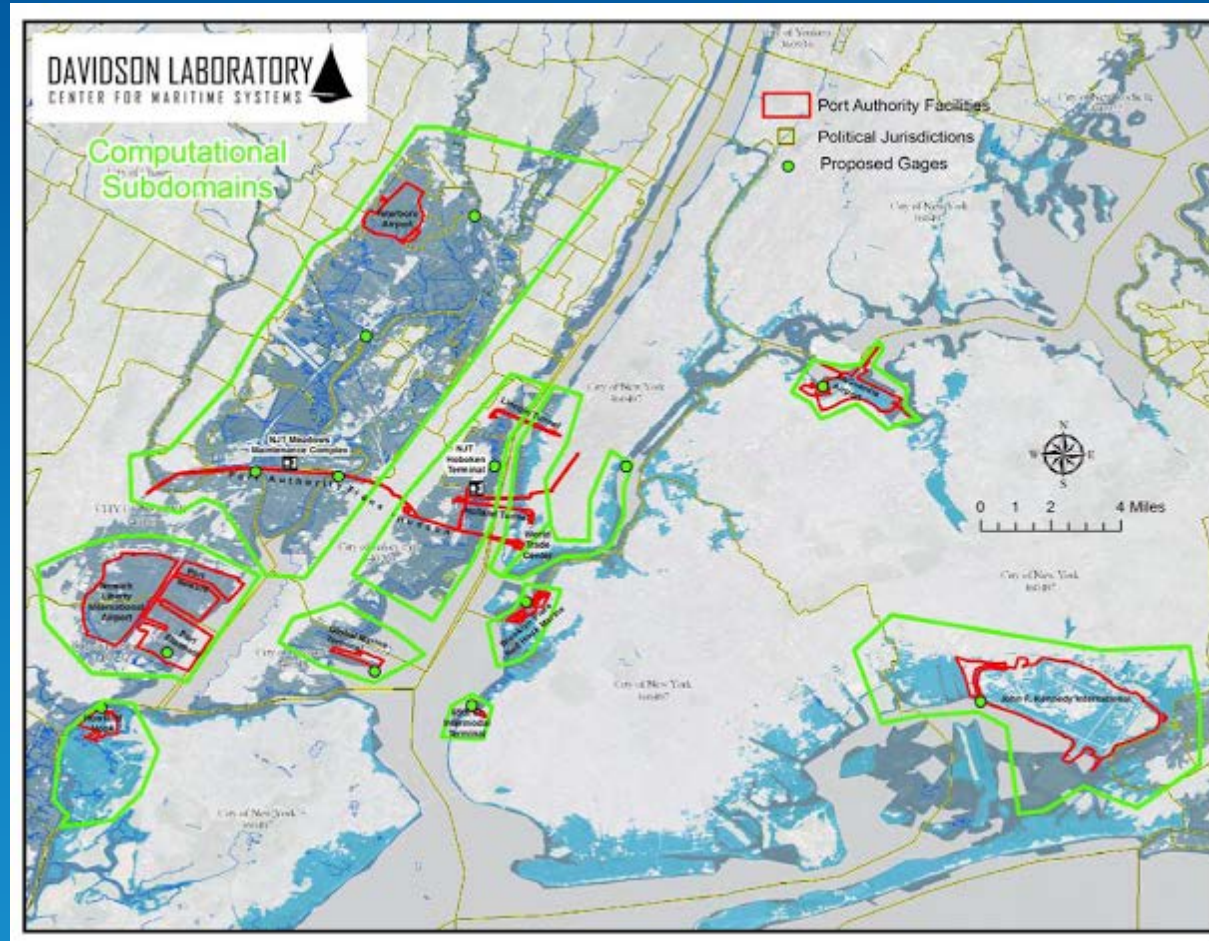


Rain and Storm Surge Integrated Hydrodynamic Modeling system for overland flood forecasting in the NJ Meadowlands region

Nickitas Georgas, Davidson Laboratory, Stevens Institute of Technology

The overall objective is to predict inundation occurring from a storm surge | rainfall event.



Co-authors

Stevens Institute of Technology

Alan Blumberg, Thomas Herrington, Thomas Wakeman, Firas Saleh, David Runnels, Alex Yakubovskiy, Joe Formoso, Kara Pepe, Howard Goheen, Omar Lopez, Larry Yin

The Port Authority

of New York and New Jersey

Gerard McCarty, Michael Ricker, John Giancaspro, Nathaniel Kimball, Paul Quant

NJ Meadowlands Environmental Research Institute

Dom Elefante, Joe Grzyb and Francisco Artigas

- New Sensors
- New Surge/Rain Forecasts
- Street-Scale 2D Dynamics
- Ensemble Met Predictions
- Web Maps and Time Series
- Automatic Alert Triggers

SSWS -> PANYNJ FAS: Combined Flood Advisories, at NAVD88

Click for Storm Surge Warning System (SSWS) as of 2012-10-29 9:00 AM

Stations below have current or forecast flood level! Box color indicates current with forecast in parent!

- Hudson River at Albany NY (Minor Flood)
- Schedack Island, NY (Hydrological) (Near Flood)
- Tappan Bays South, NY (Hydrological) (Near Flood)
- Norrie Point, NY (Hydrological) (Moderate Flood)
- Hudson River below Poughkeepsie NY (Moderate Flood)
- Newport RI (Minor Flood)
- Hudson River at South Dock at West Point NY (Moderate Flood)
- New London CT (Minor Flood)
- New Haven CT (Moderate Flood)
- Bridgeport CT (Moderate Flood)
- Kings Point NY (Moderate Flood)
- The Battery NY (Moderate Flood)
- Bergen Point West Reach NY (Moderate Flood)
- Hudson Bay at Freeport NY (Major Flood)
- Jamaica Bay at Inwood NY (Major Flood)
- Reynolds Channel at Port Lockwood NY (Moderate Flood)
- East Rockaway Inlet at Atlantic Beach NY (Moderate Flood)
- Rockaway Inlet near Floyd Bennett Field NY (Moderate Flood)
- Sandy Hook NJ (Major Flood)
- Shark River at Eatons NJ (Major Flood)
- Barnegat Bay at Barnegat Light NJ (Moderate Flood)
- Little Egg Inlet near Tuckerton, NJ (Moderate Flood)
- Atlantic City NJ (Major Flood)
- Great Channel at Stone Harbor NJ (Minor Flood)
- Cape May NJ (Minor Flood)
- Lewes DE (Moderate Flood)

Urban Ocean Observatory at Davidson Laboratory

Present Conditions NYHOPS Forecast Surface Currents NYHOPS Traces Storm Surge Mobile Stations Our Sponsors Time Series

Port Authority of New York and New Jersey Flood Advisory System
Forecast Period: 2014-11-25 1:00 PM through 2014-11-28 12:00 AM ET

Select Station

Station:

-
 Major Flood
-
 Moderate Flood
-
 Minor Flood
-
 Near Flood
-
 Normal Levels
-
 Blowout
-
 X No Current Observations X

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

Registration for email flooding notifications is not yet active

If you have questions or comments, please contact [Dr. Nickolas Georgas](mailto:Dr. Nickolas.Georgas)

PANYNJ FAS is a collaboration among [Stevens Institute of Technology](#), [Stony Brook University](#), [NOAA Meteorological Development Lab](#)

Funding has been provided by [The Port Authority of New York and New Jersey](#) and [New York Sea Grant](#)

DISCLAIMER: PANYNJ FAS adheres to NOAA standards and guidelines for use and reliability of our forecasts. Click [HERE](#) to view.

