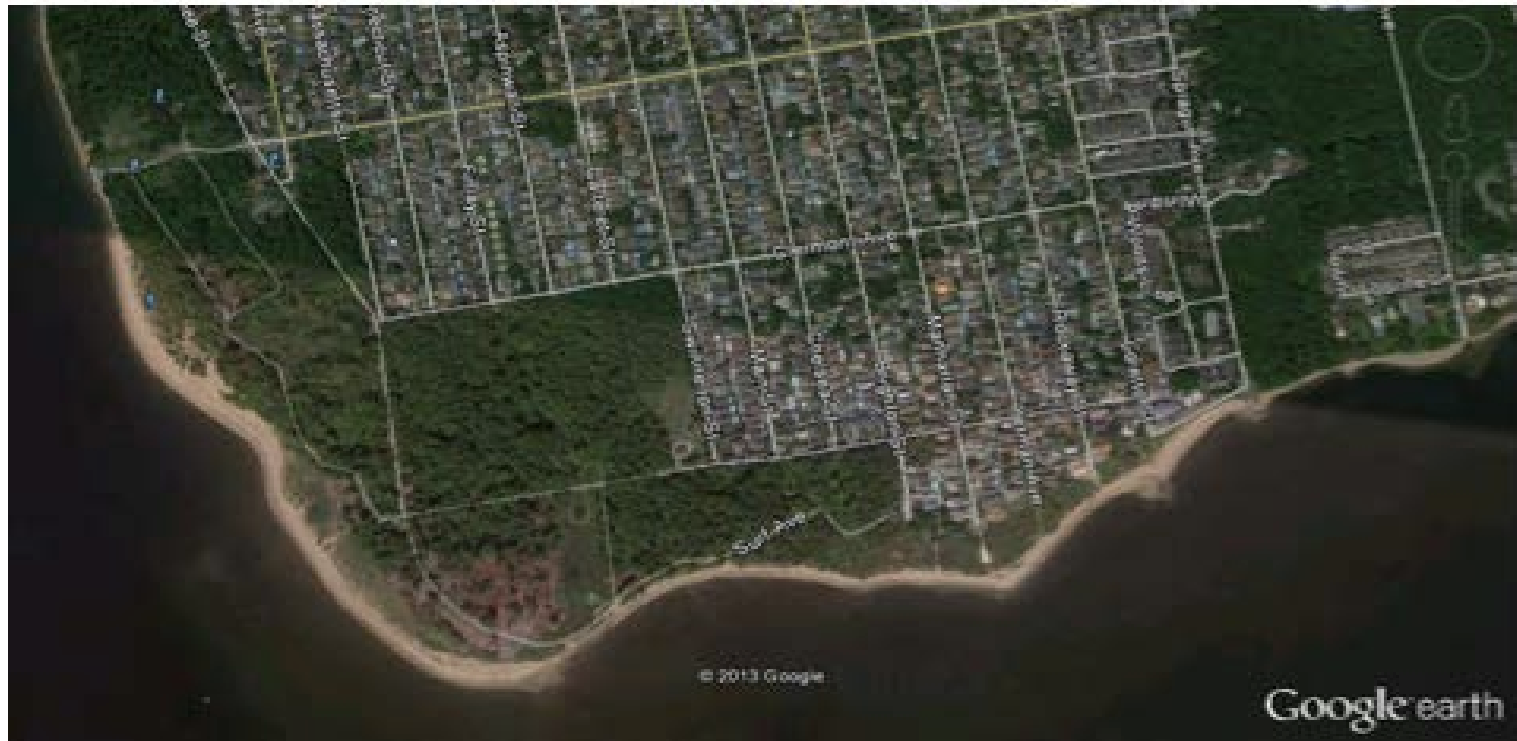


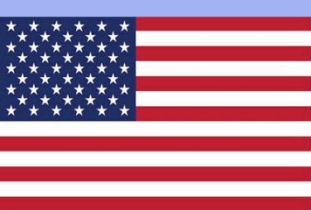
Translating Flood Hazards on Google Earth

- Using high-resolution topographic elevation maps as a layer in Google Earth, forecasted flood depths can be mapped in:
 - 1. Horizontal extent on contour maps
 - 2. In depth on Google Street View images
- Consistent datum is important
 - Here we use the North American Vertical Datum of 1988 (NAVD 88)



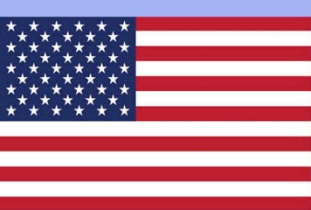
Google Earth Image of South Tottenville





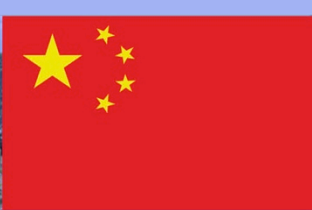
Manhattan St. looking South from Google Earth Street View





Forecasted Flood Depth





Why This Matters

这为什么重要



The Earth at Night



晚间地球



Population Density



人口密度



The Bigger Picture

In the year 2000:

