New York Harbor Observing and Prediction System
The NYHOPS Forecast Model

Receiving water forecasts for 3D hydrodynamics with floatable and plume forecasting capabilities around New York and New Jersey

Nickitas Georgas, Alan Blumberg, Philip Orton, Dave Runnels, Michael Bruno, Thomas Herrington

NJWEA Atlantic City 05/13/13

Providing marine forecasts for 7 states and growing.
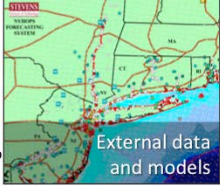
A group with a vision.

New York Harbor Observing and Prediction System

Transport Forecasts

The high-resolution NYHOPS models forecast the three-dimensional circulation in these waters 72hrs in advance, based on comprehensive tidal, meteorological, hydrological and point source (WPCP and Power Plant) forcing

New York Harbor Observing and Prediction System

Providing Environmental Awareness for the Urban Ocean

New York Harbor Observing and Prediction System

NYHOPS supports:

Marine Search and Rescue (SAR) Missions…………

NY/NJ Harbor Commercial Pilots & Schedulers (Harbor Pilots Associations, Marine Transportation)……………

Recreational Boaters (Regattas, Kayaks,…)………………..

Coastal Flooding Responders (PD, FEMA, NWS)……

Scientists/Engineers……

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An automated system of systems.
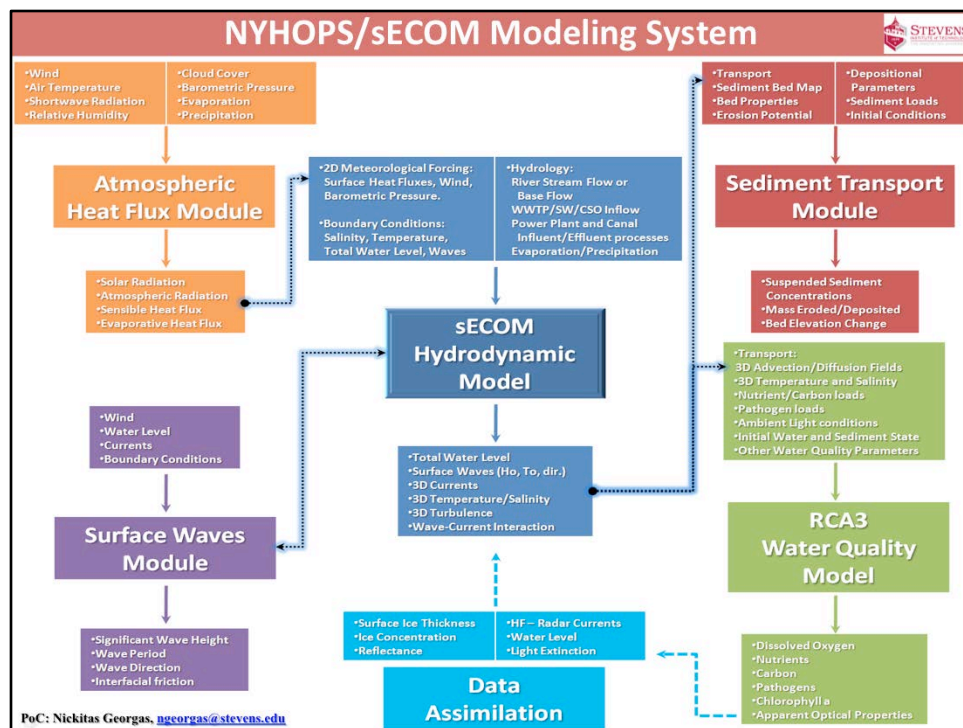
Based on a wonderful numerical code of the physics of the ocean.

New York Harbor Observing and Prediction System

Input Hydrology

NYHOPS includes 548 Buoyant Inflows

93 Major Rivers

Rivers and streams in NYHOPS HIDEF with locations of applicable real time gages

146 Minor Ungaged

241 Sewage Tr. 39 Pwr. Plants

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And an accurate and detailed description of the forces and inputs that govern it.

Emergency Responders.

Search and Rescue.

New York Harbor Observing and Prediction System

Fate and Transport Forecasts

The NYHOPS transport model is linked to a fate forecast model for colored dissolved organic matter, and to tracking models for oil, floatables, and tracer forecasting.

Office of Naval Research for CDOM forecasting.

