STEVENS INSTITUTE of TECHNOLOGY THE INNOVATION UNIVERSITY

DAVIDSON LABORATORY CENTER FOR MARITIME SYSTEMS

New York Harbor Observing and Prediction System (NYHOPS)

Nickitas Georgas
Davidson Laboratory
Stevens Institute of Technology

Hudson River Environmental Symposium
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More info: nickitas.georgas@stevens.edu

www.stevens.edu/NYHOPS

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

sECOM model

NYHOPS

More info: nickitas.georgas@stevens.edu

New York Harbor Observing and Prediction System

A fully automated system of systems

NYHOPS Forecast Model. – It is all about realism!

3D General Circulation Model dynamically coupled to 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) **NOS**
- ✓ **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) **USCG**

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In the process of building a NYHOPS 65+ member ensemble with different forcing functions.

Output: Hindcast+72h forecast 4x/day

Results every 10min, since 2006.

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

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NYHOPS - Sandy - HRE: Verrazano Narrows to Troy

NYHOPS - Sandy - HRE: Verrazano Narrows to Troy

NYHOPS - Irene - HRE: Verrazano Narrows to Troy

Good Salt Front Positioning. Allows for projections.

Location of Hudson River salt front (high slack tide)

Hudson River Basin Regional Scale Hydrologic Model

- Drainage Area: 14,000 mi²
- Average Discharge: 21,900 cfs
- HEC-HMS model
- Gridded Precipitation Data
- Discharge Forecasts up to 87 hrs out using precipitation from weather models
- Automated Runs

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New York Harbor Observing and Prediction System (NYHOPS)

NYHOPS supports

Search and Rescue (NOAA OR&R, USCG ERD, PD)……

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

Recreational Boaters (Regattas, Kayaks, Fishermen)……

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

Scientists/Engineers……

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Objective: Flood Forecasting on the Human Scale

Move from the static, area-wide flood elevation forecasts to dynamic flood simulations for event preparation/response and long-term flood mitigation.

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Modeling the Hudson River (1)

Hudson region of the 7-state-wide, Stevens NYHOPS OFS.

A great forecast model used by the NWS, USCG SAR, NOAA HAZMAT, Hudson River Pilots, among others.

The NYHOPS OFS grid includes the whole tidal Hudson up to Troy.

But the computational grid is somewhat coarse. 2,444 boxes used to describe the Hudson from Battery to Troy.

www.stevens.edu/NYHOPS

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Modeling the Hudson River (2)

Based on the NYHOPS hydrodynamic model, we built an ultra-high resolution grid.

And then coupled the forces that move the water to it, in a more accurate and distributed manner.

E.g. Better shoreline definition, tributary networks, etc.

2,444 boxes in NYHOPS OFS -> 77,452 boxes up to NYSDEC coastline -> 114,464 boxes up to +10m NAVD88 contour.

Almost two orders of magnitude increase in generated information.

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An ultra resolution model built for the Hudson

...that hugs the NYSDEC shoreline...

… includes tributaries, back bays and islands…

Hudson River Sustainable Shorelines Project
Engineering Components

Literature Review
- 28 shoreline stabilization approaches identified and compared

Cost Analysis
- 70 lifecycle cost comparisons
- Ecologically enhanced methods cost-competitive

Physical Forces Analysis
- Modeled (water levels, currents, and waves)
- Measurements (Ice and wakes)

Forensic Analysis
- Evaluated 6 shorelines, during 3 historic storms

More info: jon.miller@stevens.edu https://www.hrnerr.org/hudson-river-sustainable-shorelines

Datasets Available through NYSDEC GIS Clearinghouse

http://gis.ny.gov/gisdata/inventories/details.cfm?dsid=1136

Hudson River Estuary Bathymetry Tidal Datums

Hudson River Estuary Flow Model

Hudson River Ice Climatology [an update is in the works]

NYHOPS-linked webpage for pollutant tracking: http://www.stevens.edu/traces