NYS Resiliency Institute for Storms & Emergencies (NYS RISE)

Consortium of Stony Brook University, New York University, Columbia University, Cornell University, CUNY, and Brookhaven National Laboratory

Work Unit 4.2. Integration of Multiple Monitoring Systems Targeting Coastal Zones

Workshop Presentation, July 24, 2014

Team Members:

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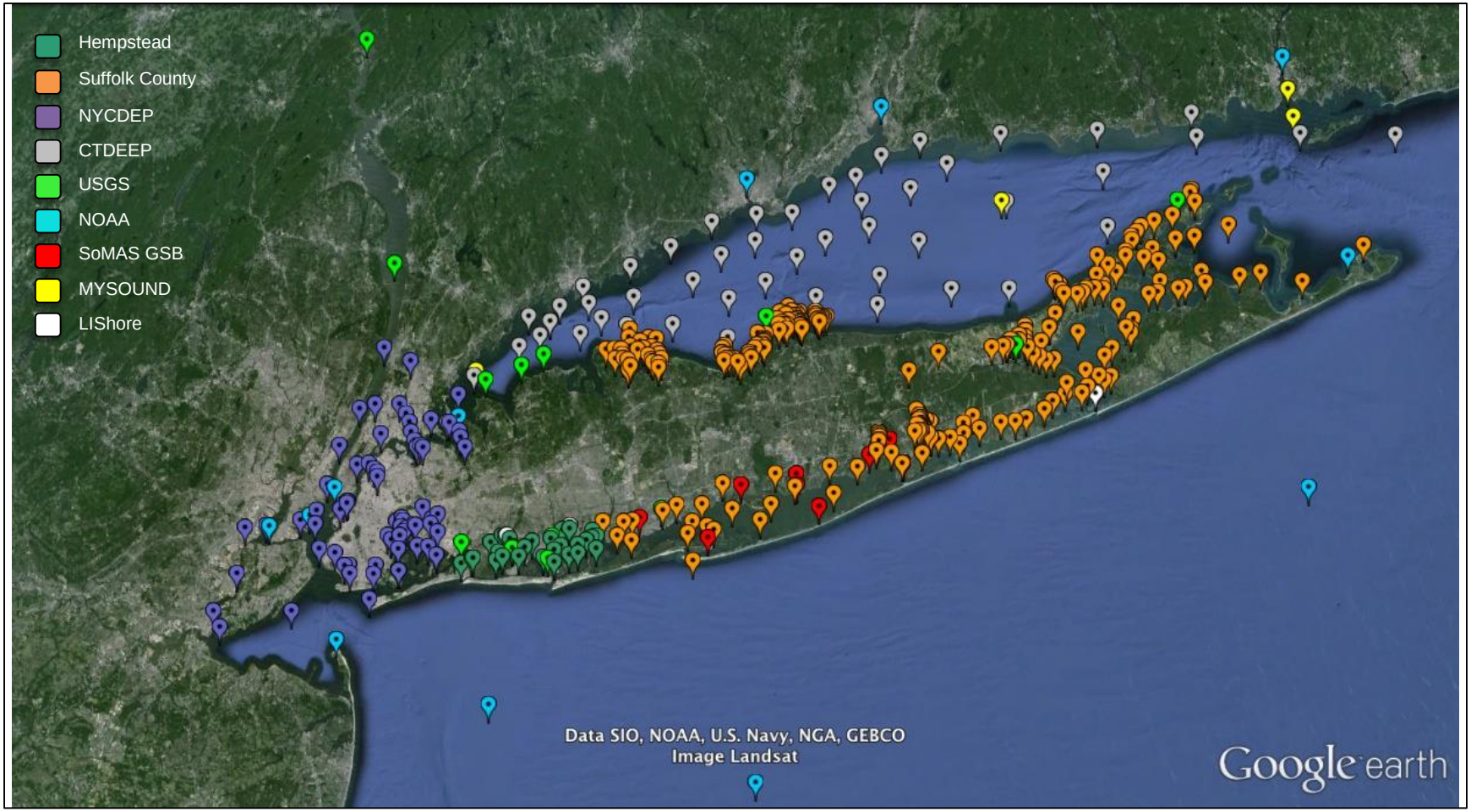
Integration of Multiple Monitoring Systems Targeting Coastal Zones

SBU participants – Christopher Gobler, Jake Thickman, Mark Lang, Tom Wilson, Charlie Flagg

Objectives:

- Report existing real-time water and ecosystem monitoring systems along the New York State coasts in order to assess storm threats to coastal ecosystems under climate change.
- Generate a database of coastal ecosystem monitoring data as a baseline.
- Generate a web interface integrating and accessing continuous coastal ecosystem monitoring data on the NYS RISE web site.