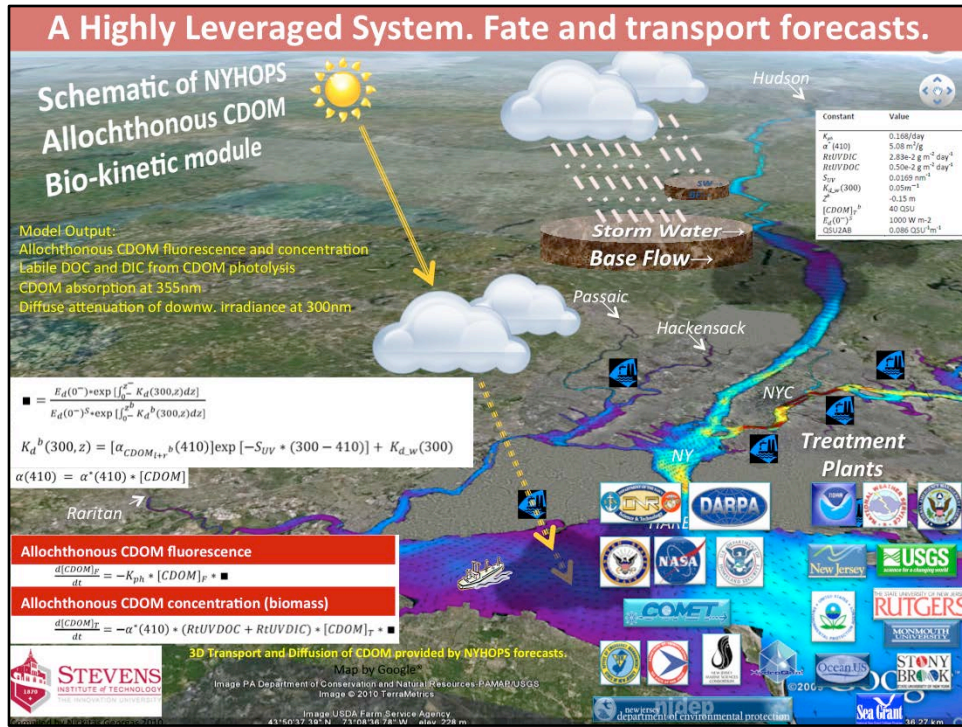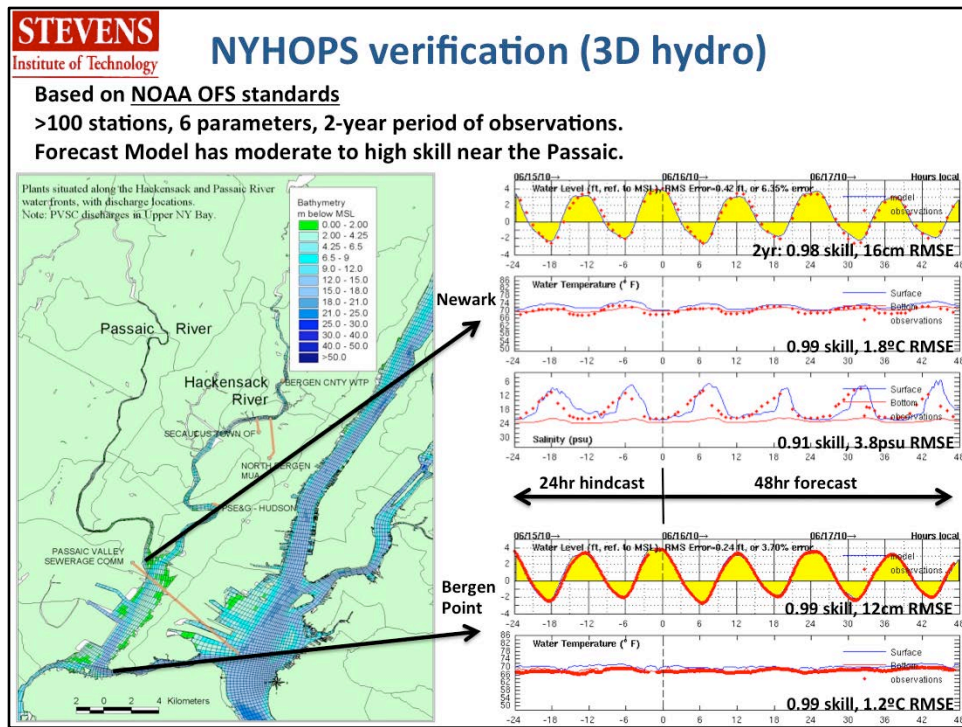Within its 7-state region, NYHOPS has been extensively verified based on NOAA Operational Forecasting System (OFS) standards, at over 100 stations with data, for 6 parameters, and for a 2-yr evaluation period. The model is also operationally validated each day against real-time observations.

In the vicinity of the Passaic River, the forecast model skill ranges from moderate to high. Example time series comparisons to observations are shown on the right for a 24hr hindcast, and a 48hr forecast period from last week. Two stations are shown, one close to the PVSC plant at Newark, and one in the Kill Van Kull at Bergen Point. 2-yr-evaluation metrics at these sites are noted. At Newark, the water level skill is 0.98, with a 16cm RMSE; for water temperature it is 0.99 skill with 1.8C RMSE; and for salinity, a 0.91 skill, with 3.8psu maximum RMSE. At Bergen Point, the model has slightly higher skill: 0.99 for both water level and temperature with a 12cm RMSE for water level and 1.2C for water temperature throughout the 2-yr evaluation period.

NYHOPS verification in the Passaic River Salinity (psu)

- Two multi-day Eco-Shuttle surveys, two very different years
- One dry and one very wet ("Tax Day flood").
- CC: 0.88 ("Dry")
- CC: 0.93 ("Wet")

Oct 23-26, 2006 "Dry"   Apr 17-19, 2007 "Wet"

Obs.

Mod.
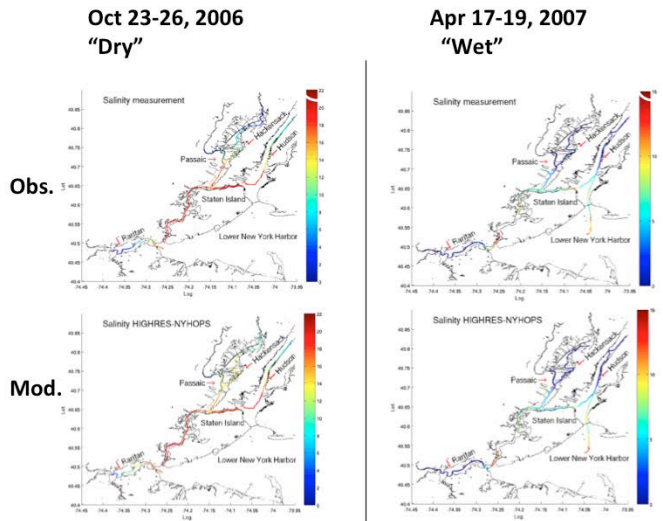
We tested the developed model and its application for the Passaic-Hackensack-Newark Bay region against ECOShuttle data obtained by a UMASS Boston team in 2006-2007. There were two intensive surveys, very different ones. The second, 2007 survey was conducted only days after the historic "tax day" flood event of April 15th 2007, which created considerable flooding in northern NJ. The figures show the observed (on the top) and NYHOPS-simulated (bottom panels) salinity for the two surveys in the NJ part of the NY/NJ Harbor and the lower Hudson River. Red is more salty, blue is freshwater; note the freshwater inflows of the Passaic, Hackensack, Raritan and Hudson rivers. It is easy to see that the NY/NJ Harbor waters in the 2007 survey (on the right) were overwhelmingly fresher than in the 2006 survey. It is also easy to see that the NYHOPS model was able to represent the observed transects of salt, for both, very different periods, very well. The correlation coefficients between model and observations were 0.88 for the 2006 and 0.93 for the 2007 surveys.

