

# Providing Environmental Awareness for the Urban Ocean

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Integrated system of observing sensors and forecast models **TO OBSERVE TO PREDICT TO COMMUNICATE** 

Weather Currents Water Level Salinity Temperature Waves





# **Real-Time Data**

# **CO-OPS Stevens partnership**

||||| 100%

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# How sensitive are estuarine and coastal ocean currents to uncertainties in bathymetry, wind and inflows?



Blumberg and Georgas, 2008, "Quantifying Uncertainty in Estuarine and Coastal Ocean Circulation Modeling". J. Hydraulic Engineering, 134, 403-415 2008.



## NYHOPS Forecast Model \_ it is all about realism!

♥ <u>3D</u> General Circulation Model dynamically coupled with Surface Wind-Wave model

### Input forcing:

- (O): Observed
- (F): Forecasted
- (H): Historic
- ✓ Tides (O+F) NOS
- ✓ Offshore Surge and
  Steric (O+F) NOS
- ✓ Offshore Waves (O+F)
- ✓ Surface Winds (O+F) NAM 12km
- ✓ Heating and Cooling (O+F)
- ✓ 239 Rivers and Streams (O+F) NERFC
- ✓ 280 Major Dischargers (H)
- ✓ River Ice (O+F)

#### Output: hindcasts+forecasts 4x/day Results every 10min, since 2006.

- ► Total water level.
- ➤3D Currents, Salinity, Temperature.
- ➢Significant wave height and wave period





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

# Real-Time Modeling CO-OPS Stevens Partnership

# Coming in 2014



#### **HF Radar Surface Currents (Annual Mean - 2009)**







#### Based on NOAA OFS standards

**STEVENS** 

Institute of Technology

>100 stations, 6 parameters, 2-year period of observations. Forecast Model has moderate to high skill near the Passaic.





# http://www.stevens.edu/maritimeforecast





End Date:

Datum

Units:



11/02

11/03

11/04

11/05

11/06

(ET)

2

-1 11/01





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"Sandy"
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# Met Forecast Products Give Wide Range of Results

Shown are observed total water levels, with sECOM-modeled surge results from met forecasts 30-40 hours prior to landfall



NAM = WRF - North American Mesoscale domain; PSU = WRF with radar data assimilation - Penn State University (Zhang et al. 2011); RU = WRF Rutgers; GFS = NCEP Global Forecasting System









#### REBUILD BY DESIGN

# Presents an opportunity for an Ocean based solution to surge reductions across the region

AN INITIATIVE OF PRESIDENT OBAMA'S HURRICANE SANDY REBUILDING TASK FORCE AND HUD

REBUILD BY DESIGN

WXY/WEST8/Stevens/Arcadis/AIR

Running the Sandy Case – with/without Islands Stevens Institute Surge Modeling for Sandy/Donna/92' Nor'easter. AIR Worldwide Surge ran loss calculations for Sandy

New York City

New Jersey

delphi

#### With Islands 11.9B saved

Connecticut

in avoided damages for insurable property alone when the Sandy Case was run 41.9B LOWER NY29.5B NJ

Post Sandy estimated total construction to address damages



Cost based upon average dredge 5.6B – 12.2B

based upon distance of ship deliveries -3year completion

Rhode Island Sov

# Conclusions

- NYHOPS established as an urban ocean forecast system large following extensive validation
- Thank you NOS and NCEP- great operational products
- **Research to operations partnerships** observations and modeling
- Build on MOU with CO-OPS
- Build out PORTS research models
- More observations mobile sensors, hf radar, tide gages, drifters, gliders and "met forcing"



