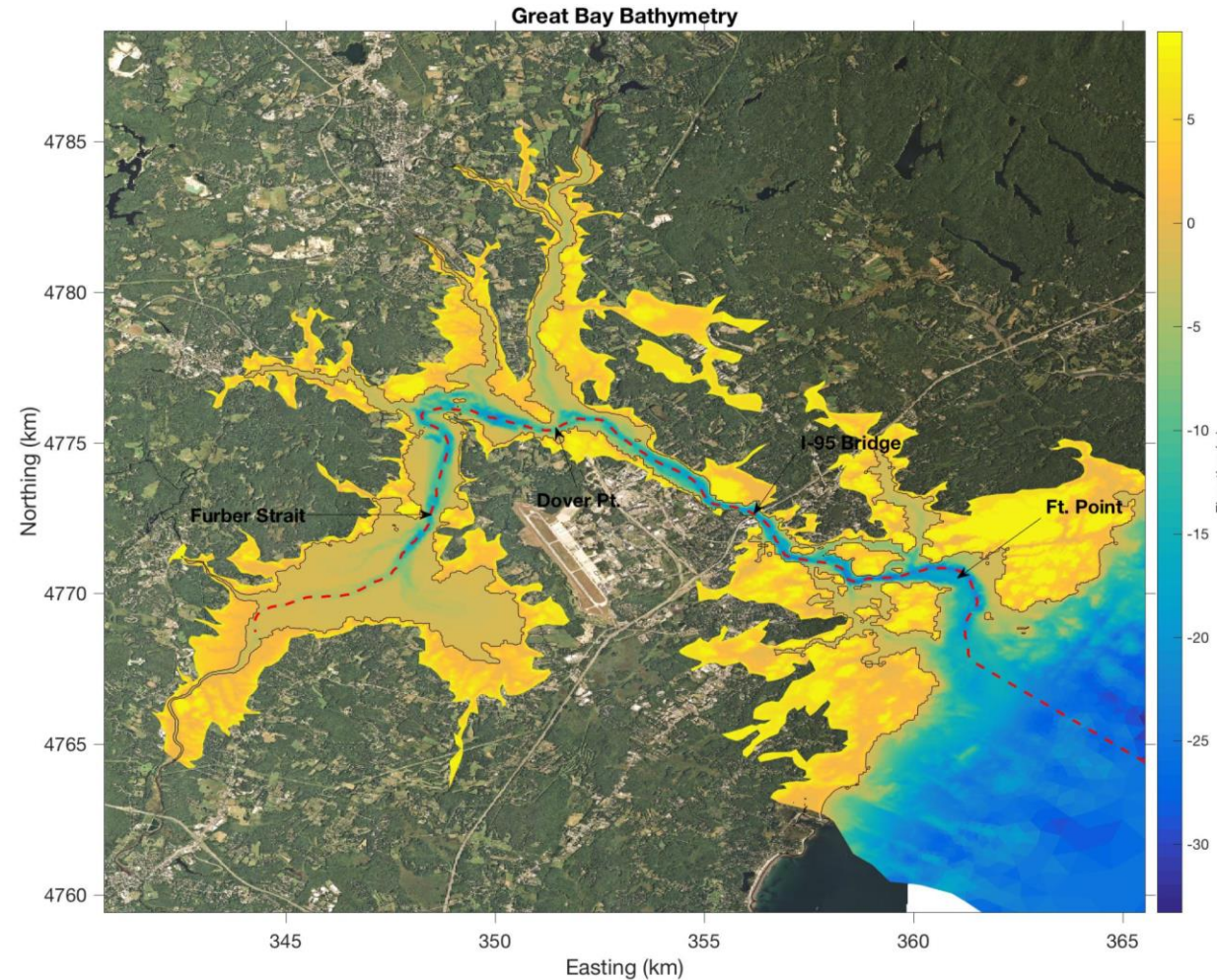


The Piscataqua River Currents with Sea Level Rise

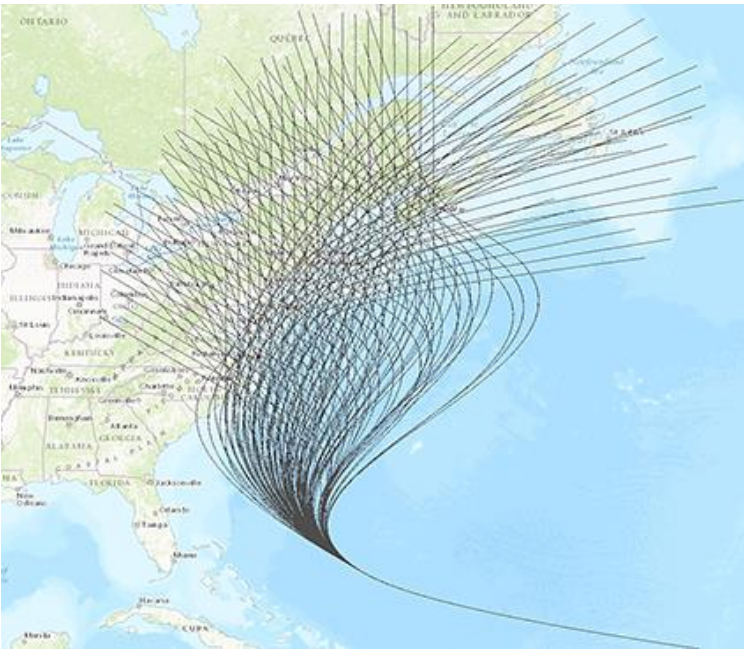
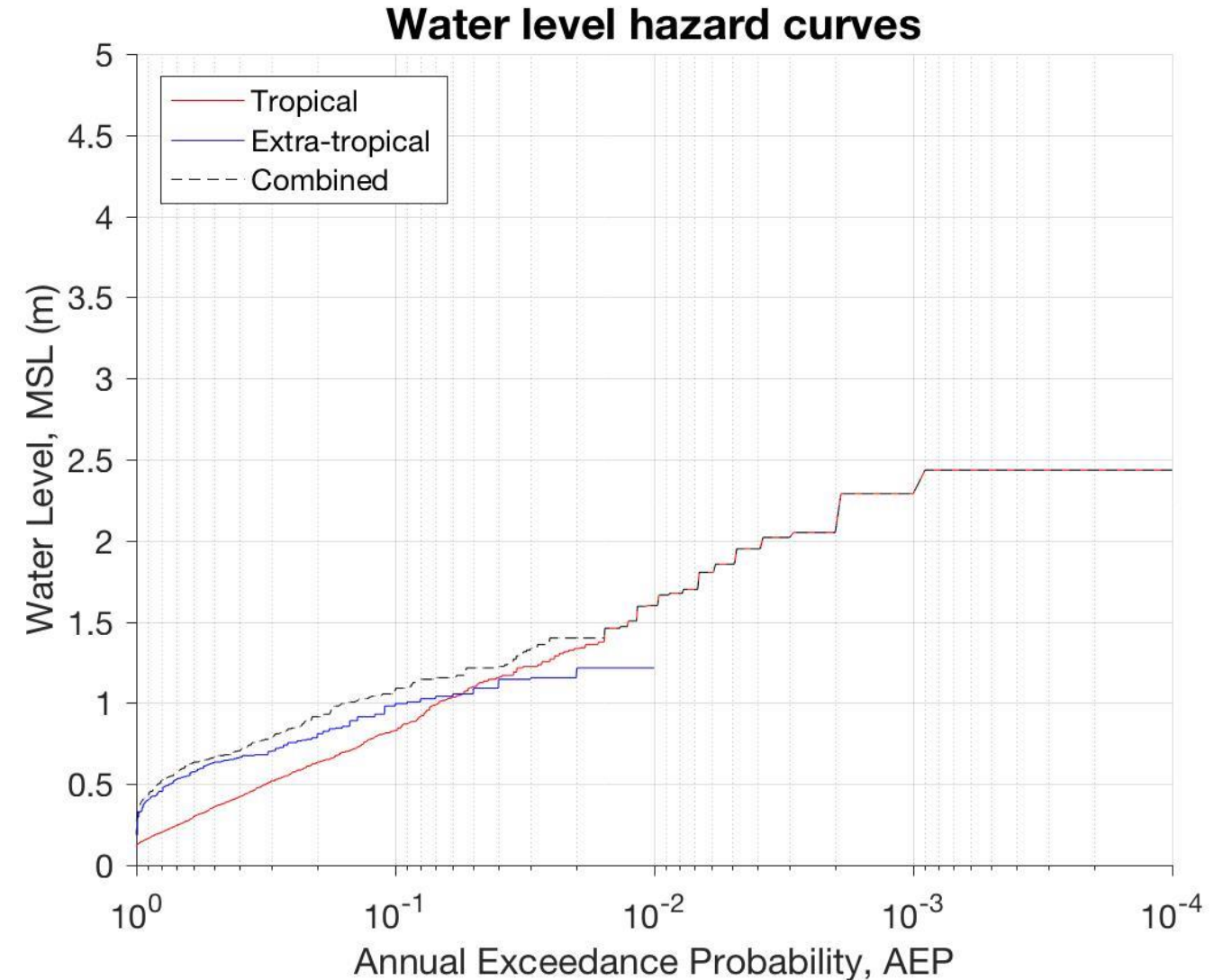
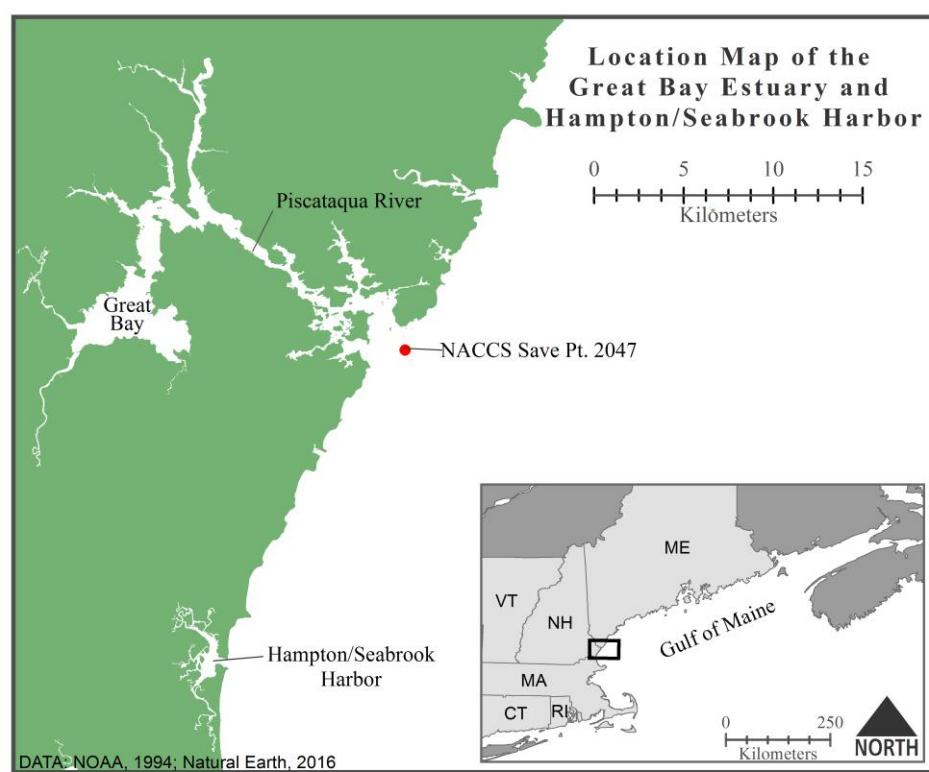
Tom Lippmann (Salme Cook & Anna Simpson)