All Monitoring Locations



Discrete Monitoring Locations

Continuous Monitoring Locations

Monitoring dashboard

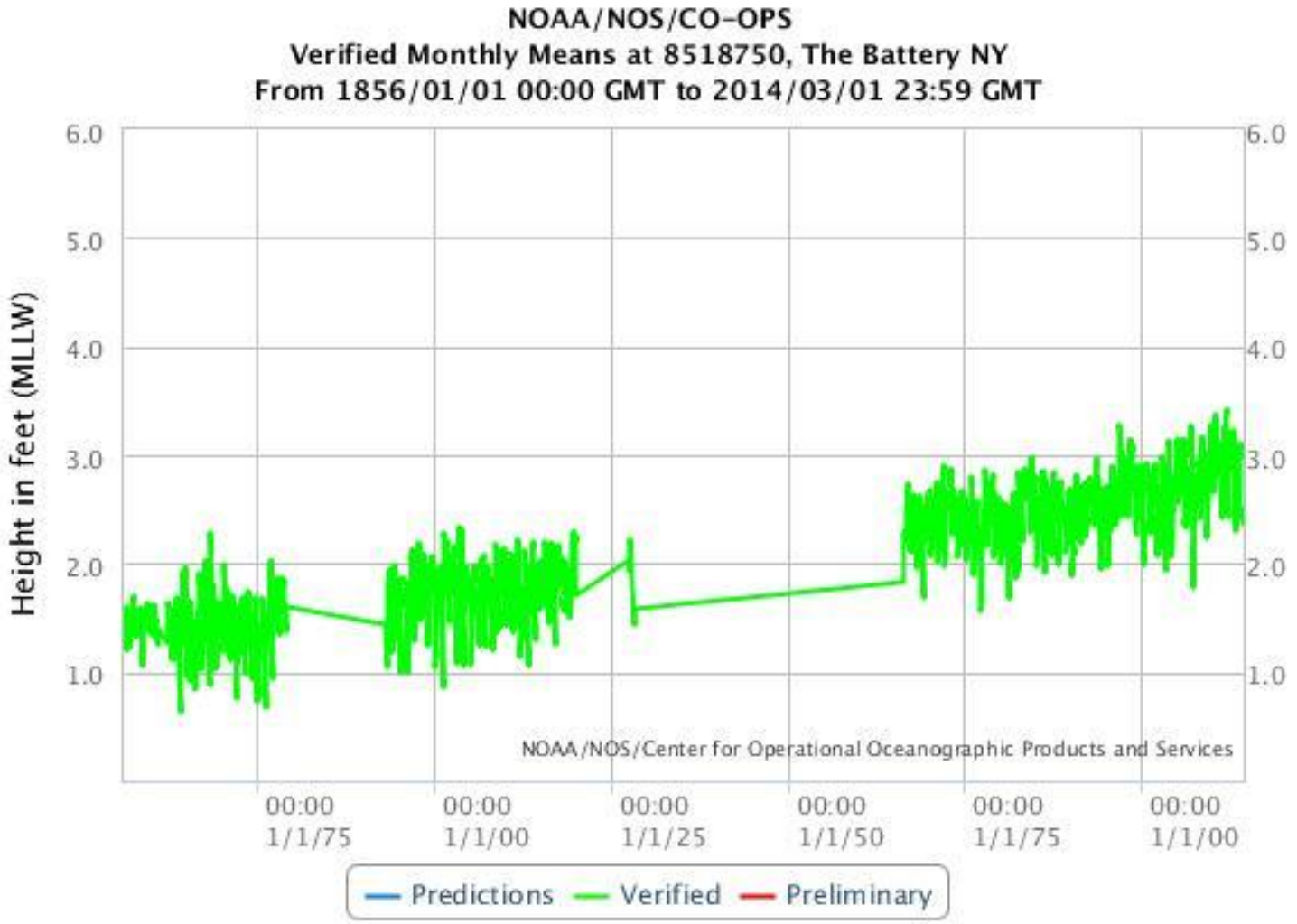
http://www.nysrise.org/pages/RT-buoys.php

>50 parameters monitored by 10 groups

	Agency									
	Discrete Sampling					Continuous Monitoring				
Parameters	NYCDEP	Suffolk County	CTDEEP	Hempstead	NYSDEC	USGS	NOAA	GSB Project	MYSOUND	LIShore
Ammonia	X	X	X							
Barometric Pressure						X	X	X	X	
Biological Oxygen Demand				X						
Brown Tide		X								
Carbon (Dissolved Organic)	X	X	X							
Carbon (Total Organic)		X								
Carbon (Particulate)			X							
Chloride		X								
Chlorophyll-a	X	X	X			X		X		
Chlorophyll-a (Fractionated)		X								
Coliform (Total)		X								
Conductivity		X	X			X				
Dew Point							X		X	
Dissolved Oxygen	X	X	X	X		X			X	
Enterococcus	X									
Fecal Coliform	X	X			X					
Fluorescence	X		X					X		
Humidity						X			X	
Metals		X								
Nitrate (NO3)		X				X				
Nitrite (NO2)		X								
Nitrogen	X	X								
Nitrogen (Dissolved)		X	X							
Nitrogen (Particulate)			X							
NOx		X	X							
Ocean elevation						X	X	X		X
Organic Pollutants		X								
Ortho-Phosphate	X	X	X	X						
Oxidative Reduction Potential	X									
pH	X	X	X			X				
Phosphorous	X	X								
Phosphorous (Dissolved)		X	X							
Phosphorous (Particulate)			X							
Photosynthetically Active Radiation	X							X		
Precipitation						X		X		X
Salinity	X	X	X	X		X		X	X	
Silica (Biogenic)			X							
Silicate	X	X	X							
Sulfate		X								
Suspended Solids	X	X	X							
Temperature (Air)							X	X	X	
Temperature (Water)	X	X	X	X		X	X	X	X	X
Transparency (Secchi)	X	X		X						
Turbidity	X					X		X		
Urea		X								
Wave height							X		X	
Wind	X					X	X	X	X	