PANYNJ Flood Advisory System

Subject: Stevens CMS/SSWS Flood Prediction Notice
Sender: zane@stevens.edu
Recipient: ngeorgas@stevens.edu
Date: 10/29/2012 6:03 PM

Dear Dr. Nickolas Georgas:

We expect flooding for the station(s) listed below at some point in the eight hour period between 2012-10-29 6:00 PM and 2012-10-30 2:00 AM local time. We have indicated the approximate time when we expect the first flooding to occur for each station. Note that there may be higher flooding later in the eight hour period, and we suggest that you click on the link for each station below to see complete surge information for that station.

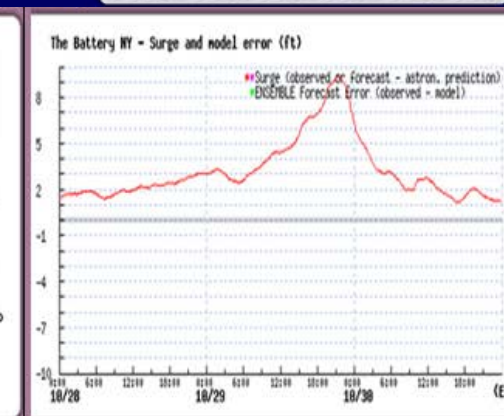
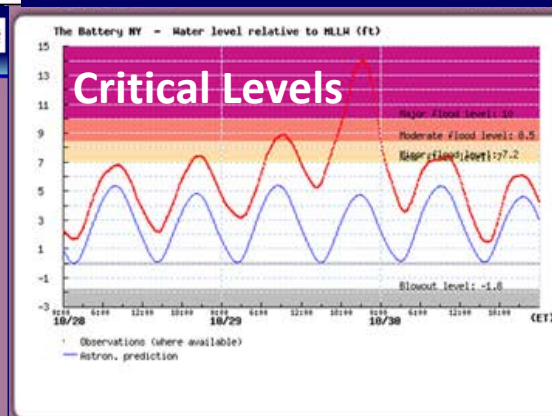
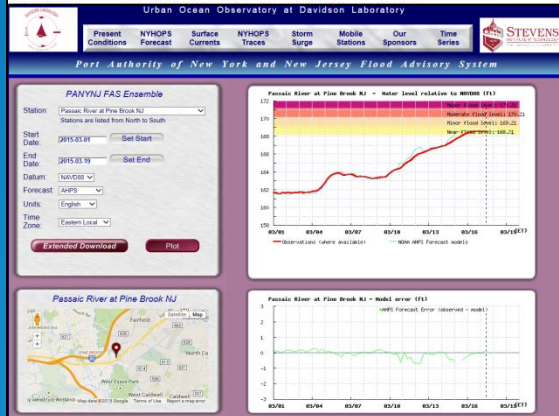
Newport RI at approximately:
2012-10-29 6:14 PM
<http://hudson.oj.stevens-tech.edu/SSWS/index.php?station=001>

New Haven CT at approximately:
2012-10-29 8:25 PM
<http://hudson.oj.stevens-tech.edu/SSWS/index.php?station=010>

Bridgeport CT at approximately:
2012-10-29 8:08 PM
<http://hudson.oj.stevens-tech.edu/SSWS/index.php?station=011>

Kings Point NY at approximately:
2012-10-29 8:28 PM
<http://hudson.oj.stevens-tech.edu/SSWS/index.php?station=014>

River floods



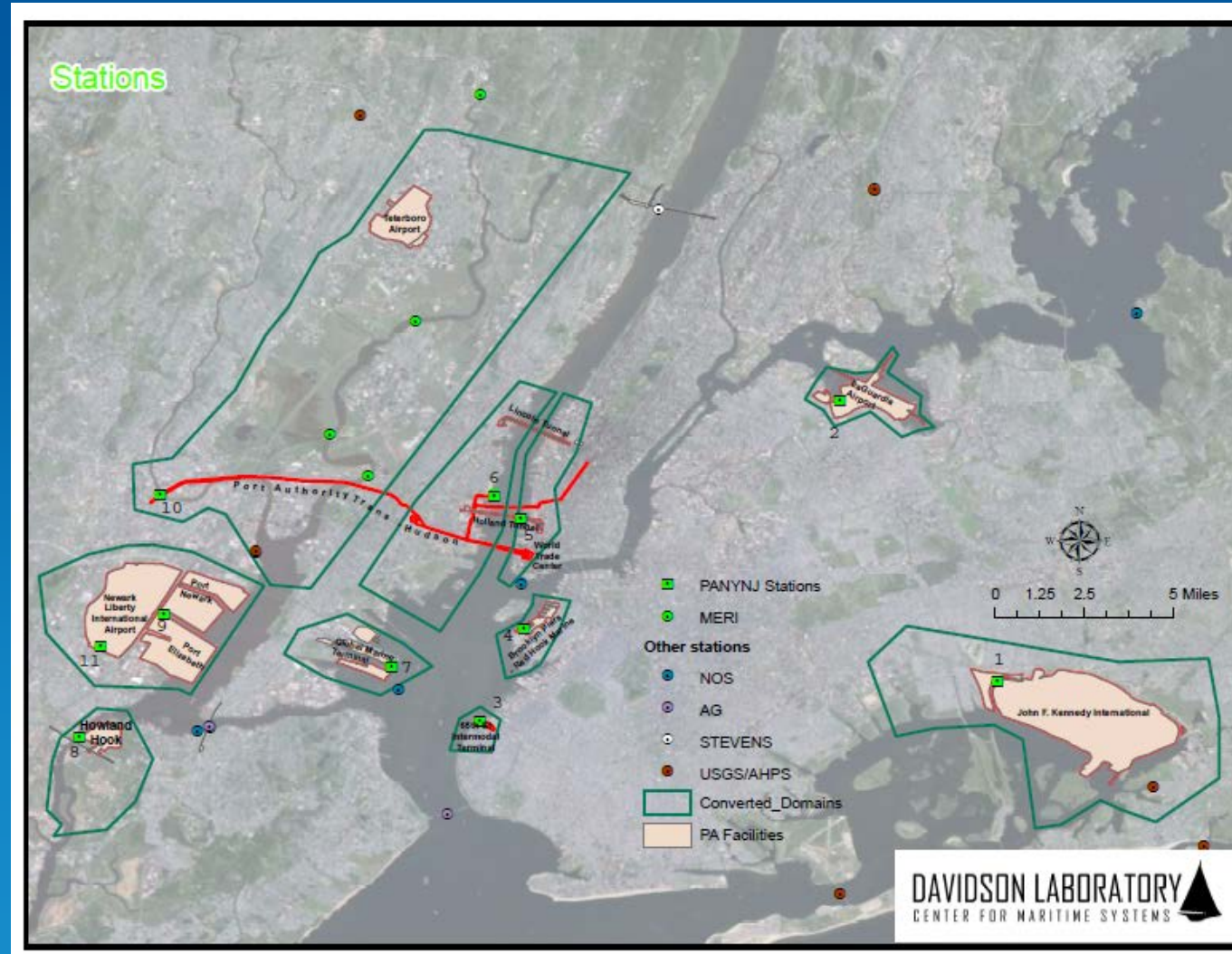
Storm Surges

Real-time Water Level Stations (Virtual and Physical)

Deploy co-located virtual (model-derived) and real-time physical stations on facilities

VIRTUAL STATIONS

- 72hr water level forecasts
- Initialized every 6 hours
- ID critical flood levels
- Trigger flood guidance
- First, from storm surge
- Then, combine rain
- Ensemble predictions



PHYSICAL STATIONS

- 11 dual procured
- Site Visits / Recon
- Approval process
- Installation/Benchmark
- RT communications
- FAS Website Integration
- Routine Maintenance

NOS-standard, Wireless Aquatrak Sensors (Water Level)