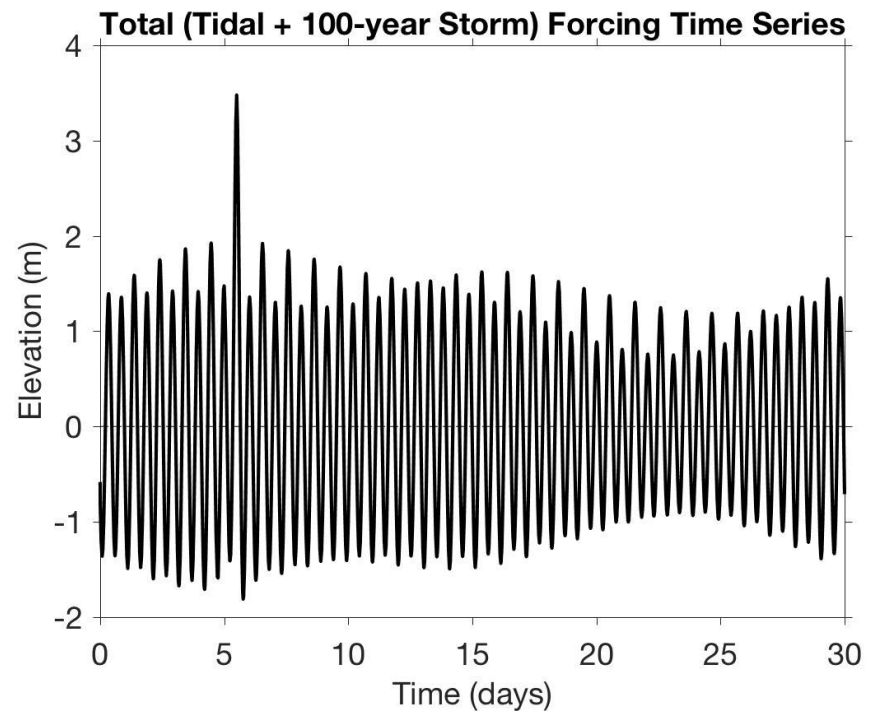
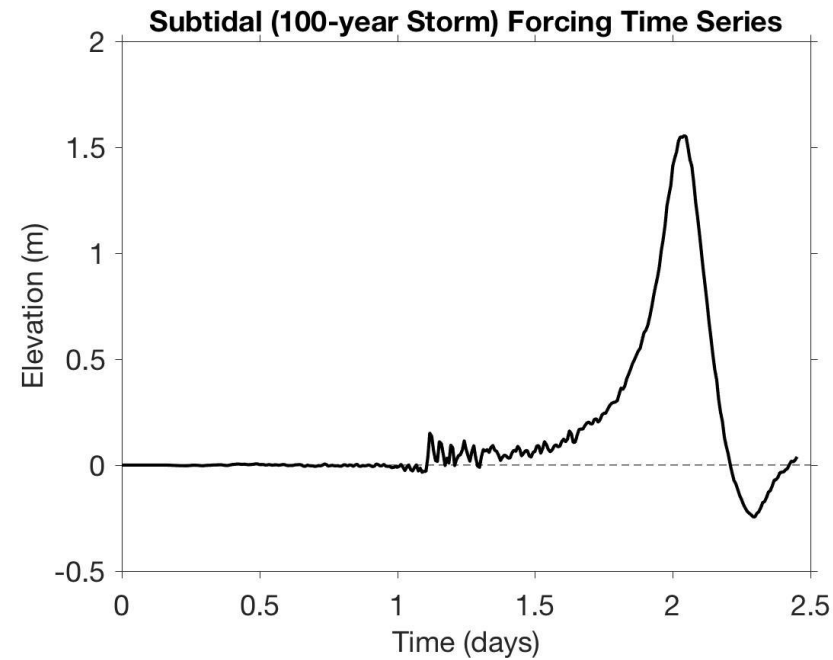
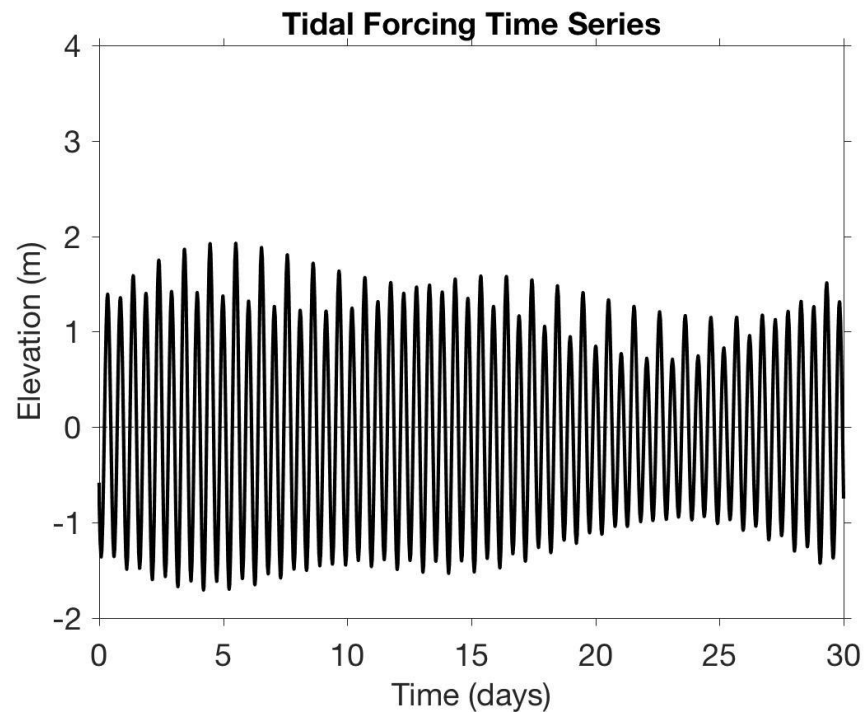
University of New Hampshire