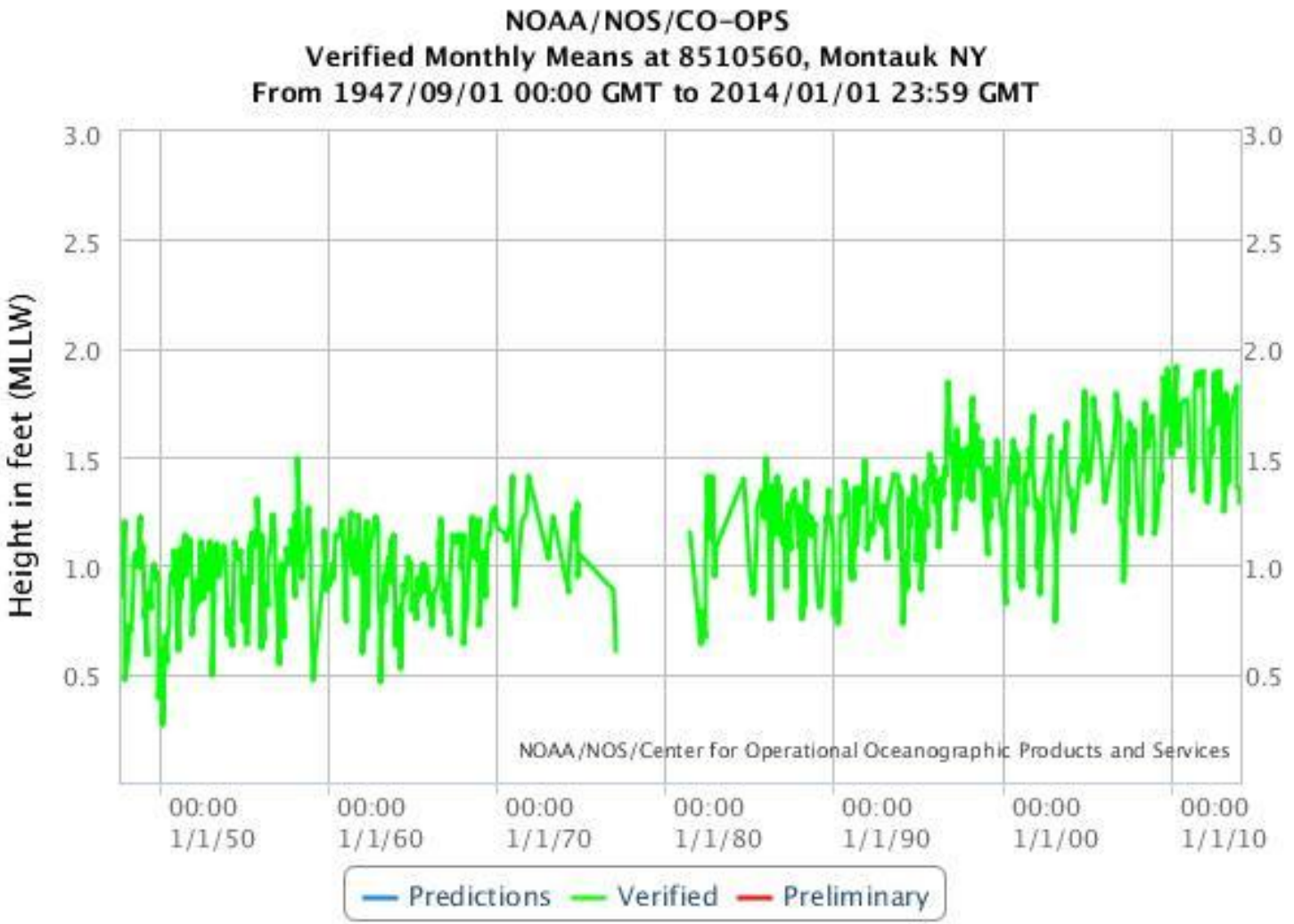
Is climate change detectable in NY coastal waters?