- 20% of the world's population lived within 30 km (walking distance) of the coast
- 40% lived within 100 km (1 hour drive)
- 50 % (3.1 billion people) lived within 200 km of the coast
- 11 of the world's 15 largest cities are located in the coastal zone.
- Global sea level rise and land subsidence are causing coastal sea level rise of approximately 1 foot per 100 years along the US Atlantic and Gulf coasts
- “Humanity is the first species to become a geophysical force.” (E.O. Wilson)



在2000年：

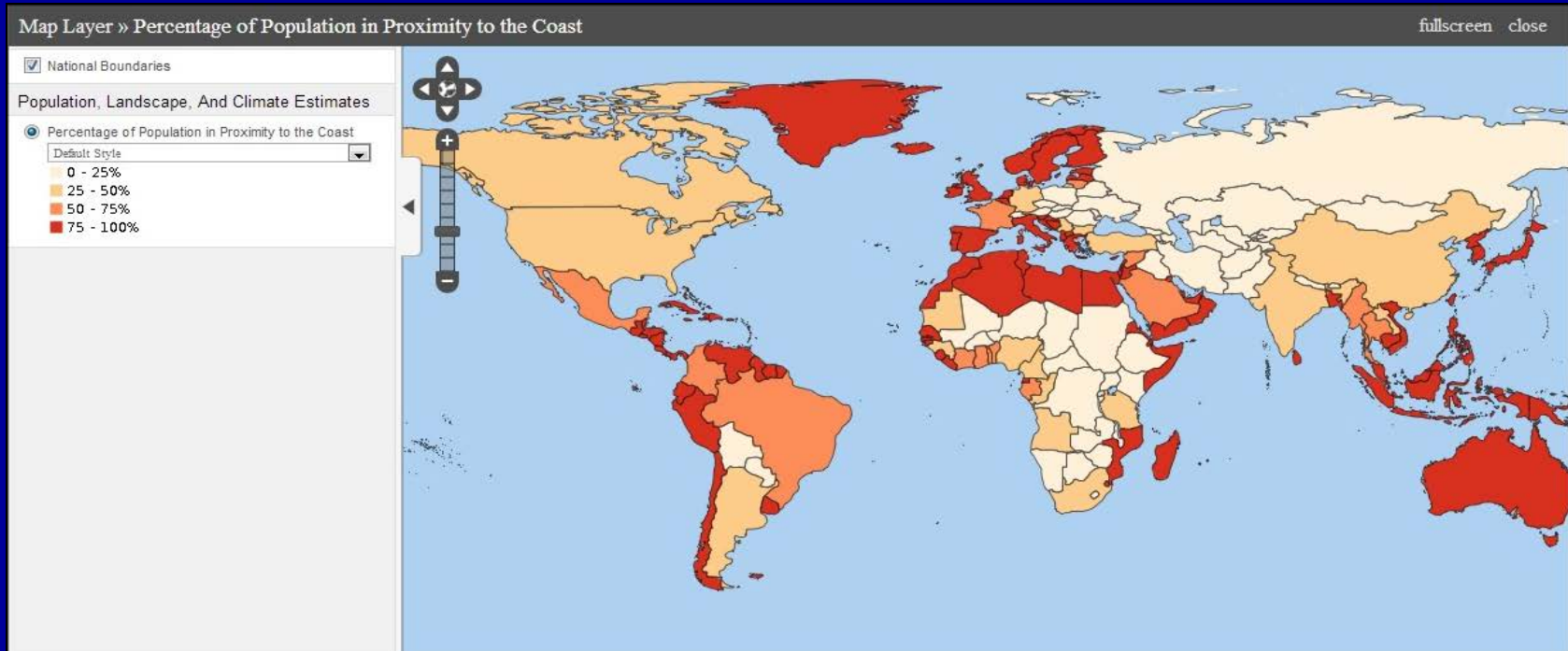
更大的图景

- 20%世界人口住在距海岸线30公里以内(步行距离)
- 40%住在距离100公里以内(一小时车程)
- 50%(31亿人)住在距离200公里以内

- 世界上最大的15个城市有11个在海岸区

- 全球海平面上升和地面沉降正使美国东部和南部的海岸水位以约每百年一英尺的速率上升

- “人类成为第一个能影响地球物理的物种” (E. O. Wilson)



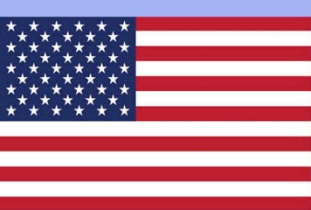
% population living within 200 km of coast (2010)



What's Next? 下一步?

We – the scientific community – need to work together on an international scale to address two primary needs:

1. Develop guiding principles, supporting data, and design guidelines for Resilient Coastal Urban Communities.
2. Develop more effective ways to Translate scientific information, and Risk and Vulnerability into terms that the public can understand and act on. This will lead to Public Policy informed by new knowledge & better understanding. 公共政策基于更新的知识和对科学更好的理解



Thank you!
谢谢！