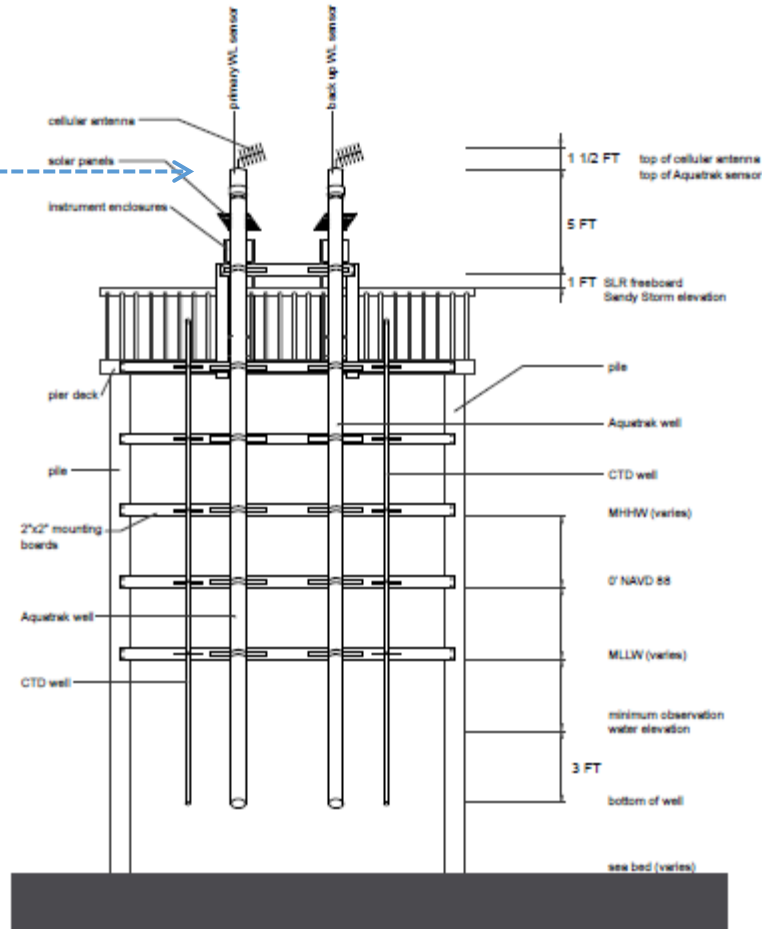


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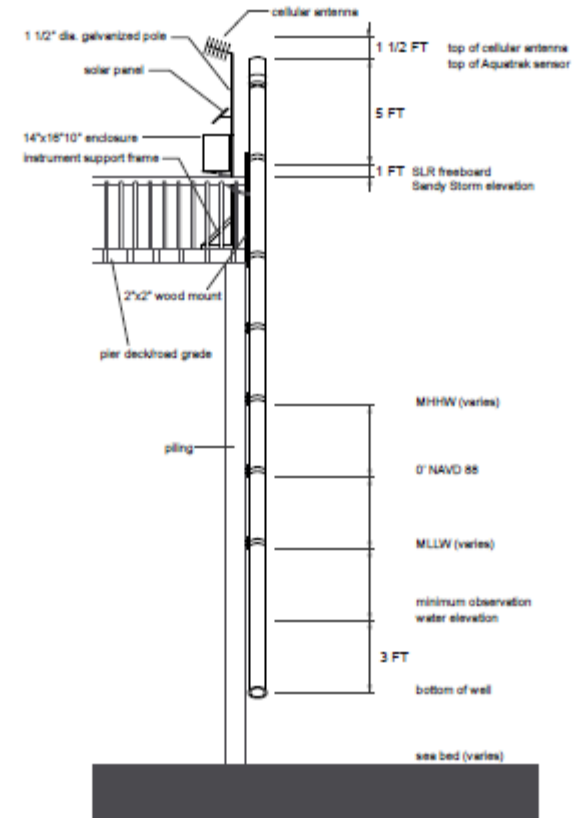
Greenspan

Analytical

EC250 C/T



Front View



Side View

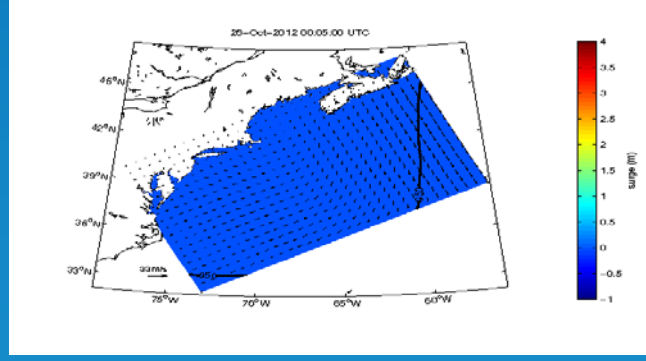
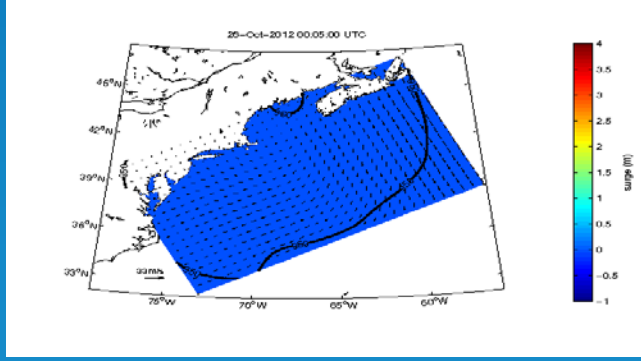
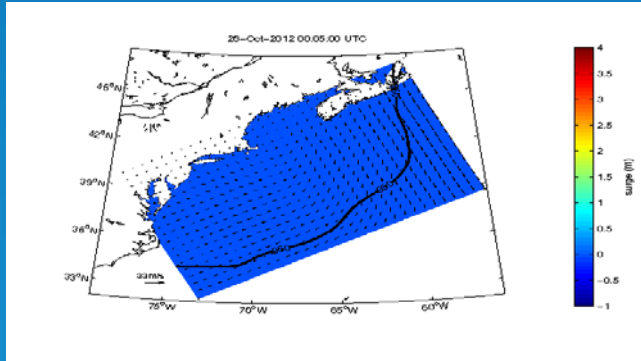
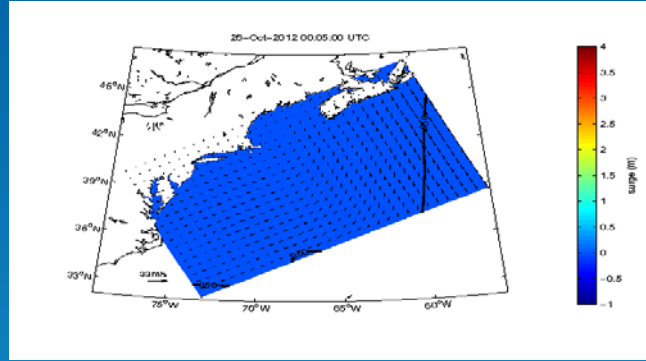
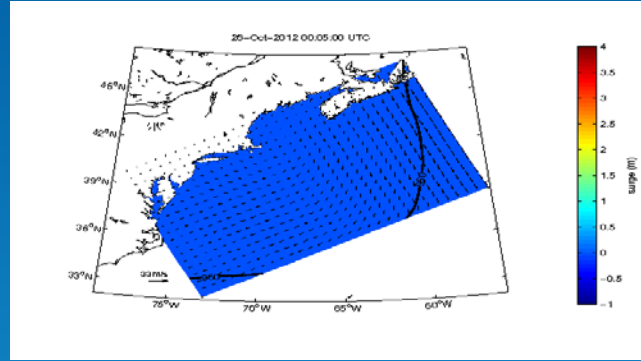
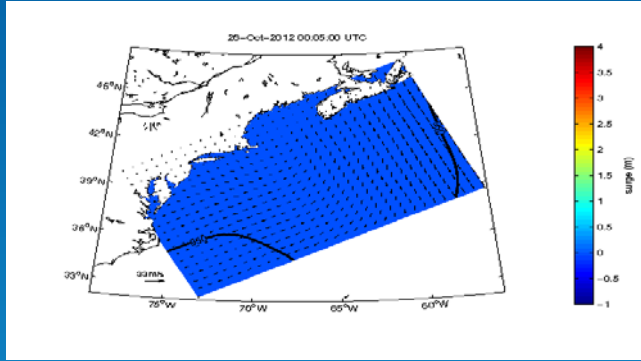
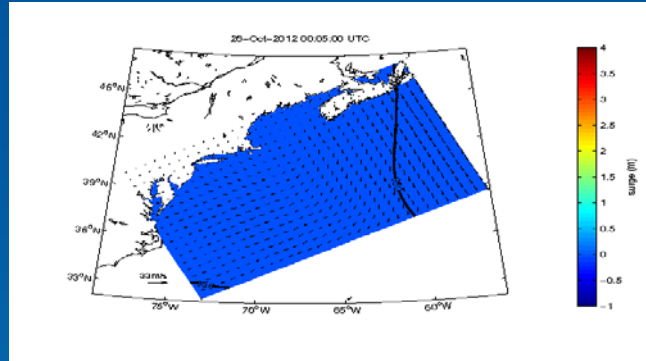
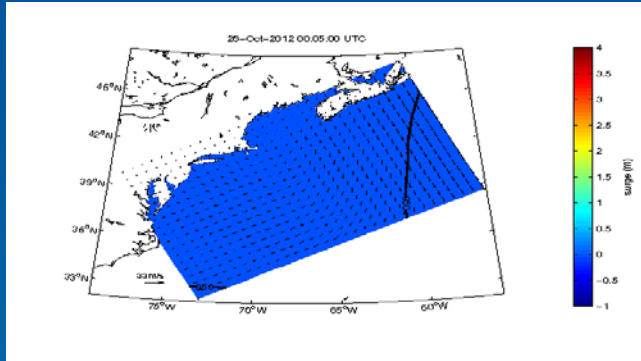
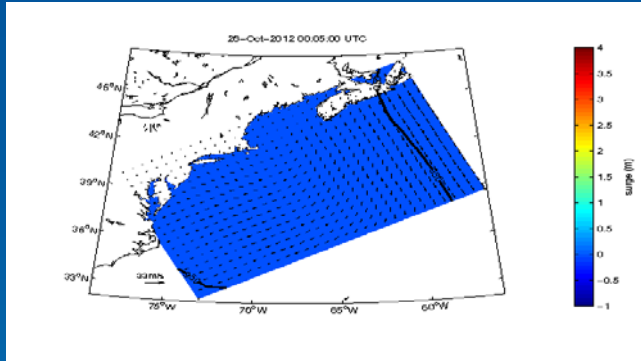
Pharos cluster at the Stevens Hyper-Scale Computing Center