Sea Level, New York City Battery



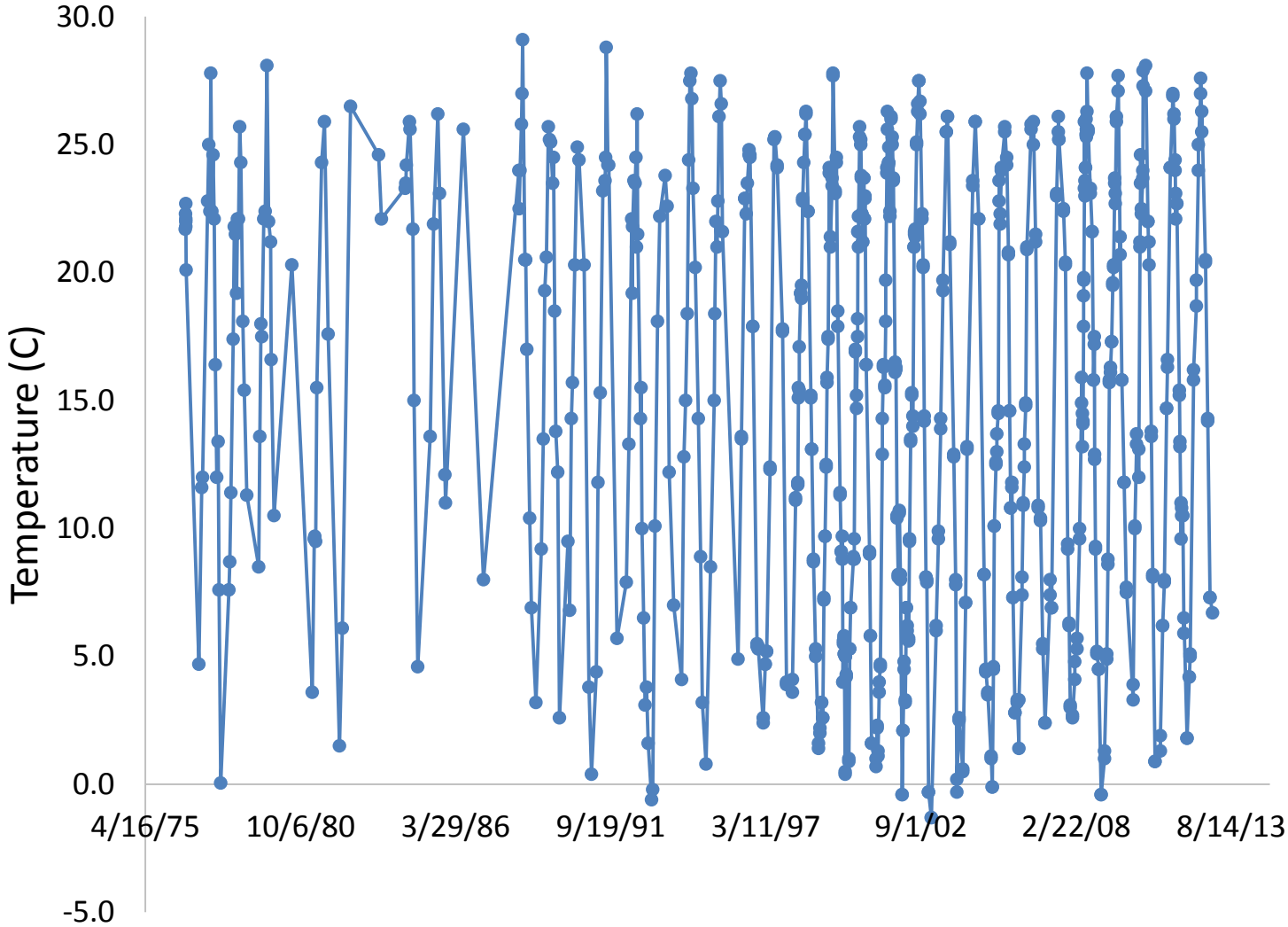
NOAA buoy BATN6

Sea Level, Montauk

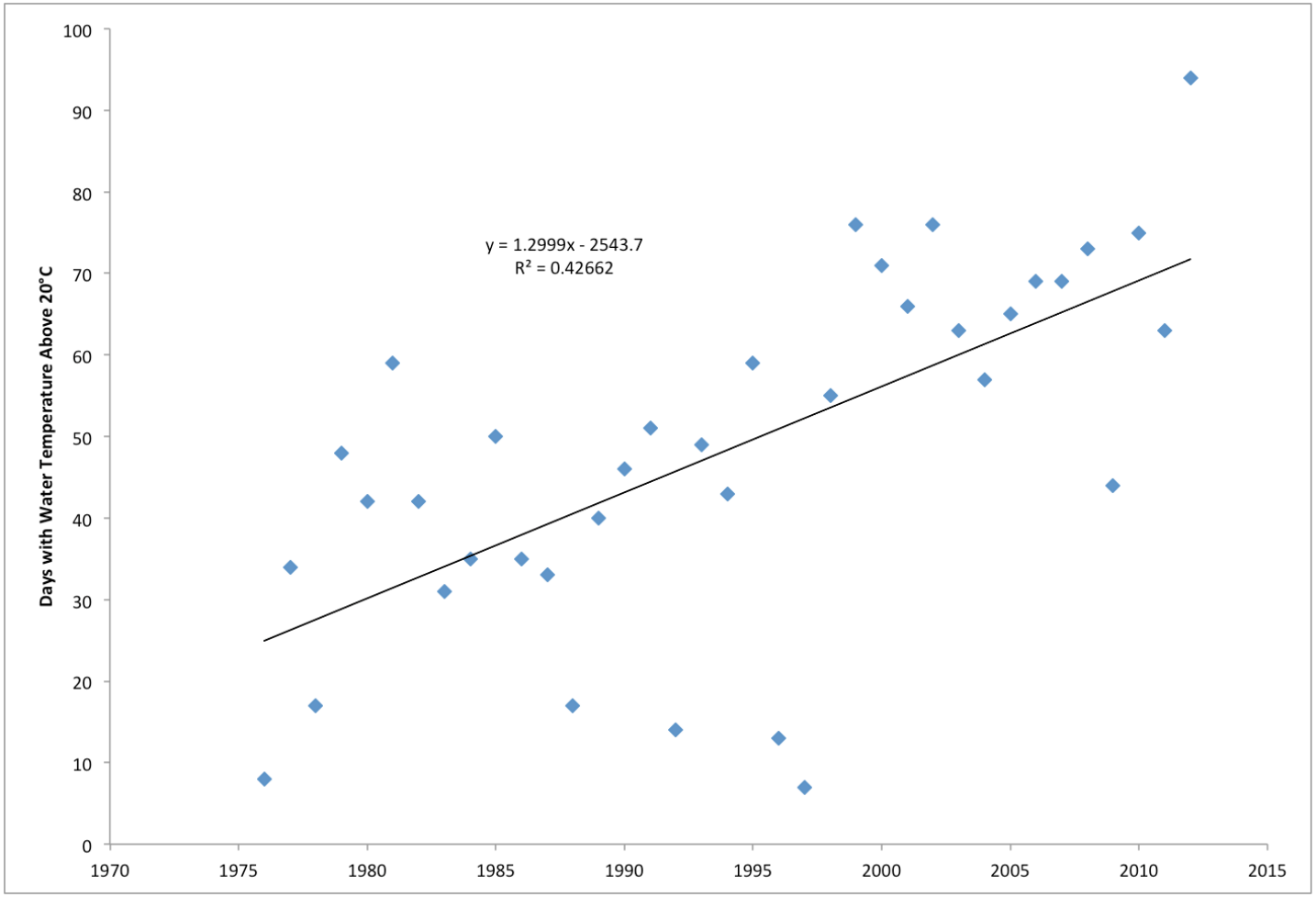


NOAA buoy MTKN6

CLIMATE CHANGE?
Temperature, Great South Bay 1976-2012

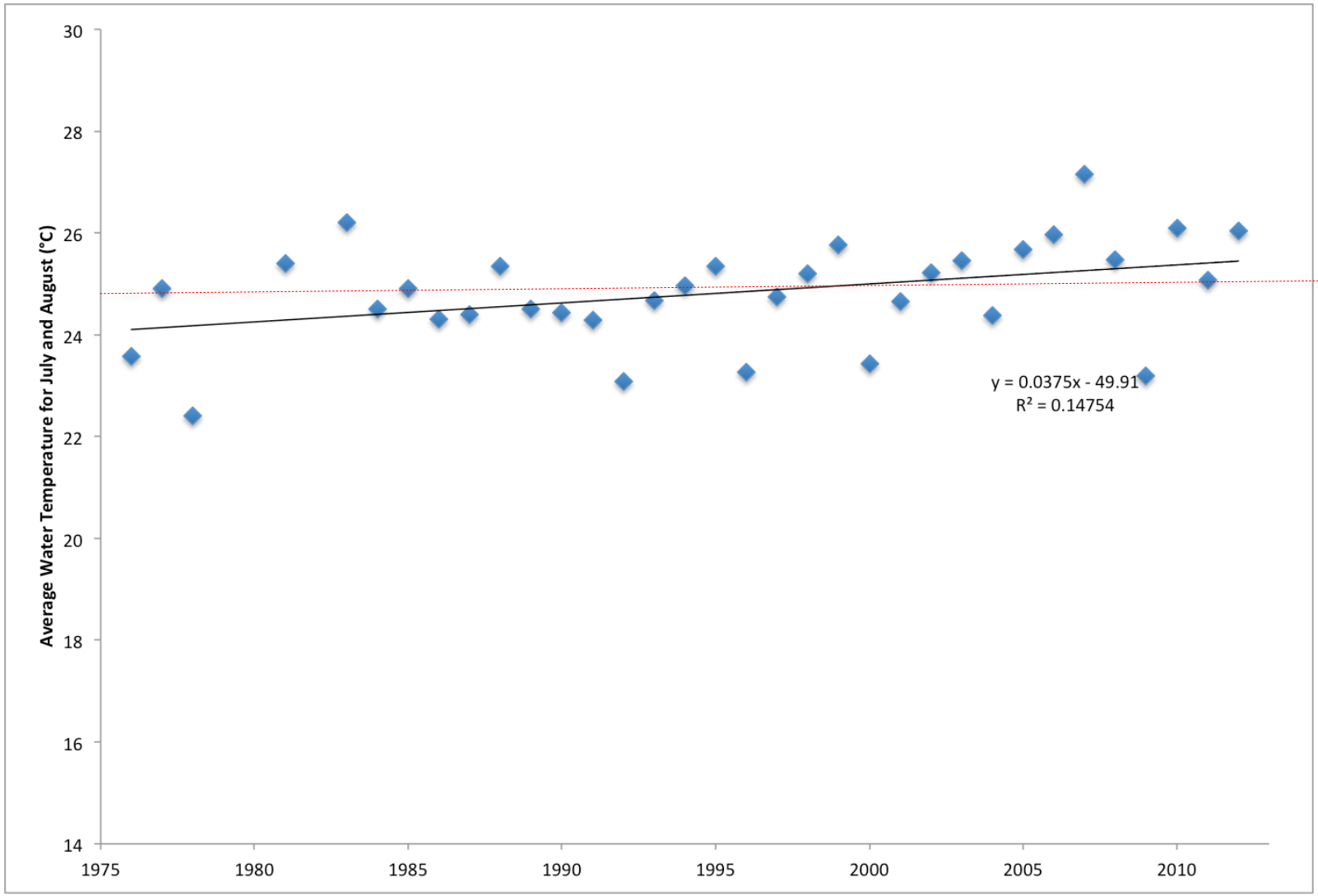