NYHOPS verification CDOM fluorescence (QSU)

- CDOM diluted from runoff during Tax Day storm
- CC: 0.95 ("Dry")
- CC: 0.67 ("Wet")
- R^2= 0.86
- Passaic Rel. error: 5.9% ("Dry"), 9.0% ("Wet")
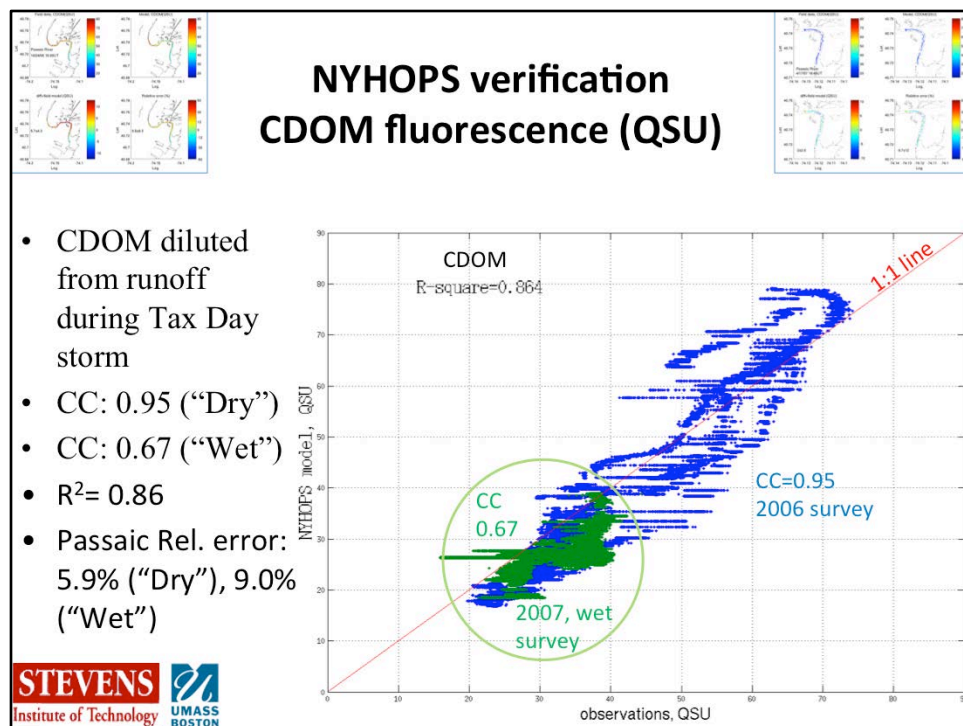
This correlogram shows observed versus NYHOPS-simulated CDOM fluorescence for the same surveys. Blue is the "dry" 2006 survey, and green is the "wet" 2007 survey. The NYHOPS CDOM model reproduced the observed CDOM fluorescence along the ECO-Shuttle paths very well, even though the environmental conditions were very different among the two surveys. Note the dilution of receiving water CDOM fluorescence in 2007 compared to 2006, apparently due to the major contribution from low-CDOM storm water runoff during the 2007 Tax Day flooding event. During the 2007 survey, CDOM fluorescence in the NY/NJ Harbor was measured and predicted to be less than 40QSU, while in the 2006 survey it had reached close to 80QSU.
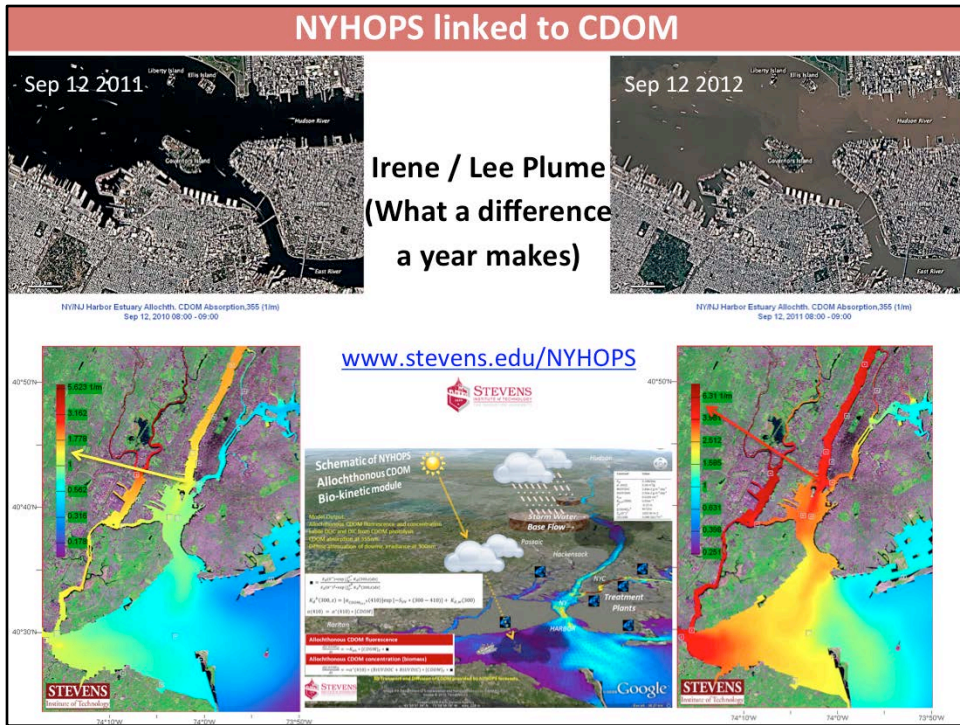
These brown humic substances were really showing during Irene.