1,280 cores, 2PB+ of RAIDed Xyratex storage, UPS, Generator.
65 ensemble endmembers running, every 6hrs, 72hr forecasts.



Now: 65 Stevens North Atlantic Predictions (SNAP) forecasts



Operational NYHOPS Forecast model

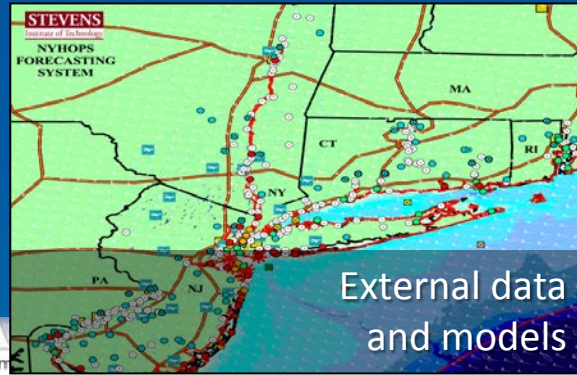
3D General Circulation and Surface Wind-Wave Model

Input forcing:

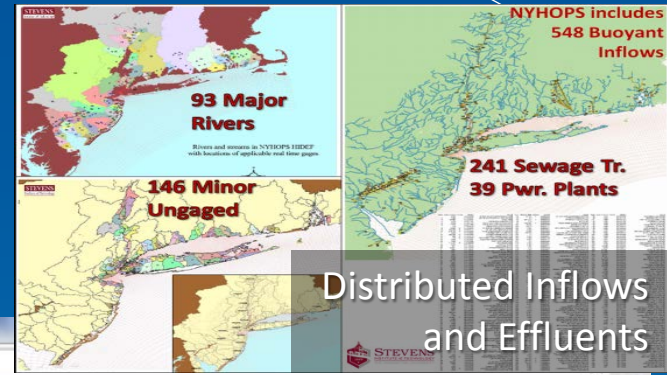
- ✓ Tides
- ✓ Offshore Surge and Steric
- ✓ Offshore Waves
- ✓ Surface Winds/Pressure
- ✓ Heating and Cooling
- ✓ 239 Rivers and Streams
- ✓ 280 Major Dischargers
- ✓ River Ice



+



+



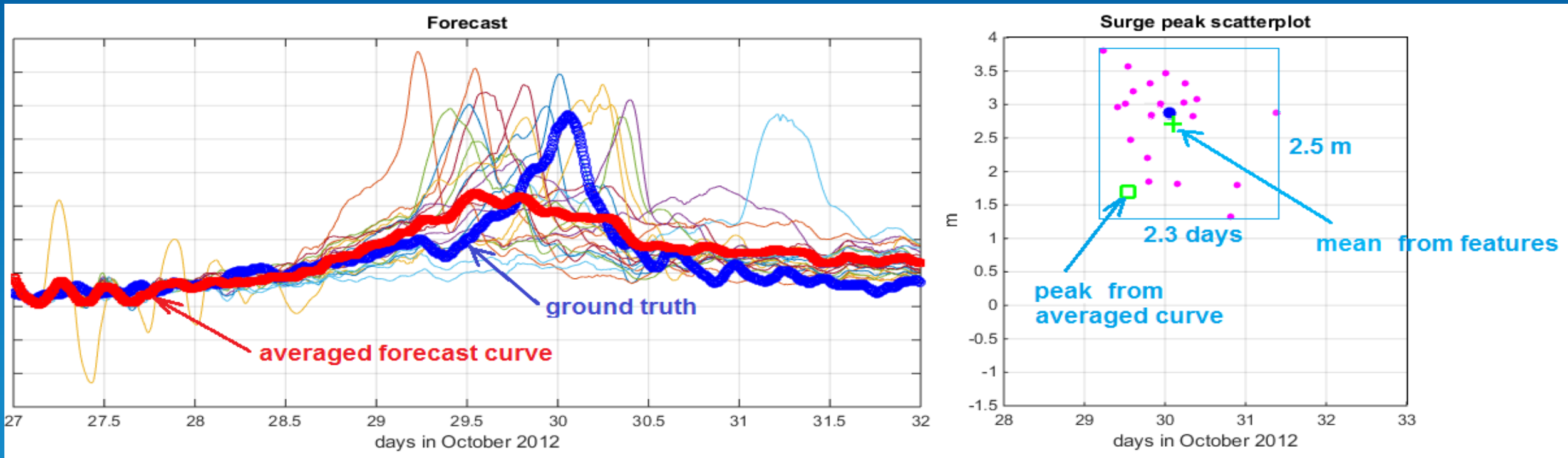
Output:

- hindcasts+72-hr forecasts 4x/day
- Results every 10min, since 2006.
- Total water level.
- 3D Currents, Salinity, Temperature.
- Significant wave height and wave period.