Number of days with water temperature > 20°C, Long Island Sound



Annual degree days greater than 20°C recorded at the Millstone power station in southeast Connecticut.

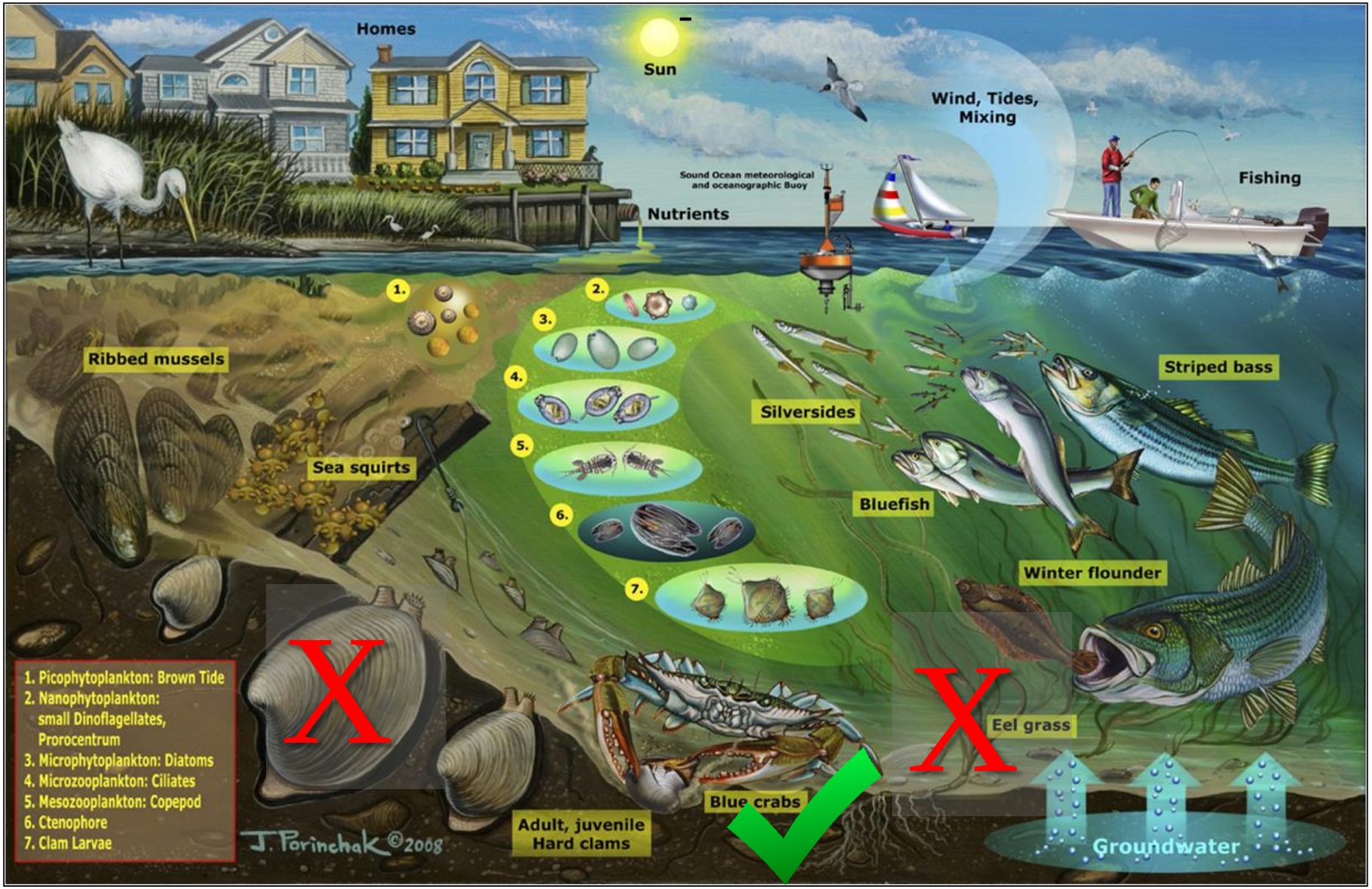
July and August temperatures in Great Peconic Bay