- **Numerical models (bathy, grids, b.c's)**
COAWST- ROMS (also FVCOM)
30 m grid resolution
- **Simulate:**
Flows (3-dimensions)
Water levels (tides, subtidal) w/ & w/o SLR
- **Verification**
Field Observations (time series of Flows & water levels)
- **Results**
Inundation from Storm Surge (10%, 1%, 0.1% events; NACCS)
with and without SLR: 2100 (1.92 m)
Changes to the Max Surface Water Levels & Max currents
- **Conclusions**
Currents: Increase significantly with Storm surge & SLR

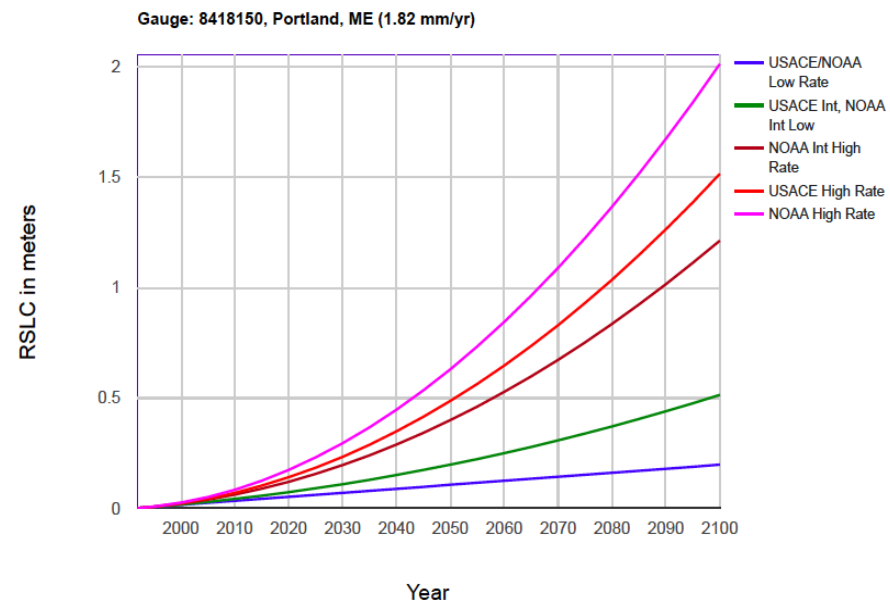


NACCS Save Pts. in Gulf of Maine Near NH

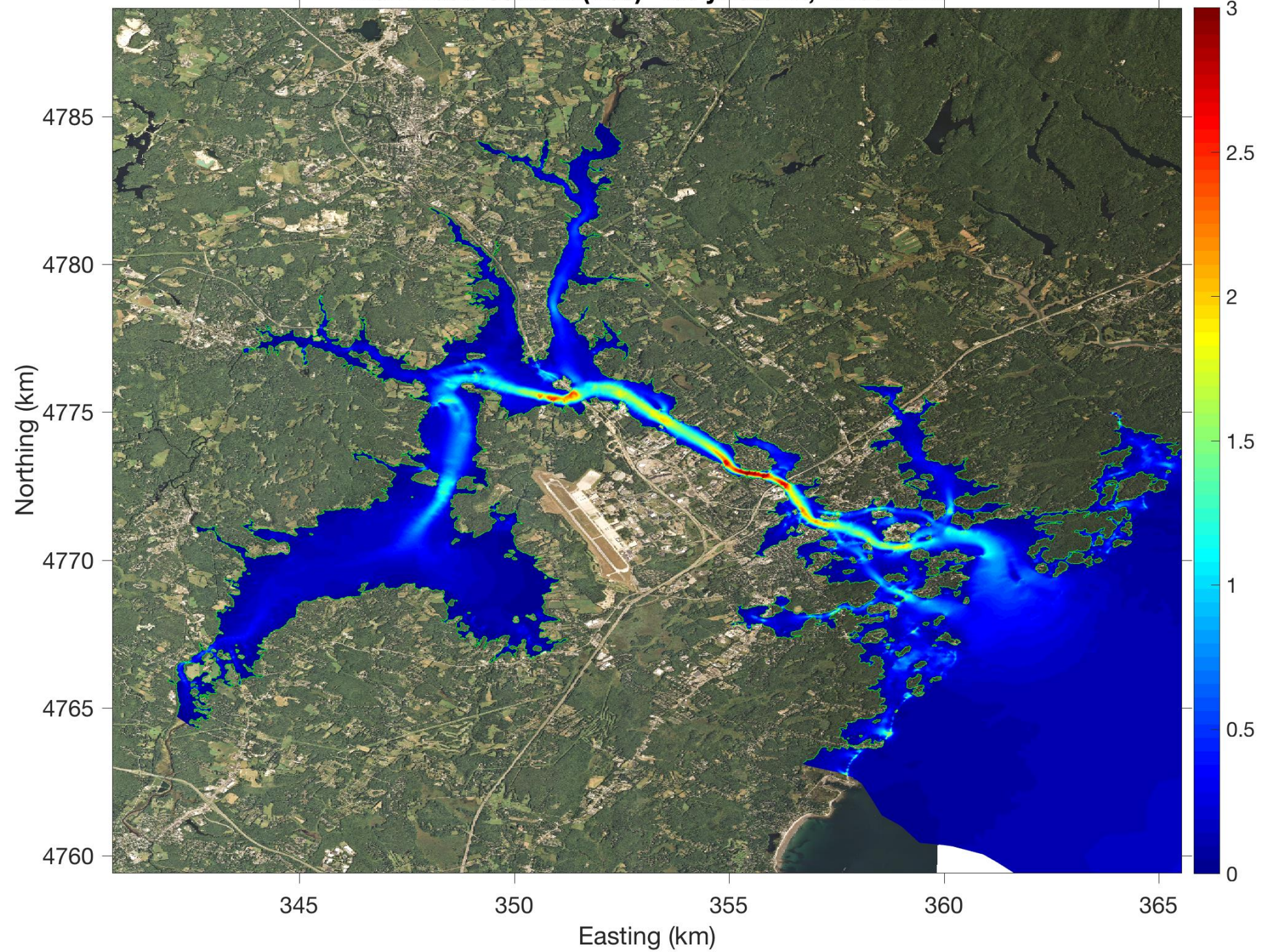




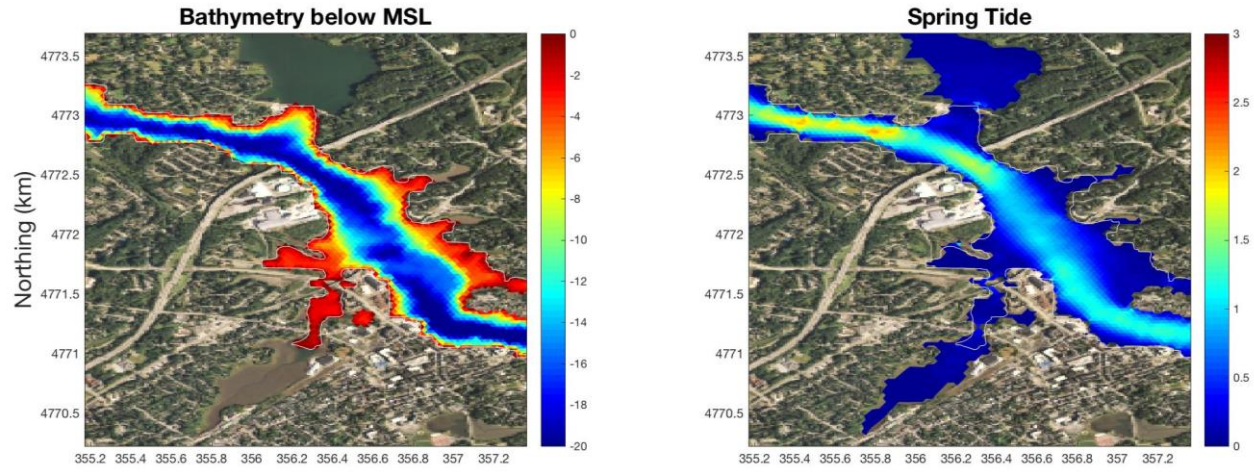
SLR from Climate Change Projections



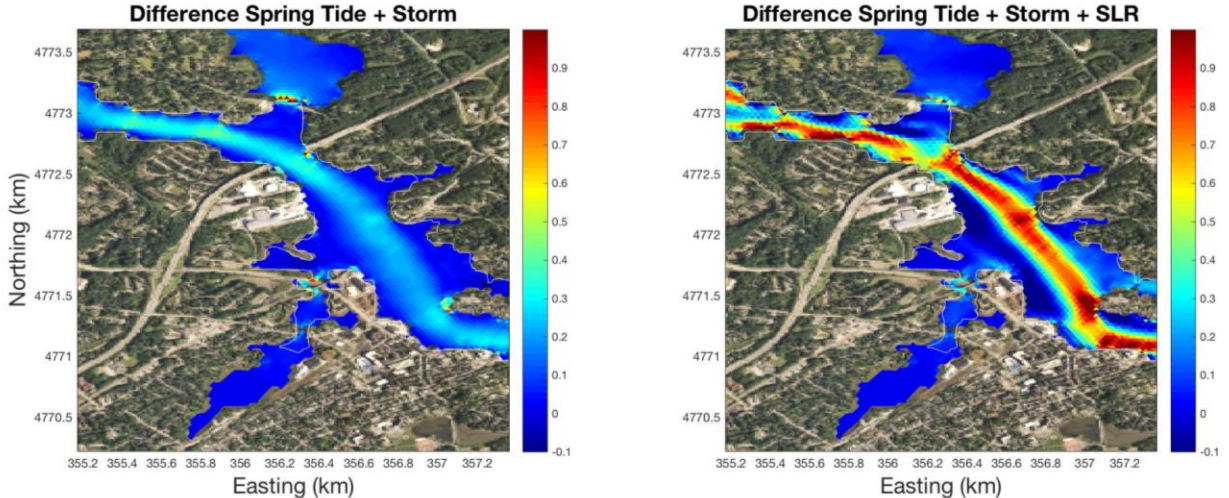
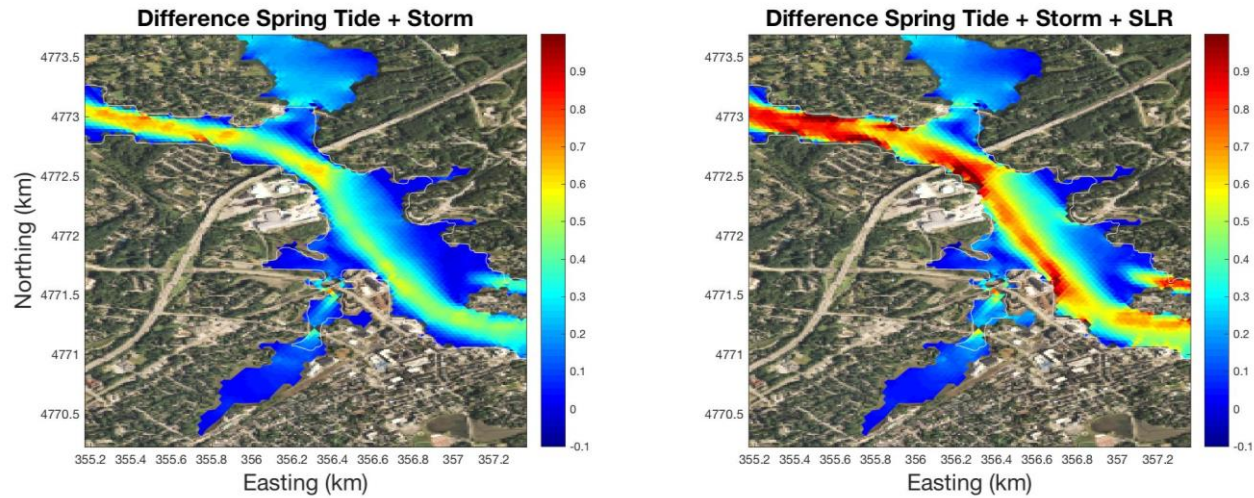
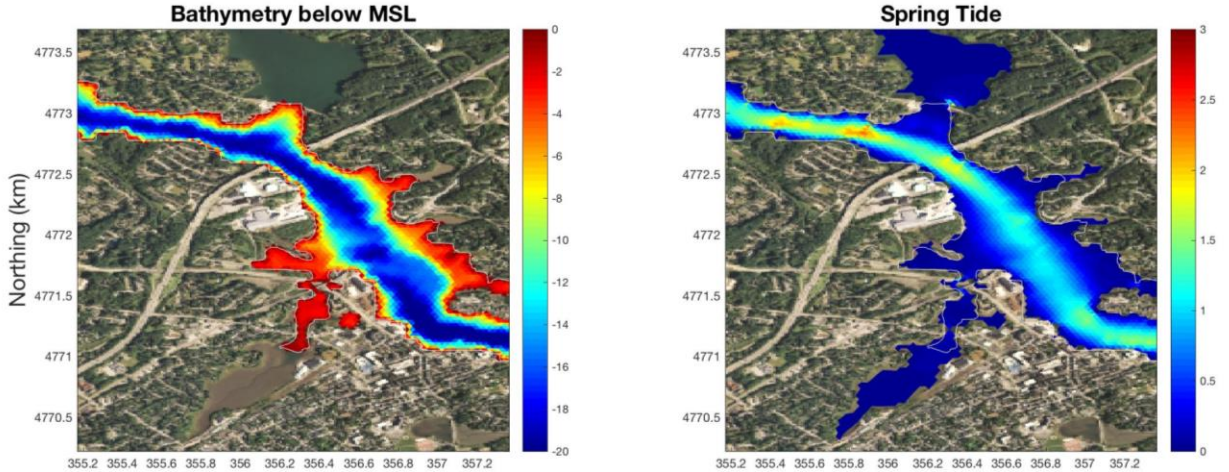
Max Flood Current (m/s) 100 yr Storm, 2100 SLR