Research on Forecasts and Ensembles

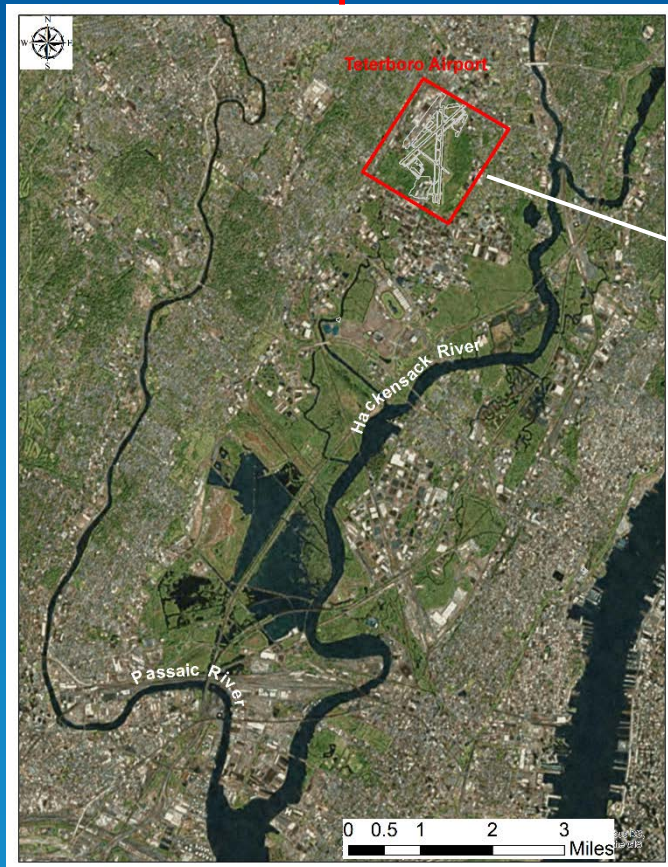
De-bias models -> Ensemble predictions -> Best Forecast, Reasonable Uncertainty Range



Flood Forecasting Framework in PANYNJ Facilities

The inland forecasting framework is based on a coupled approach

Regional scale rainfall-runoff model generates boundary conditions and external inflows to a local scale model

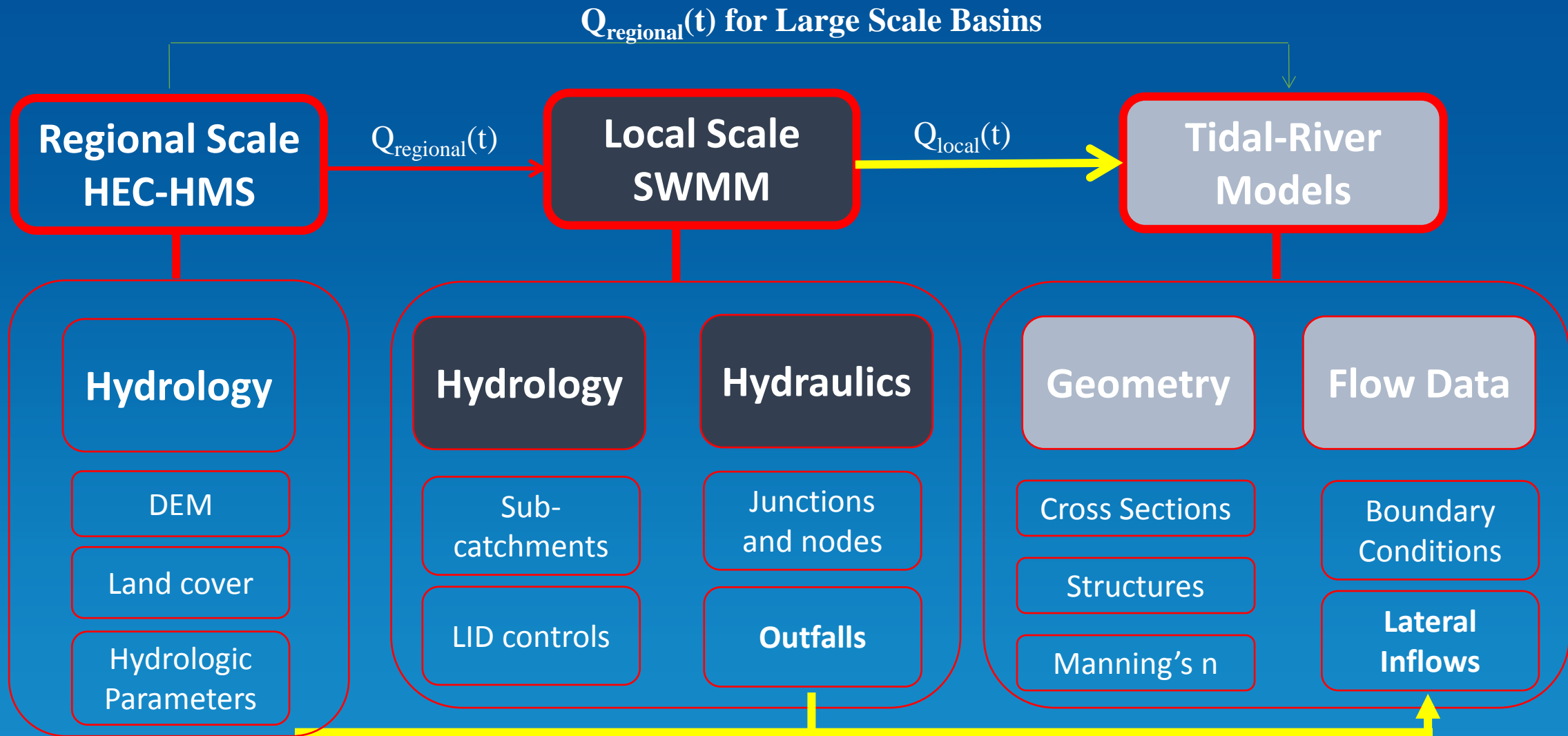


Discharge inflow to a Tidal-River model



Downstream tidal boundary conditions [NYHOPS]