Maximal thermal tolerance of eelgrass, hard clams

Annual average water temperature for readings taken in July and August for Suffolk County site 060130 at Great Peconic Bay.

The fate of NY marine ecosystems under climate change?



Conclusions:

- The NYSRISE monitoring dashboard serves as a clearinghouse for all NYS coastal water monitoring data.
- Assessment of the monitoring data set has revealed multiple strengths and vulnerabilities for NYC and Long Island.
- Use of the dashboard has revealed long term impacts of climate change: Sea level rise and water warming.

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Work Unit 4.2. Integration of Multiple Monitoring Systems Targeting Coastal Zones: New York State (other than NYC and Long Island)

Workshop Presentation, July 24, 2014

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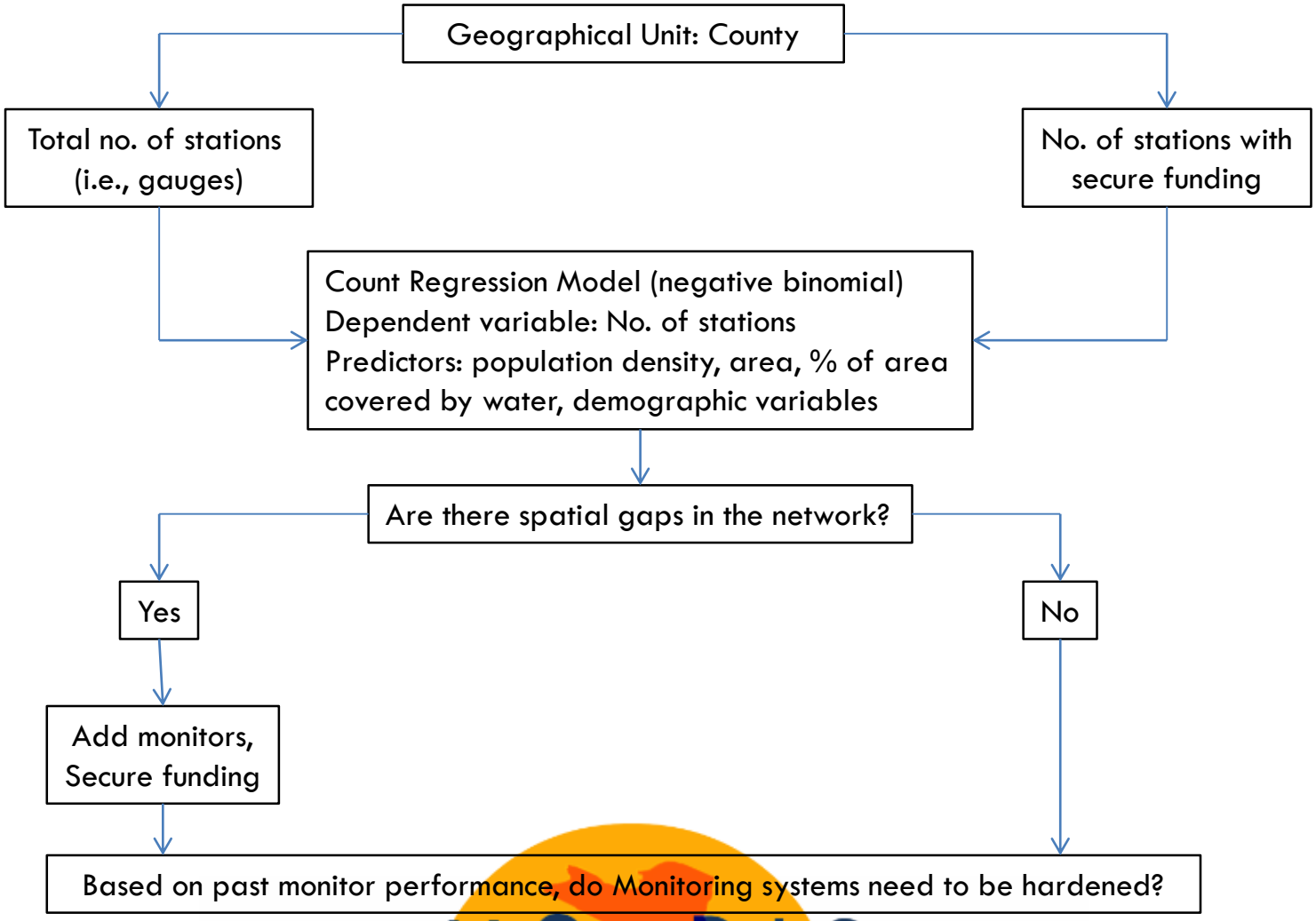
Work Unit 4.2 Summary: Task Objectives

- Provide New York State with a Tool based on a statistical regression model that can provide inputs to policy decisions about deployment of and investments in monitoring sites. Inputs for the Tool include:
  - Identification, characterization, and evaluation of Environmental Monitoring efforts and databases
  - Identification of threats to current Monitoring efforts
- Develop procedures to use existing Monitoring to identify vulnerable areas (link to SBU "dashboard")
- Recommend improved Monitoring to support storm and emergency management.