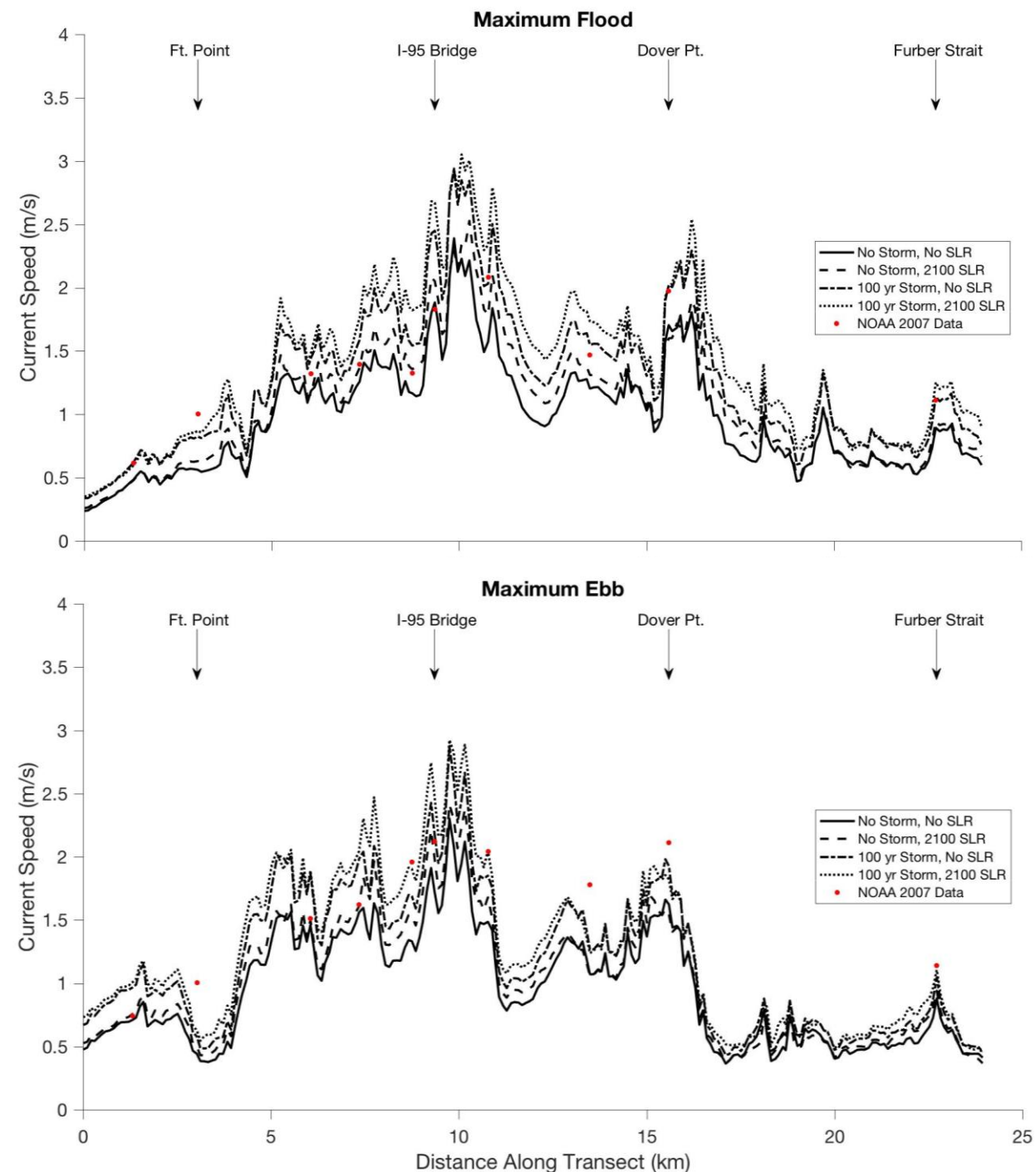
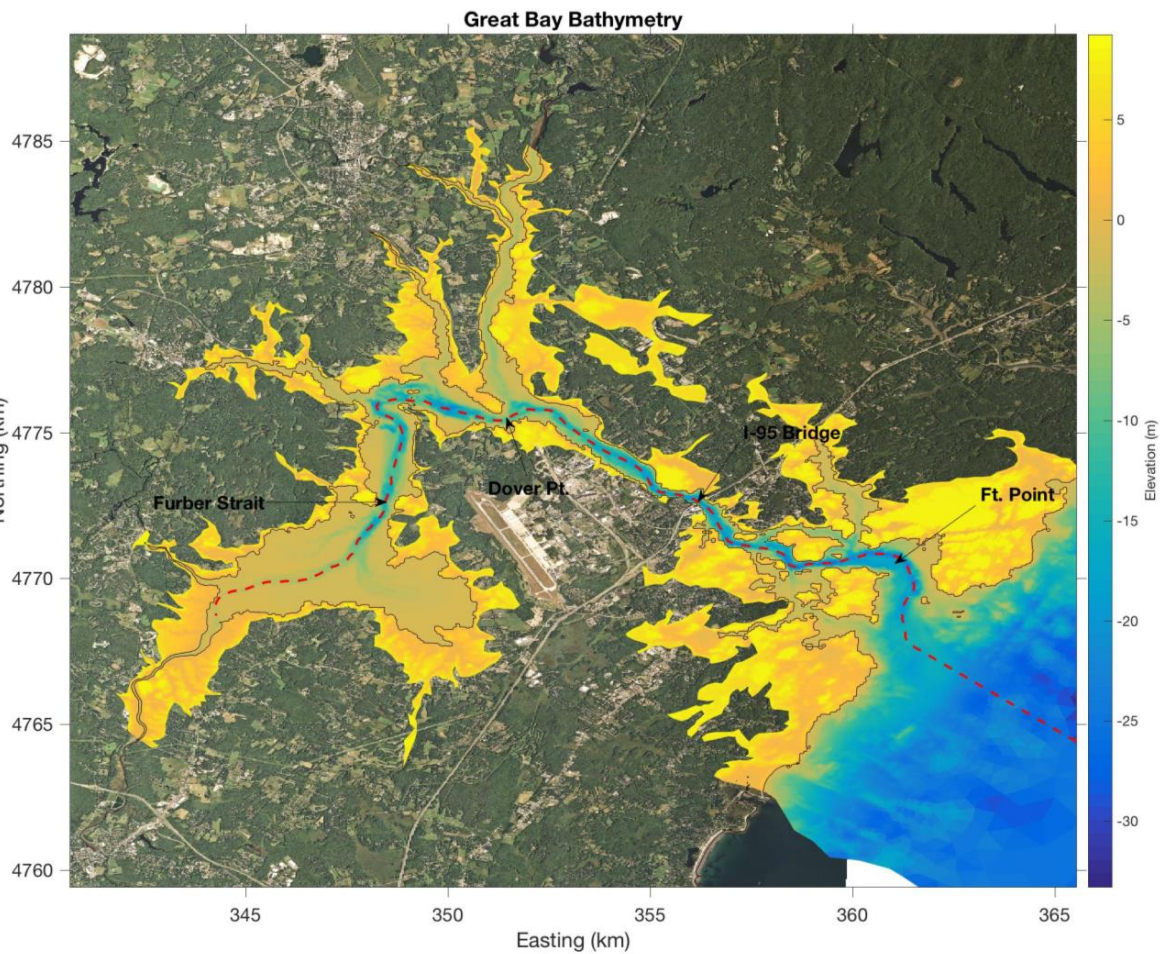
Flood Currents