A useful
next step is to begin incorporating observations and CSO forecasts into hydrodynamic models,
enabling us to provide water quality nowcasts and forecasts for the region's waterways and
swimming areas.
An interesting test case for this concept came last summer when a fire at the North River
Wastewater Treatment Plant in New York City disabled the facility and caused a 3-day sewage
spill. Here, New York City area observations of the sewage indicator microbe *Enterococcus* are
presented, and comparisons are made with real-time (un-tuned) test simulations made using
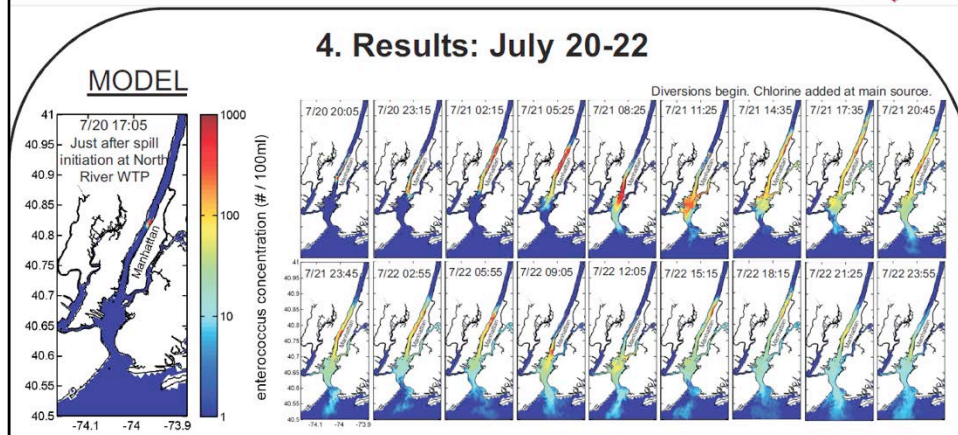Stevens ECOM, the model utilized for the New York Harbor Observing and Prediction System
(NYHOPS)

NYHOPS predictions for Water Quality

The North River Sewage Spill and the NYHOPS Waterborne Pathogen Forecast Concept (July 2011)

OBSERVATIONS

7/21/2011 *Enterococcus* conc. (most probable number per100 ml)

| Station (Approx river mile – name)	West (NJ)	Cross-channel location Mid	East(Manhattan)
North			
27.5 - Tappan Zee mid		<10	
18.5 - Yonkers mid		<10	
18.5E - Sawmill River Mouth			<10
17.5E - Yonkers STP			<10
14W - Englewood boat basin	<10		
14E - Dykeman			>24196
12 - GWB mid		313	
8W - Edgewater, NJ	31		
8 - 125th St mid		74	
7.9E - 125th Pier			>24196
7.9E - 125th Pier			104,620
7 - 79th St mid		161	
7 - 79th mid		152	
7E - 79th St boat basin			1722
6W - Weehawken, NJ	<10		
6E - Pier 96			12033
4.7W - Castle Pt, NJ	<10		
0 - NYC Battery		10	
South			

7/22/2011 *Enterococcus* conc. (most probable number per100 ml)

Station (Approx river mile – name)	West (NJ)	Cross-channel location Mid	East(Manhattan)
North			
27.5 - Tappan Zee mid		<10	
18.5 - Yonkers mid		<10	
18.5E - Sawmill River Mouth			10
17.5E - Yonkers STP			<10
14W - Englewood boat basin	<10		
14E - Dykeman			12033
14E - Dykeman			7030
12 - GWB mid		20	
8W - Edgewater, NJ	52		
8 - 125th St mid		41	
8E - North River STP			75
7.9E - 125th Pier			96
7 - 79th St mid		41	
7 - 79th St mid		31	
7E- 79th St boat basin			163
6W - Weehawken, NJ	63		
6E- Pier 96			1500
4.7W - Castle Pt, NJ	<10		
South			

Enterococcus count (under 35/100ml) is acceptable by EPA standards

Enterococcus count (between 25 and 104/100ml), if sustained over time, would be unacceptable by EPA standards