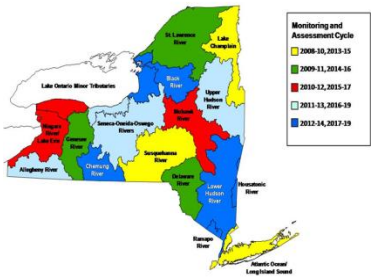
Work Product: Tool Framework

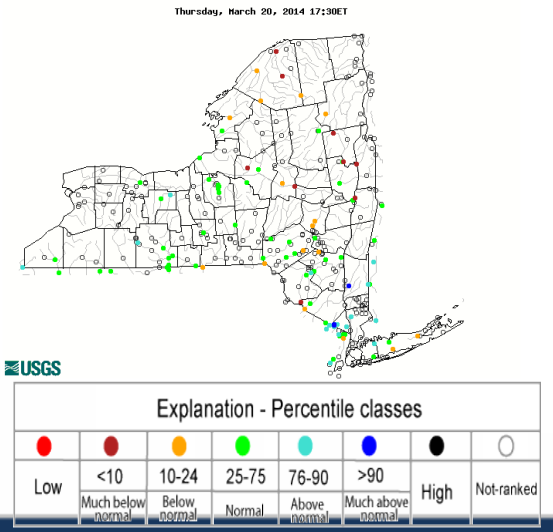


Sample Tool Input: Environmental Monitoring Efforts and Databases

Sample Results: The following monitoring efforts and databases have been identified and types of parameters covered have been evaluated:

- NYS Department of Environmental Conservation - Water
  - The Rotating Integrated Basin Studies (RIBS) Program (see map): http://www.dec.ny.gov/chemical/29576.html
  - Stream Biomonitoring
  - Toxicity Testing Program
  - Lake Classification and Inventory (LCI) and Citizens Statewide Lake Assessment Program (CSLAP)
  - Water Assessments by Volunteer Evaluators (WAVE)
  - Groundwater Sampling in New York State
- U.S. Geological Survey (USGS) – Real-time, daily, 7-day average, 14-day average, 28-day average, monthly and annual average data
  - Streamflow data(map) (http://waterwatch.usgs.gov/index.php?r=ny&id=ww_current)
  - Flood conditions
  - Turbidity
  - Dissolved oxygen
  - Water temperature
- Great Lakes Monitoring Network – NOAA
- NYS Department of Environmental Conservation – Air quality





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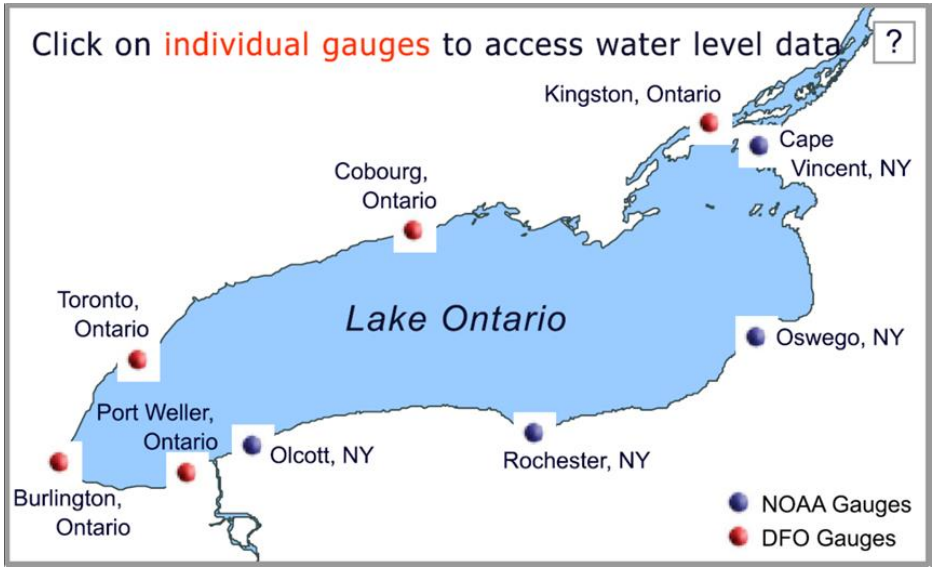
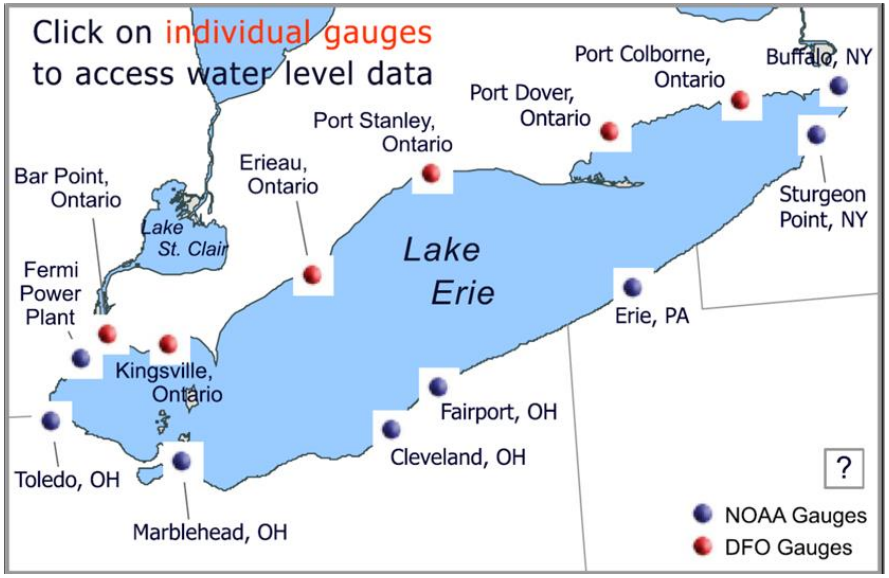
Sample Tool Input: Water Levels in the Great Lakes