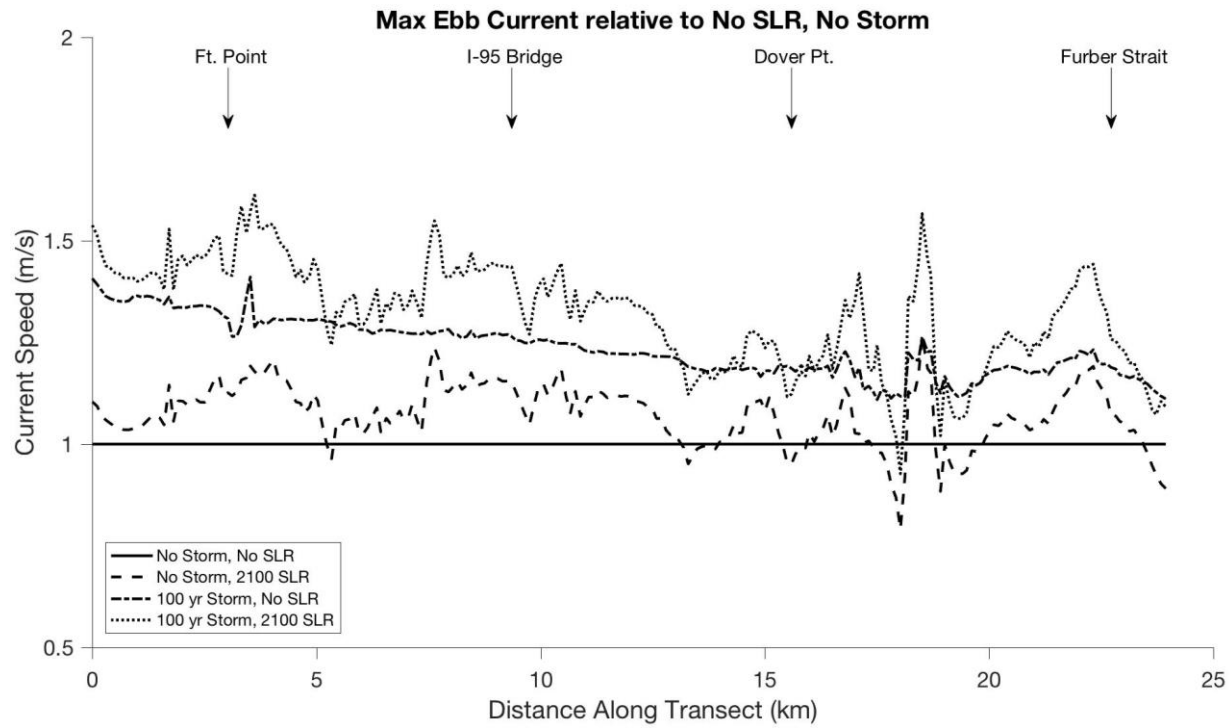
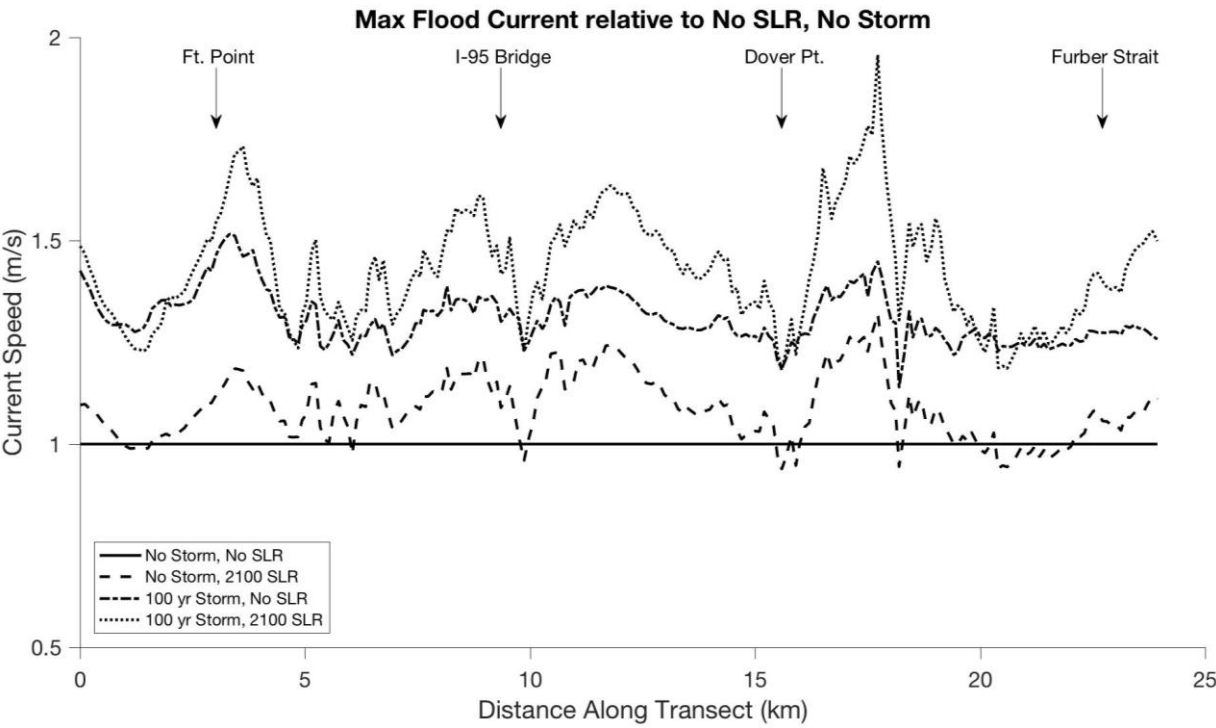
Ebb Currents



Max currents along center channel Great Bay



Fractional Change in Max currents along center channel Great Bay



				SLR No Surge	No SLR Surge	SLR Surge
Channel	Currents	(Fractional Change)				
Flood	Avg	1		1.09	1.31	1.43
	Max	1		1.32	1.52	1.97
Ebb	Avg	1		1.07	1.23	1.32
	Max	1		1.26	1.41	1.61

Conclusions/Summary

Numerical hydrodynamic models have been established for GBE (and HSE)
(Presently have not considered ocean waves)

Link to Surge models (NACCS) for Storm Impacts (e.g., 10%, 1%, 0.1% return periods)

Consider SLR as part of the modeling (e.g., 2100 & 2060 NOAA High Scenarios)

Sync the surge to tidal cycles (e.g., max spring tide, or approximate MHW)

Estimate: Inundation, Max. Sea Surface Elevation, Flood Depth/Duration, & Current Velocity Changes

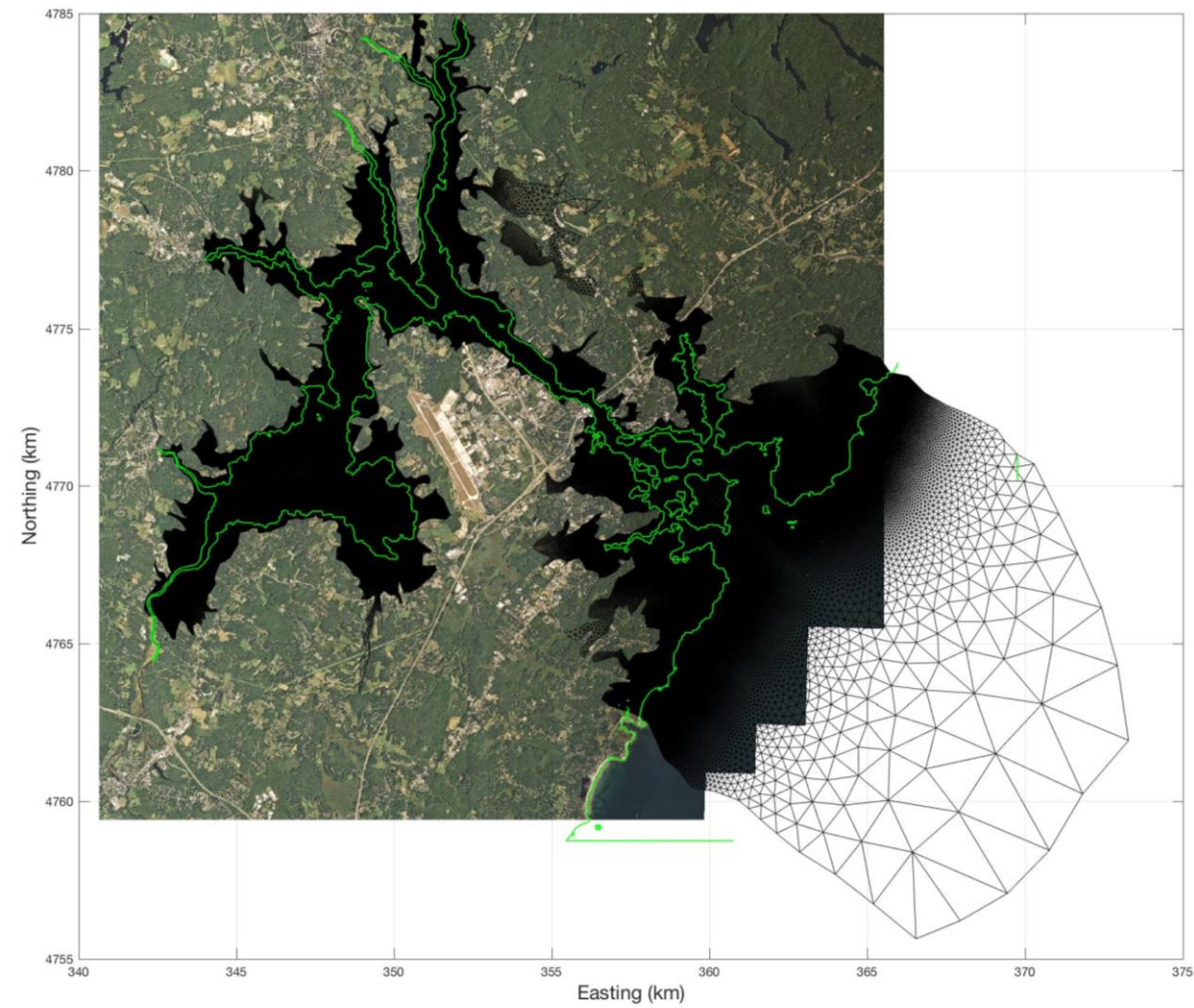
- *Inundation and Flooding for economic impact analysis...