Enterococcus count (over 104/100ml) is unacceptable by EPA standards

NYHOPS in NOAA GNOME

Operational Forecasting for Spills and Floatables
With Backtracking Forensics

Aug 2008 — *Avalon Forensic Case*
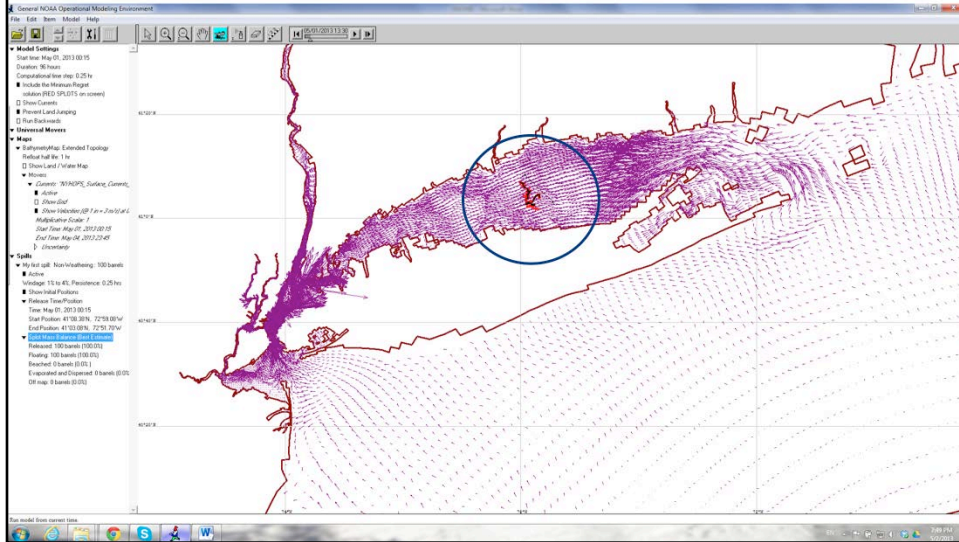
Medical Waste Has Avalon Puzzled
Environment | 45 weeks 1 day ago | Comments 5
Tags: Avalon, avalon fire department, closed beaches, medical waste
By Leslie Trulock

Home page. Officials inspect syringes that washed ashore in Avalon on Aug. 23. Left: Volunteer looks for additional syringes. Photos by Harry B. Scheeler Jr.

AVALON — After numerous beach sweeps Aug. 23-25 about 175 pieces of medical debris, IV-type needles and eight-inch cotton swabs were collected after washing up along the surf between 9th and 24th streets here. Eight more pieces were recovered Monday morning before beaches were reopened at 10 a.m.

Conclusion

- Possible source is a coastal release between Townsends Inlet and Great Egg Harbor Inlet, North of Avalon

- NOT from South, Delaware Bay region

- Along-shore currents near Avalon, tidal currents across the Delaware Bay, and the shoreward directed offshore currents formed a clockwise cell circulation nearshore of Avalon resulting in local washing-up of floatables near Avalon beach

Pa. Dentist Charged with Dumping Medical Waste that Washed Up in Avalon
Crime | 43 weeks 2 days ago | Comments 14
Tags: Avalon, county prosecutor's office, Crest Haven, medical waste
By Leslie Trulock

How track helped crack the Avalon medical waste mystery

Jan 2009 — *Miracle on the Hudson*

Source: Department of Homeland Security   Released: Thu 19-Feb-2009, 16:05 ET   Printer-friendly Version   STEVENS Institute of Technology

Hudson Rescue Workers Aided by Science

Libraries
Science News
Keywords
DEPARTMENT OF HOMELAND SECURITY, SCIENCE AND TECHNOLOGY DIRECTORATE, S&T, DHS, US AIRWAYS, SULLY SULLENBERGER, NYHOPS, NEW YORK HARBOR OBSERVING AND PREDICTION SYSTEM, STEVENS MARITIME CENTER, STEVENS INSTITUTE OF TECHNOLOGY

Contact Information
Available for logged-in reporters only

Description
Underwater sensors and forecast models provide lifesaving information on wind and water conditions to

Homeland Security

Photo of the plane being guided to its temporary location along the southern Manhattan waterfront, with the Stevens ocean buoy in the foreground.

The NYHOPS buoy floats in the Hudson downstream from the splash landing site. It and others in the area provided the key data.

The New York Times
VOL. CXVIII ... No. 54,587   NEW YORK, SUNDAY, FEBRUARY 15, 2009

AROUND NEW JERSEY

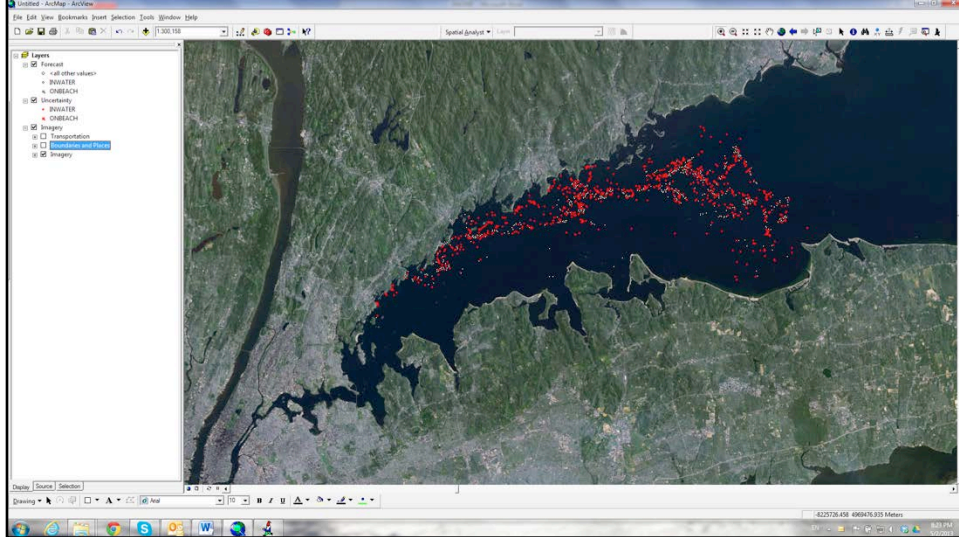**Advising Flight 1549 Rescuers, From the Stevens Institute**