The Great Lakes Network provides information about water gauges and water levels in the Great Lakes

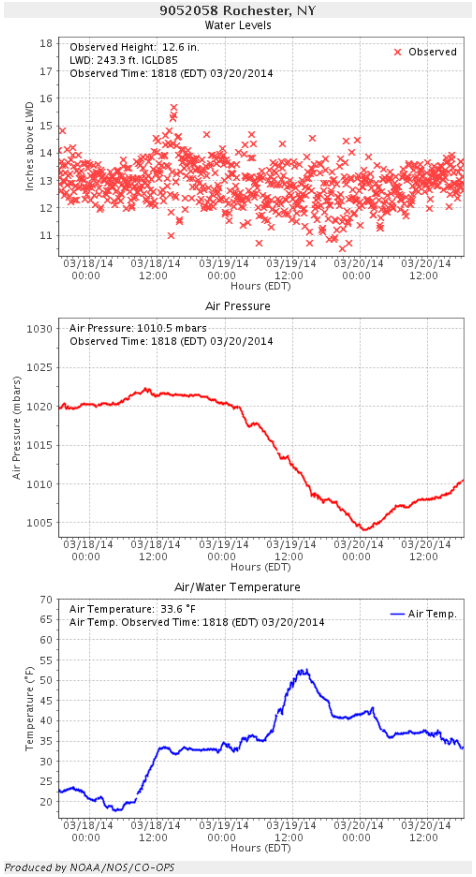
The gauges are maintained by NOAA along the U.S. side and by the Department of Fisheries and Oceans (DFO) Canada along the Canadian side

Source: Great Lakes Network; http://www.great-lakes.net/envt/water/levels/levels-cur/ontwlc.html

Sample Output: Spatial/Temporal Variation in parameter coverage among stations, Great Lakes

Body of Water	Station Name	Parameters Included
St. Lawrence River	Ogdensburg, NY	No real time data available
	Alexandria Bay, NY	Water levels, air pressure, water temperature
Lake Ontario	Cape Vincent, NY	Water levels
	Oswego, NY	Water levels, winds, air pressure, air temperature, relative humidity
	Rochester, NY	Water levels, air pressure, air temperature
	Olcott, NY	Water levels
Niagara River	Ashland Ave., NY	Water levels
	American Falls, NY	Water levels
	Niagara Intake, NY	Water levels, air pressure, air temperature
Lake Erie	Buffalo, NY	Water levels, winds, air pressure, air temperature, water temperature, relative humidity
	Sturgeon Point, NY	Water levels, air pressure, air temperature

Rochester example:
Station 9052058



Source: NOAA – 3/21/14
http://glakesonline.nos.noaa.gov/glin.shtml?station_info=9052058+Rochester,+NY

Threat to Monitoring: Storm Effects on Water Gauges

- The destruction of gauges during storms seriously compromises the ability to obtain data on stream surge and other storm characteristics:
  - During Hurricane Irene and Tropical Storm Lee: "In Eastern New York, 3 gauges were destroyed, 58 had some type of damage, 17 were flooded, and 1 exceeded operational limits;" Failure of Gilboa Dam (Schoharie County) gauges created uncertainty about how much water was going into and out of the dam*
  - In Hurricane Sandy, NOAA reported 73 tide stations damaged**
- More robust gauges are needed, and technologies exists to harden them against storms.*

Sources:
*U.S. Department of Commerce, NOAA (September 2012) Service Assessment Hurricane Irene, August 21–30, 2011 Silver Spring, MD: U.S. Department of Commerce, NOAA, p. 76.
**J. Gillis, Tide Gauges Needed for Research are often Victims of Storms," NYT, 1/13/14. http://www.nytimes.com/2014/01/14/science/tide-gauges-needed-for-research-are-often-victims-of-storms.html

Flooded Tide Gauge. U.S. Department of Commerce, NOAA (September 2012), p. 76*

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Current Work: Product

Tool Framework, including Count Regression Model

- We have developed a framework for the Environmental Monitoring Tool that incorporates a regression model and inputs including monitoring characteristics and threats
- We are developing a count regression model that will allow New York State to assess whether the distribution of environmental monitoring stations such as stream and tidal gages is deficient for some areas.
- This model will be illustrated using county-level data but it can easily be adapted to other geographical units such as watersheds depending on data availability

Current Work: Product

Count Regression Model

- The dependent variable in the model is number of environmental monitors (i.e., tidal, stream and flood gauges). In addition, the model will also be used to assess the distribution of monitors with secure sources of funding.
- The predictors in the model are: population density, area, percentage of area covered by water, past history of flooding, social and demographic indicators (poverty, race and ethnicity, social vulnerability index), and others.
- The results of the model can be used as inputs to public policy regarding the distribution and funding of environmental monitors.

Summary: Findings & Results to Date

Stream, flood and tidal gauges

- We have identified potential threats to the successful continuation of these environmental monitoring programs such as budgetary cutbacks and robustness of monitoring systems during storms and extreme weather events.
- Funding for flood gauges has changed from earmarked funding to less secure sources of funding
- Given concerns about air quality in some communities affected by Sandy from particulate matter from sand and construction debris, an initial review of air sampling stations and delays in deployment of these monitoring systems in affected communities was carried out.

SUMMARY: FINDINGS & RESULTS TO DATE

Other Types of Environmental Monitoring: Air Quality

Outdoor Air Quality

- In the aftermath of Sandy many communities were concerned about air quality.
- Particulate Matter (PM) can increase significantly as a result of sand and construction debris.
- In these situations it is important to deploy temporary air quality monitors that can identify air pollution hotspots that the New York State Department of Environmental Conservation network of air quality monitors is not designed to address.

Summary: Findings & Results to Date

Indoor Air Quality

- In the aftermath of extreme weather events households often resort to gas stoves for heating and gas powered generators for electricity.
- The use of these appliances can result in high exposures to carbon monoxide (CO) which sometimes results in death.
- Risk communications strategies should take this into account.