- *Currents for navigation, sediment transport, & engineering design...

Max Currents: Increases significantly in the Piscataqua River/Great Bay (10-40%);
under SLR alone, surge alone, and SLR + Surge.

Model Grids

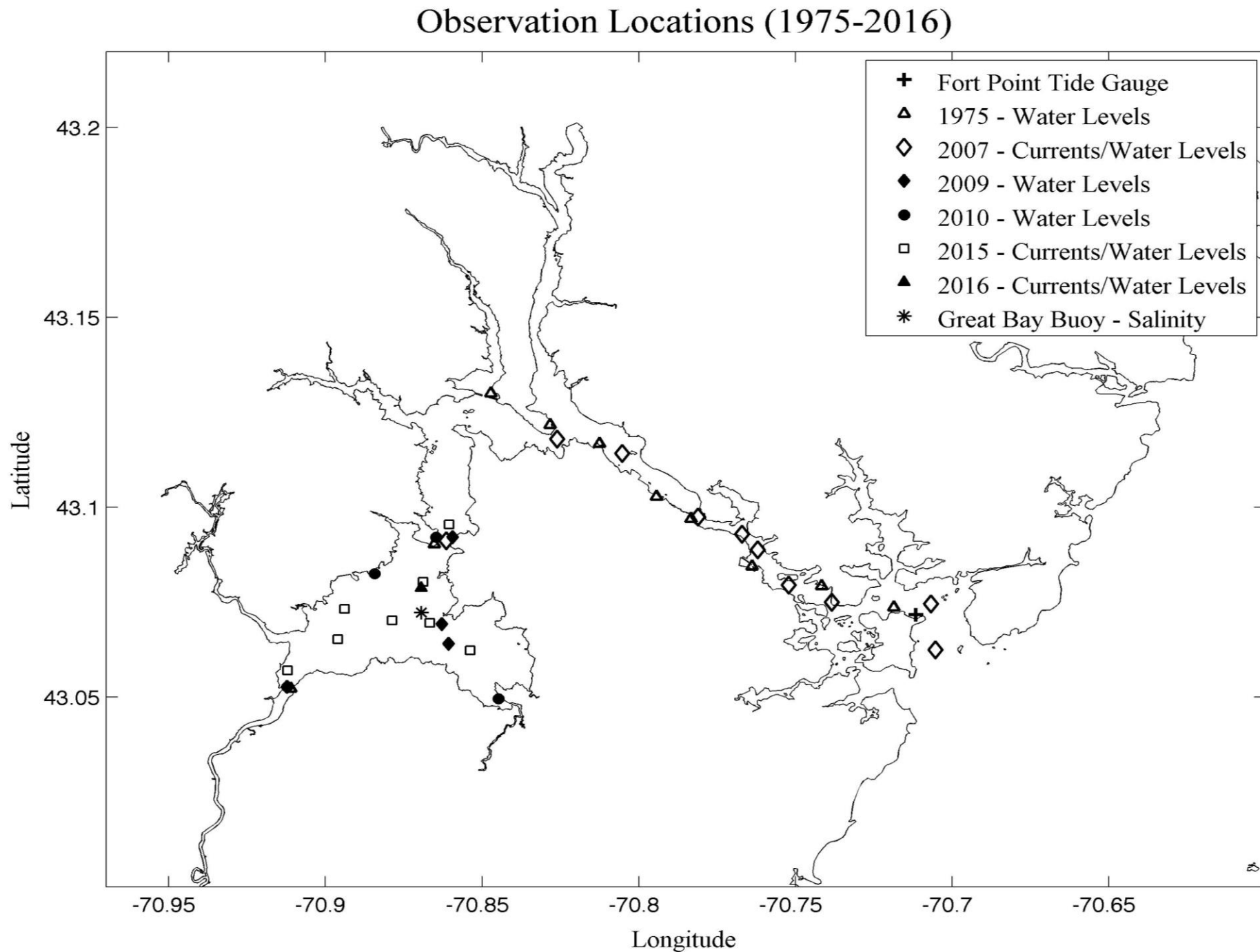
Can be rectilinear (or curvilinear), e.g., ROMS or Unstructured, e.g, FVCOM



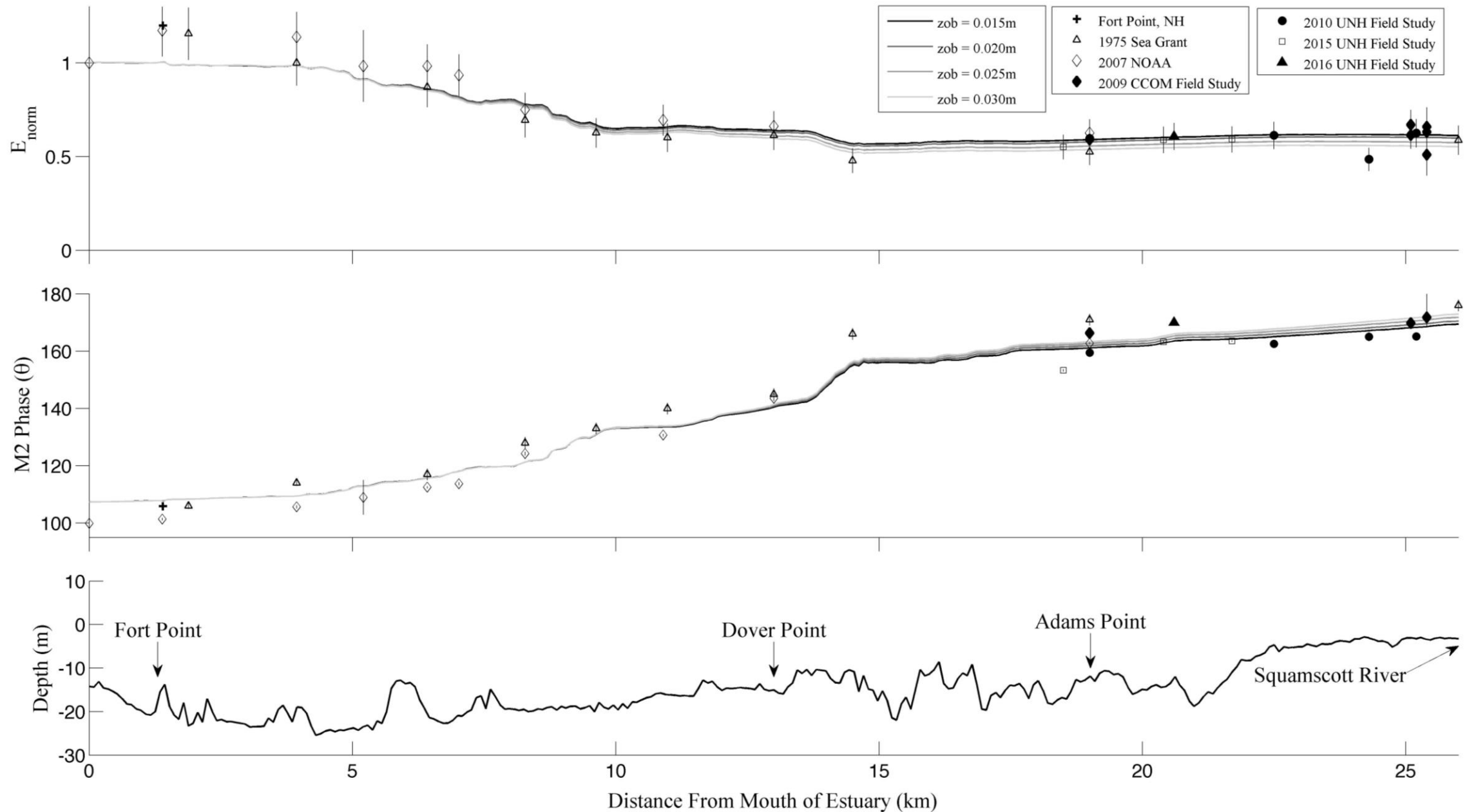
Field Verification

Instrument Locations

(Cook, Lippmann, and Irish)