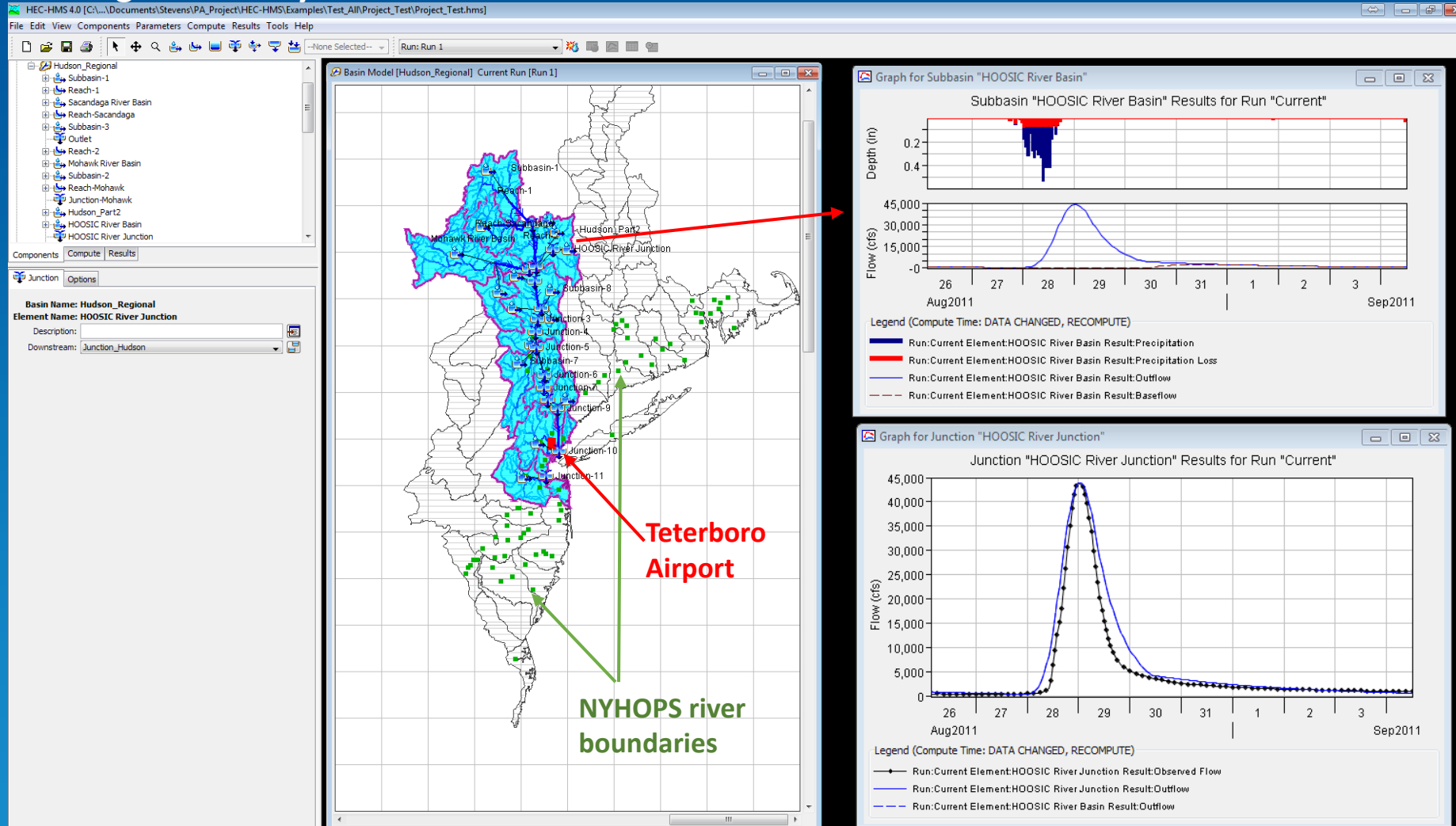
Flood Forecasting Framework in PANYNJ Facilities



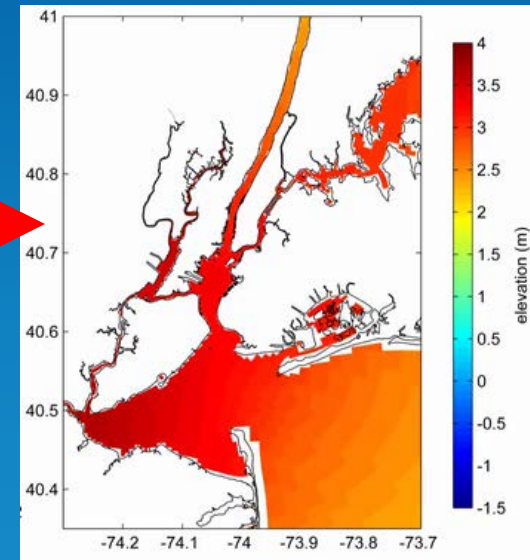
All models are forced with meteorological forecasts

HEC-HMS Coupling with NYHOPS

Automatic scripting is being built to convert the forecast precipitation data to HEC-HMS in order to forecast regional discharge boundary conditions for the local scale models as well as NYHOPS.



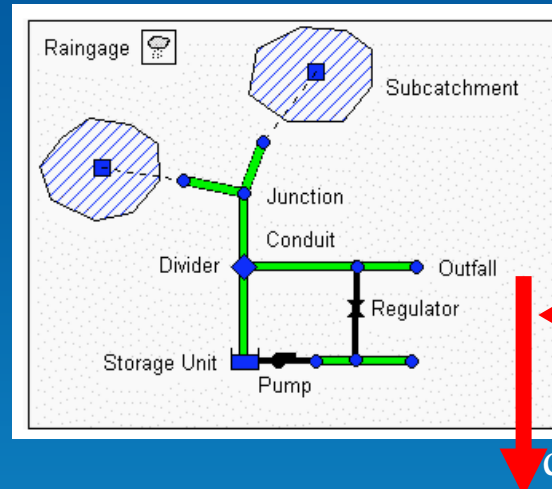
NYHOPS



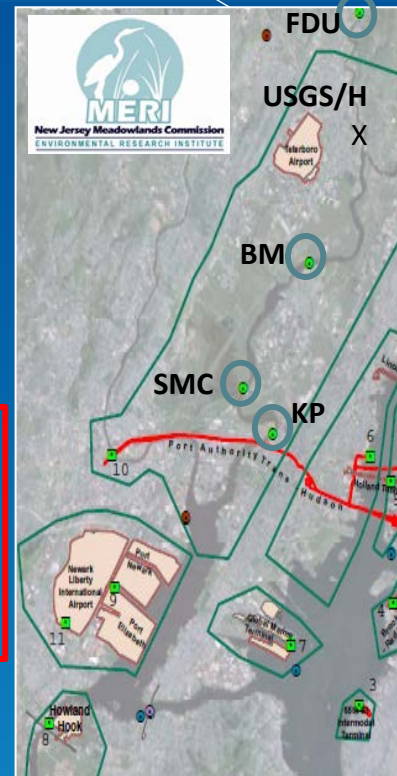
Local Scale Hydrologic/Hydraulic Modeling and Prediction



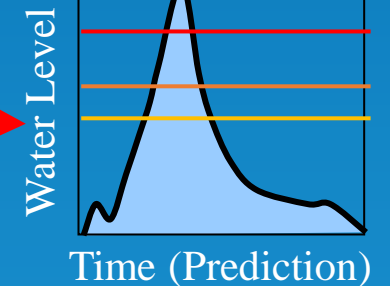
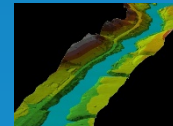
Local Scale SWMM



Downstream tidal boundary conditions [NYHOPS]