DL Ocean Modeling/Forecasting for Environmental Spills
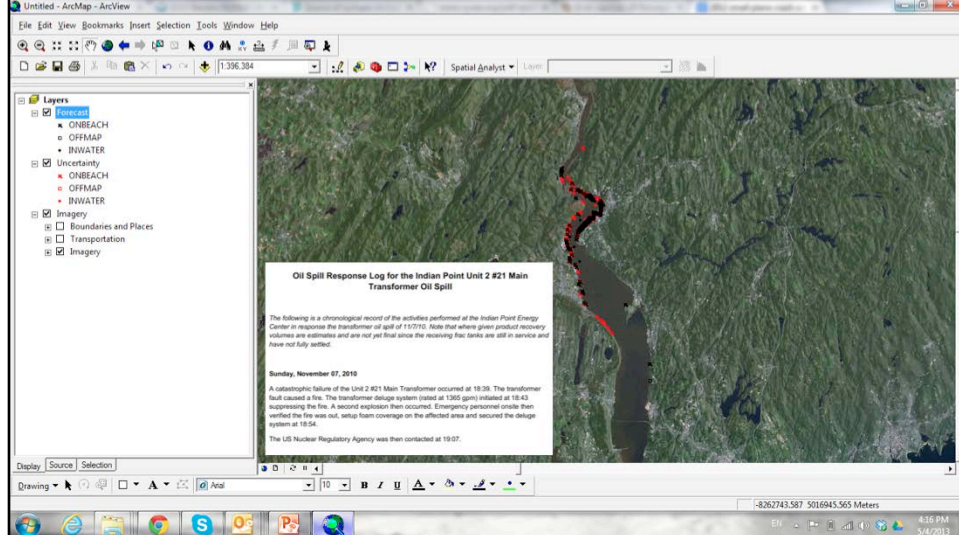IMTT Oil Spill Drill – Bayonne, NJ, Sep 14 2010
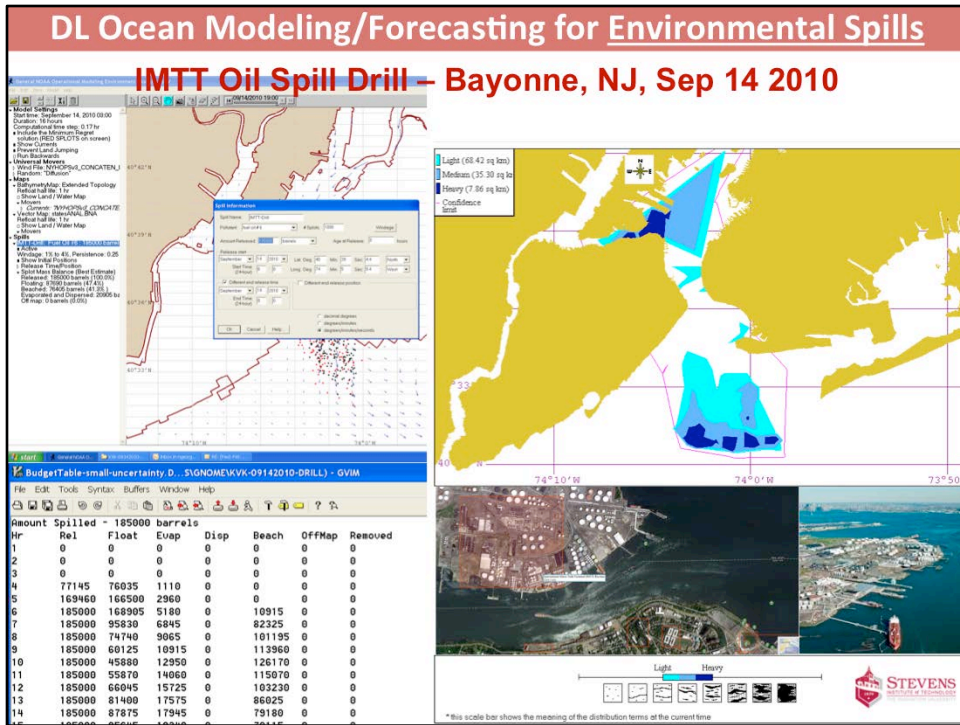
Pollutant Dispersion Tracking.

NYHOPS and GNOME in ArcGIS

7 Nov 2010
Indian Point spill
(2000 gallons Dielectric Fluid/PCB)

Indian Point Energy Center, Hudson River (Buchanan, NY)

USCG Sector Boston, on behalf of sector NY, contacted NOAA ERD at approximately 1500 on 08 NOV 2010 and requested support for a dielectric fluid/PCB spill in Buchanan, NY. The facility with the spill was identified as the Indian Point Energy Center and the spill site is about 1/3 mile up a canal from the Hudson River, about 40 miles upstream from NYC. The spill occurred at approximately 1830 on 07 NOV 2010 when a transformer exploded. The potential spilled product was reported as 20,000 gal of dielectric fluid contaminated with PCBs. It is reported that approximately 2,000gal of the fluid made it passed containment and into the water. There was a reported 1/2 mile sheen, which is boomed off. The source is not contained. USCG requested trajectory, weather and RAR products.

Envirotemp FR3 fluid or **dielectric fluid** is designed for use in transformers as transformer oil or transformer fluid.

A catastrophic failure of the Unit 2 #21 Main Transformer occurred at 18:39. The transformer fault caused a fire. The transformer deluge system (rated at 1365 gpm) initiated at 18:43 suppressing the fire. A second explosion then occurred. Emergency personnel onsite then verified the fire was out, setup foam coverage on the affected area and secured the deluge system at 18:54
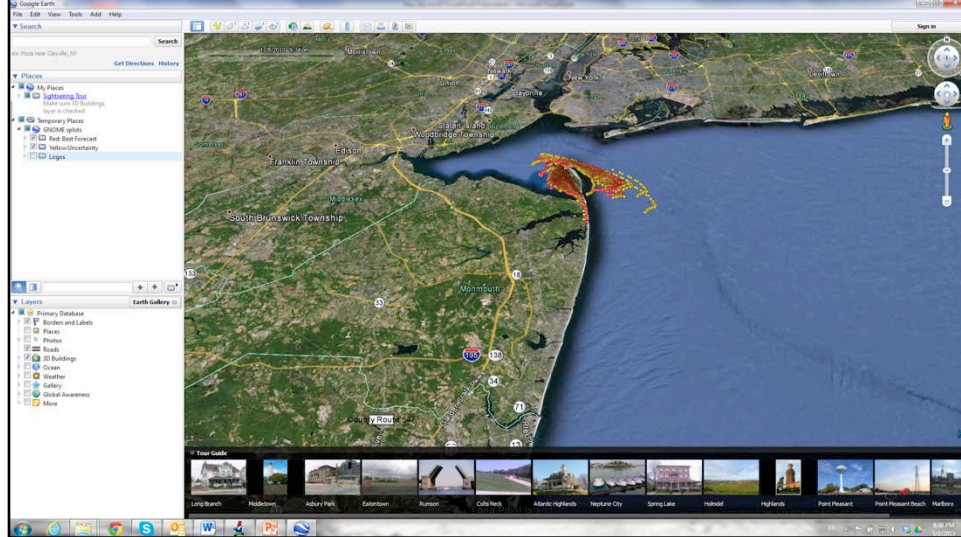
NYHOPS and GNOME in Google Earth
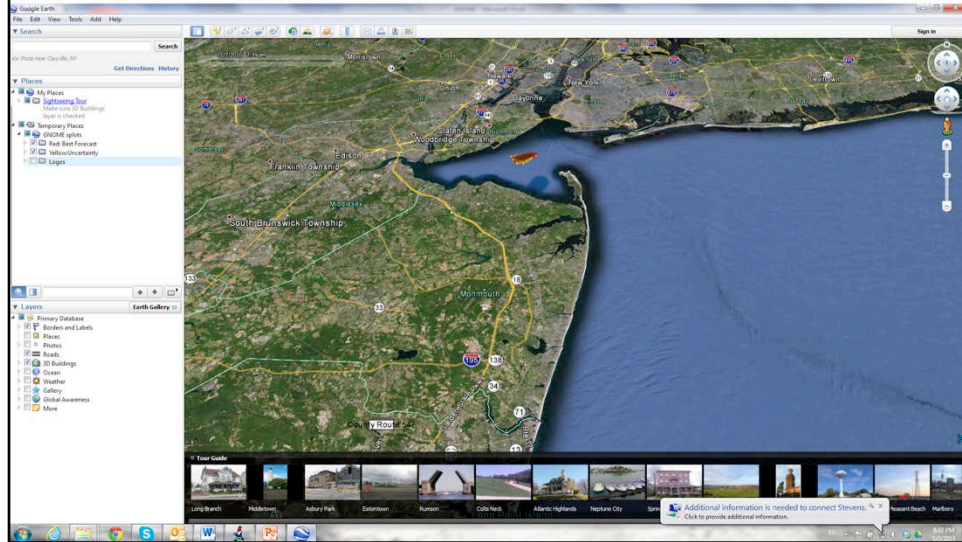
NYHOPS and GNOME in Google Earth
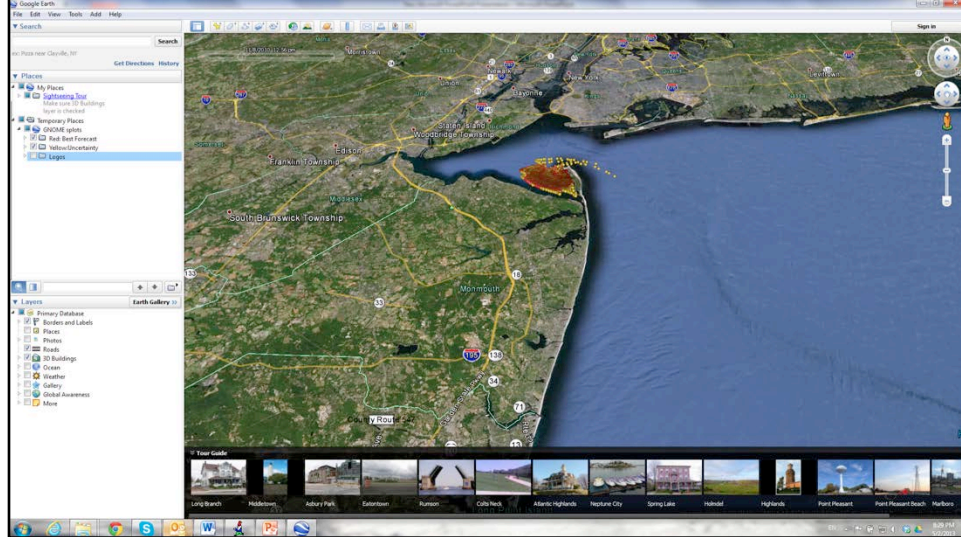
NYHOPS and GNOME in Google Earth

16 June 2012: Waste/syringes at LBI

"These syringes probably came out of stormwater discharges and could have come from combined sewer systems in the area of the urban New York Harbor. We're reviewing the weather and ocean currents around the time of the event and last week leading up to that period," DEP spokesman Larry Hajna said Monday.