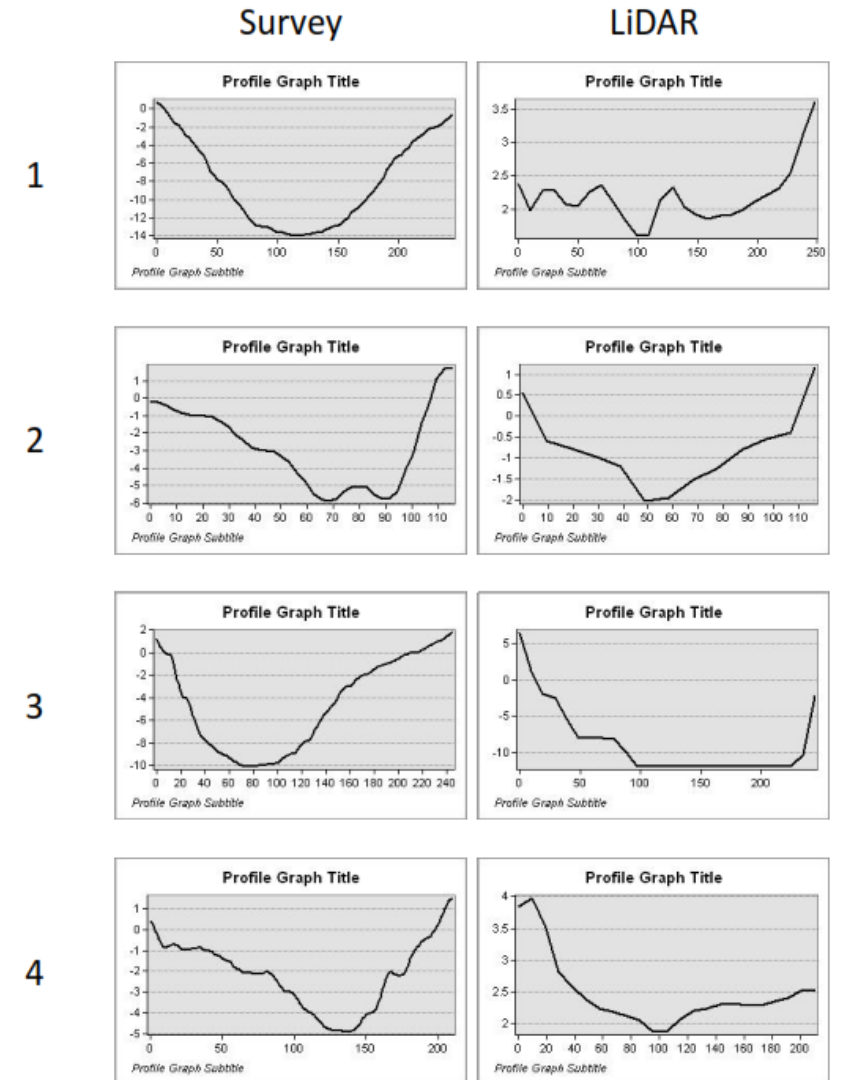
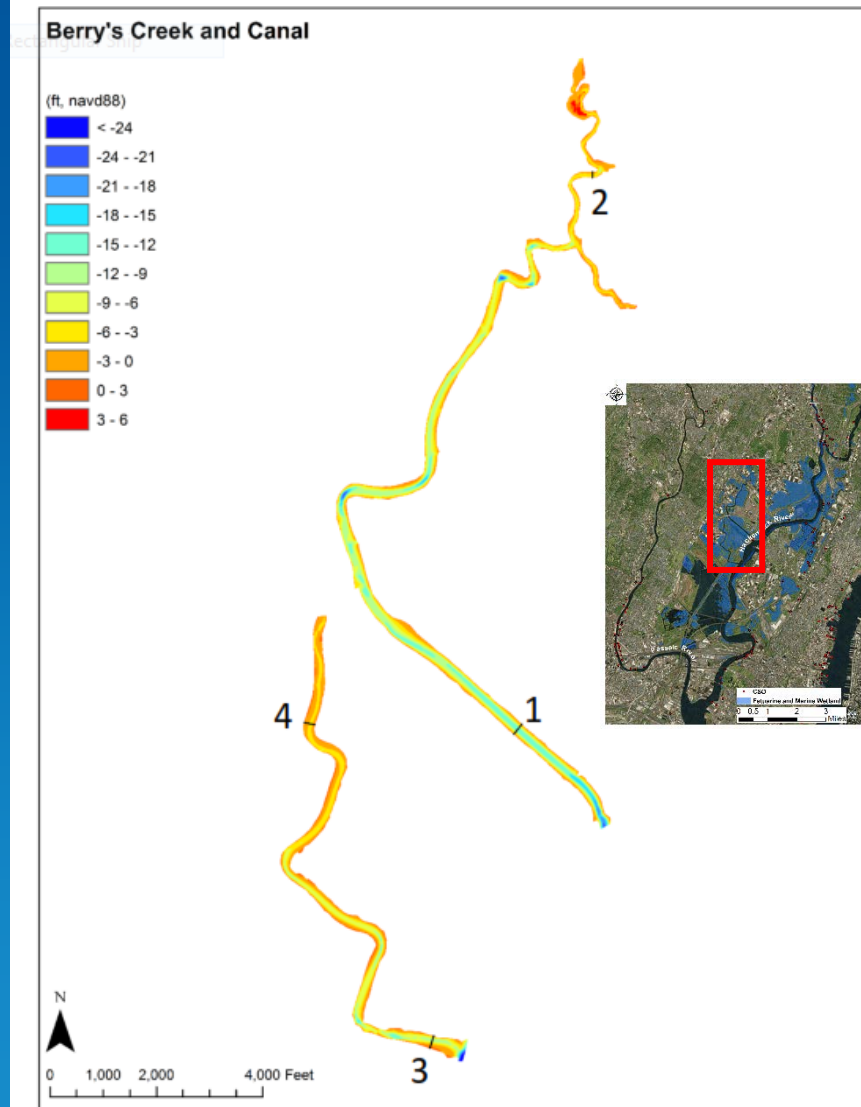


Tidal-River Models

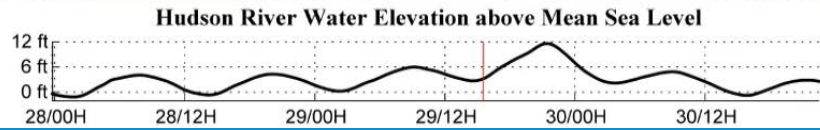
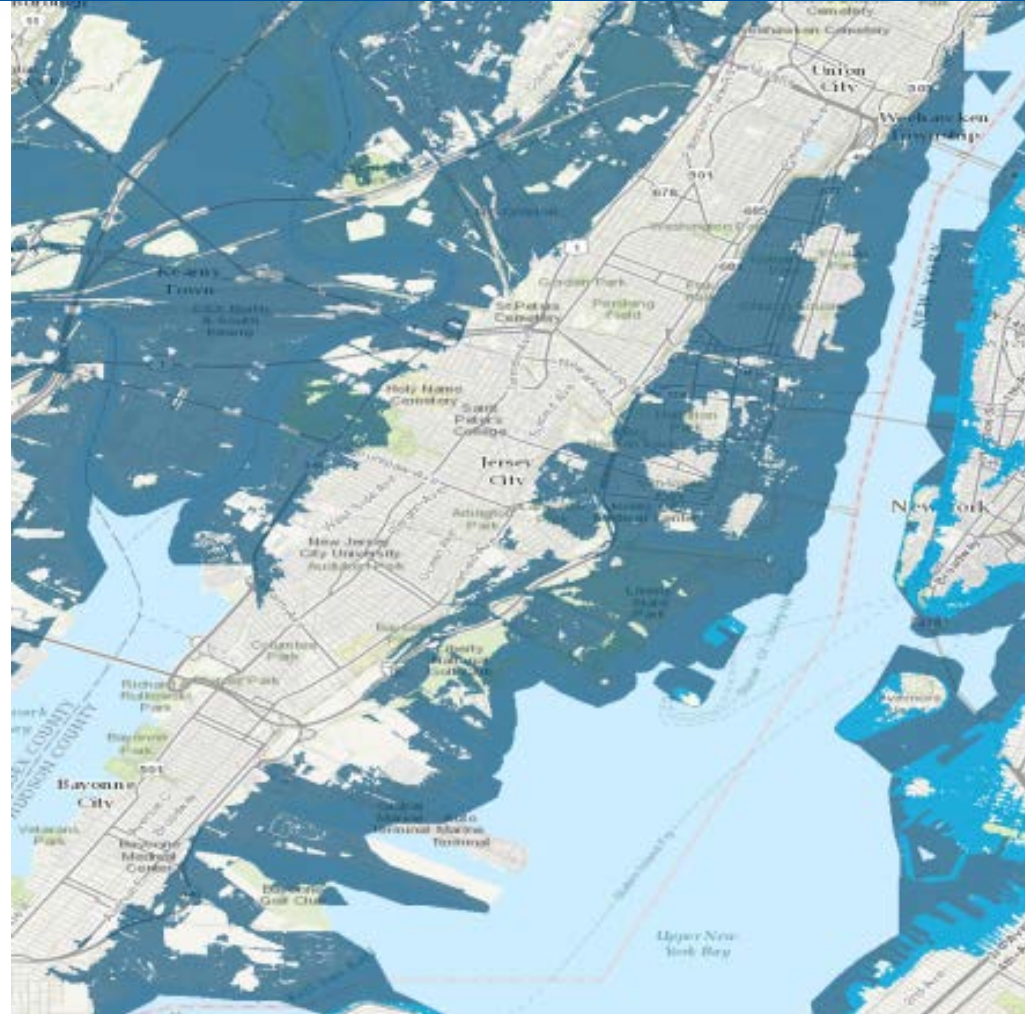
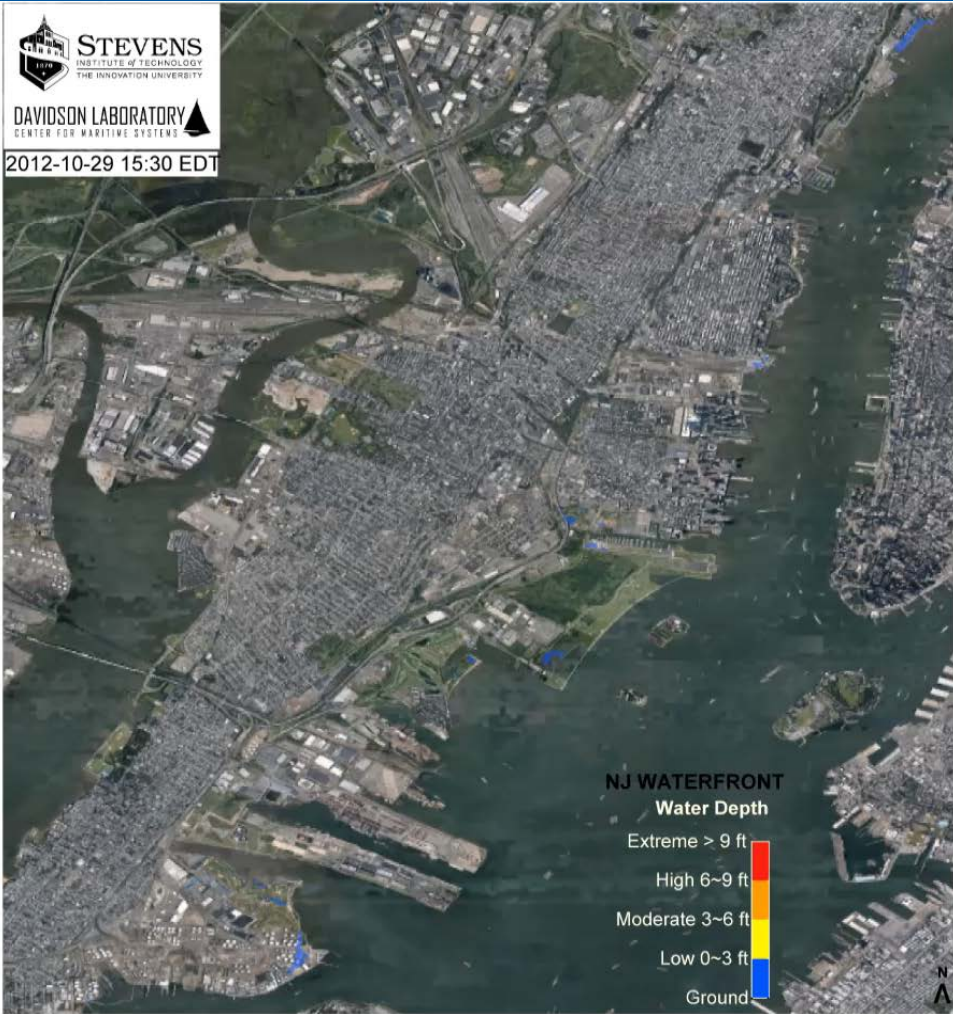


NJ Meadowlands Data provided by MERI (Thank you!)

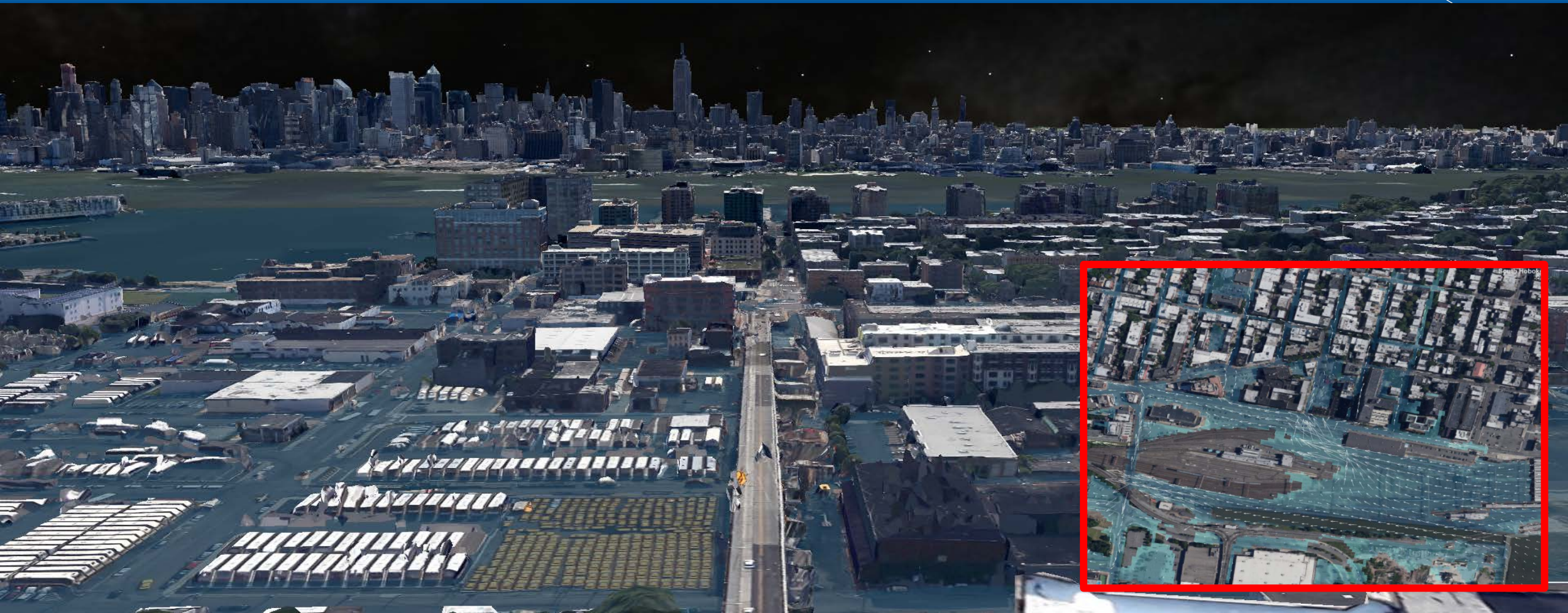
- Bathymetry for Berry's Creek and Canal
- Technical Reports
- CSO outfalls
- Locations of flood control structures within the Meadowland District
- Geometric properties of inline structures
- Hydraulic and hydrologic analysis reports and data (e.g. West Riser Tide Gates System)
- Data for validation



Street Scale Surge Model for NJ Hudson River Waterfront



Street Scale Hoboken 'Zero Hour'



Nickitas Georgas

Presentation at the New Jersey Geospatial Forum – Trenton, NJ – 2015/03/17