Backtracking to sources north
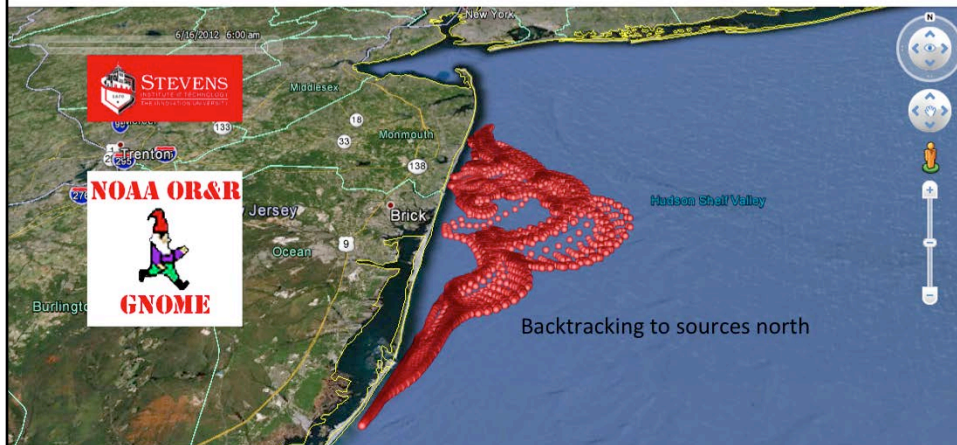
Beaches were closed to swimmers just after noon Saturday, which was the first day of the summer season here. Lifeguards patrolling the beaches found the waste that came ashore. Tim Hilferty, director of the Long Beach Island Health Department, said the waste included insulin syringes, wood, plastics, eel grass and other debris on beaches in Surf City, Ship Bottom, Barnegat Light, Harvey Cedars and the North Beach Haven section of Long Beach Township.

Hajna said the DEP is working with researchers from Rutgers University and Stevens Institute to determine the source of the washup. He said the DEP has also sent teams of inspectors from the agency's enforcement program to urban areas in the area of the Raritan Bay that have combined sewer systems. He said the DEP is also sharing technical information with the New York City Department of Environmental Protection.

Germantown Plane Pilot Recovery
May 02-03 2013
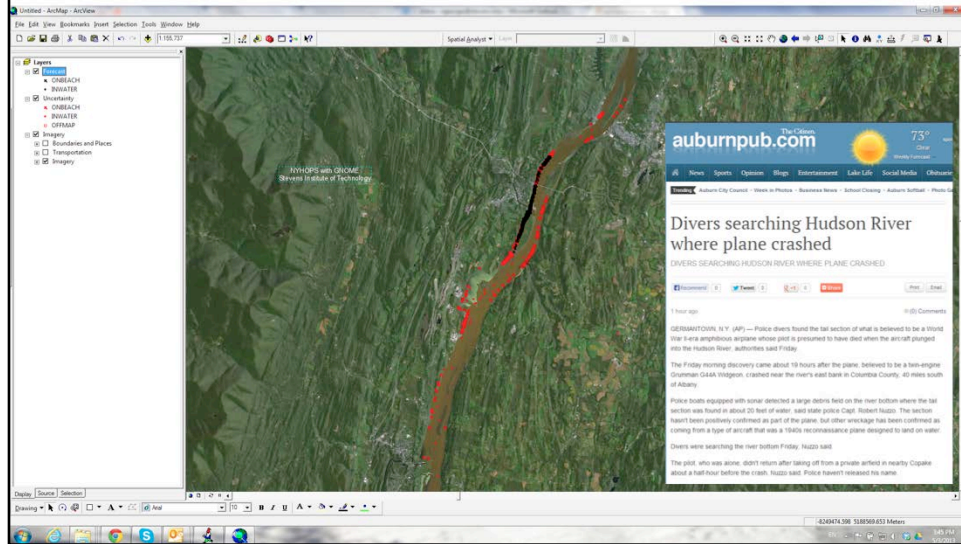
Other Incidents:
* Mandy Ness, February 2012 10 miles off Barnegat Bay; USCG Sector Delaware
- Earlier plane crass on Hudson; August 2012
- October 2012; 3Million Gallons of Sewage from Newburgh Treatment Plant
- Summer 2010; NJDEP response to Deep Water Horizon incident
- And of course Sandy but NYHOPS not in operation; 3.5b untreated, 7.5B partially treated per climate central report

New NYHOPS-linked webpage for pollutant tracking:
http://hudson.dl.stevens-tech.edu/maritimeforecast/traces

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NYHOPS and GNOME

Track pollutants and plumes based on New York Harbor Observing and Prediction System (NYHOPS) forecasts in NOAA GNOME.

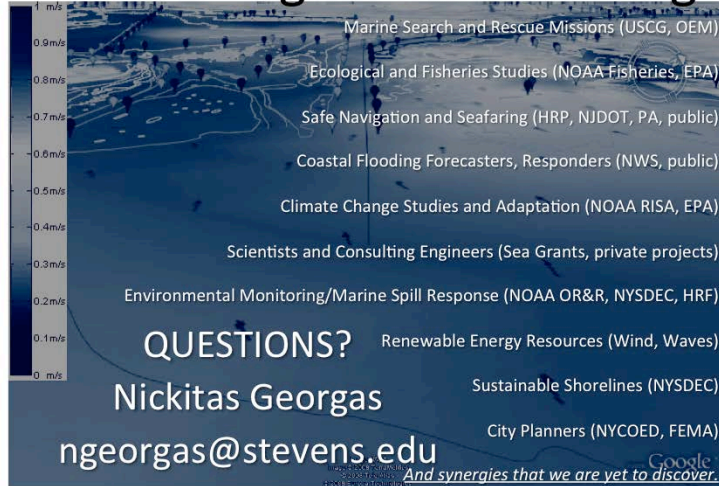Nickitas Georgas, Alan Blumberg and David Runnels

Davidson Laboratory/Center for Maritime Systems
Stevens Institute of Technology
Castle Point on Hudson, Hoboken, NJ 07030

GNOME (General NOAA Operational Modeling Environment) is the modeling tool the Office of Response and Restoration's (OR&R) Emergency Response Division of the National Oceanic and Atmospheric Administration (NOAA) uses to predict the possible route, or trajectory, a pollutant might follow in or on a body of water, such as in an oil spill.

Now you can use GNOME in its "Diagnostic Mode" with NYHOPS-generated currents forecasts and set up your spill scenarios to:

- Predict how currents and other processes might move and spread oil spilled on the waters of the New York / New Jersey Harbor and surrounding ocean over the next couple of days.

Anyone clicking "like?"