M2 Tidal Amplitude & Phase Evolution (Cook, Lippmann, and Irish, 2018)



Field Verification

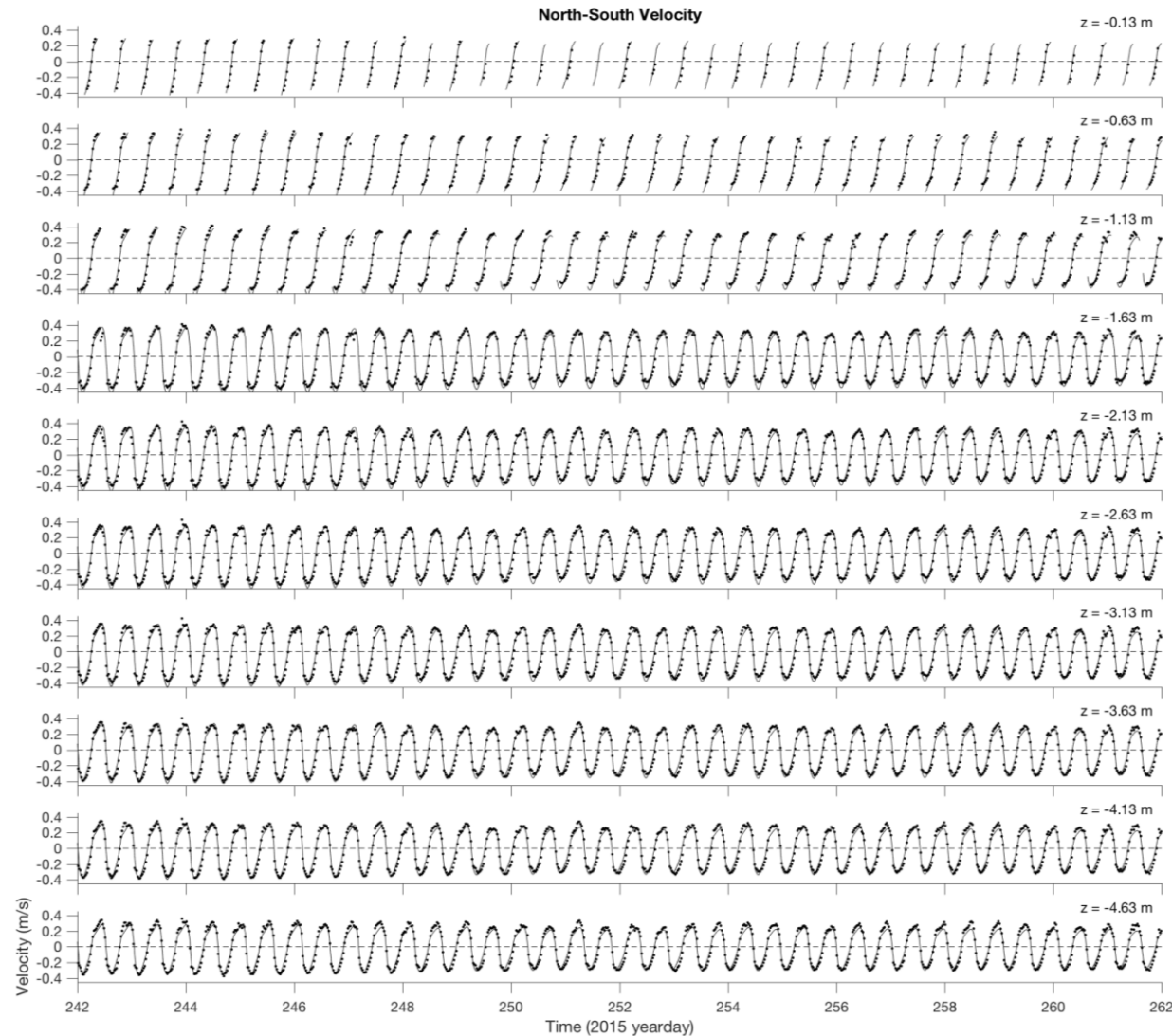
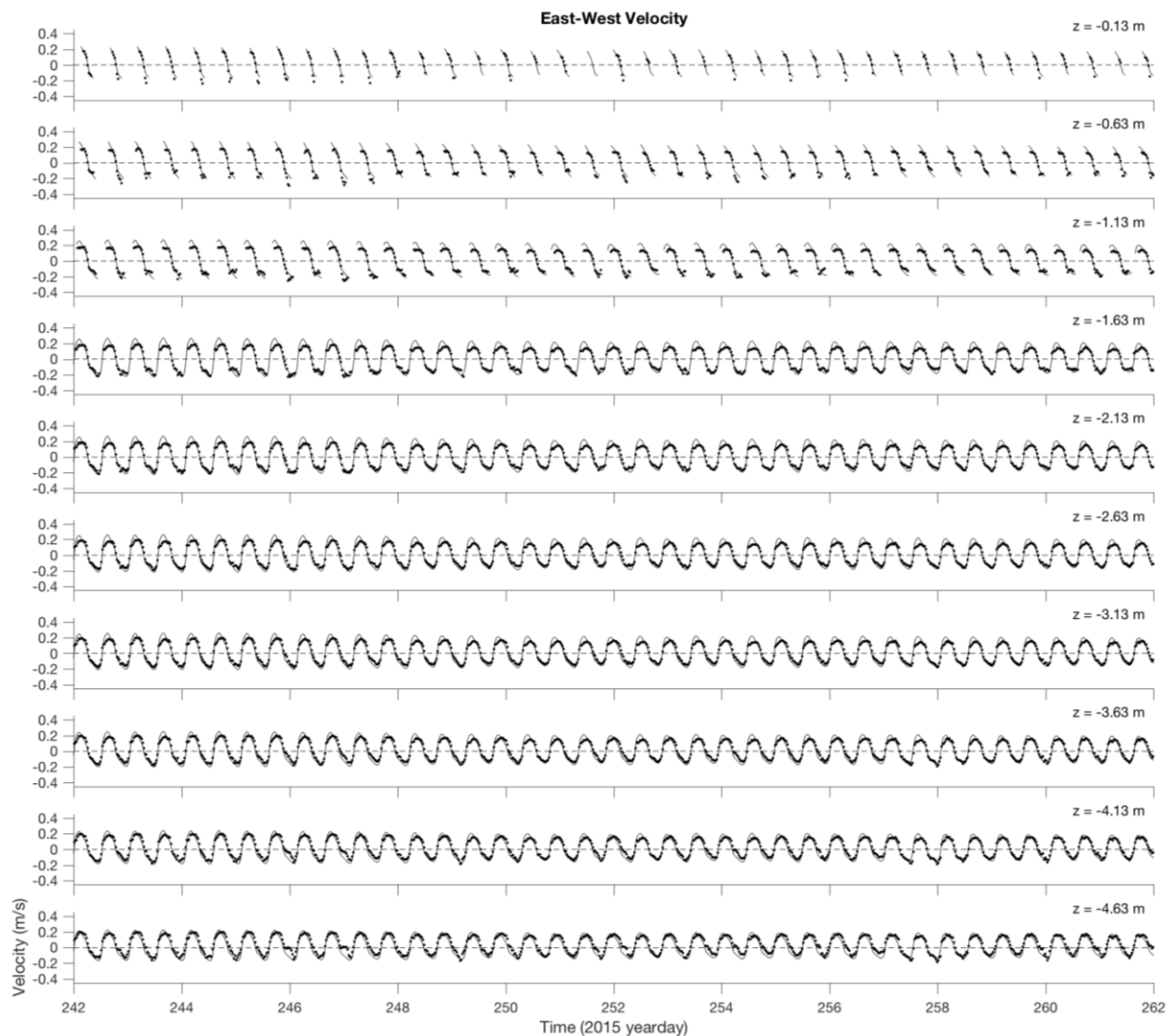
(Cook, Lippmann, and Irish, 2018)

RMS errors:

Sea surface elevation 0.096 m

East-west velocities 0.054 m/s

North-south velocities 0.060 m/s



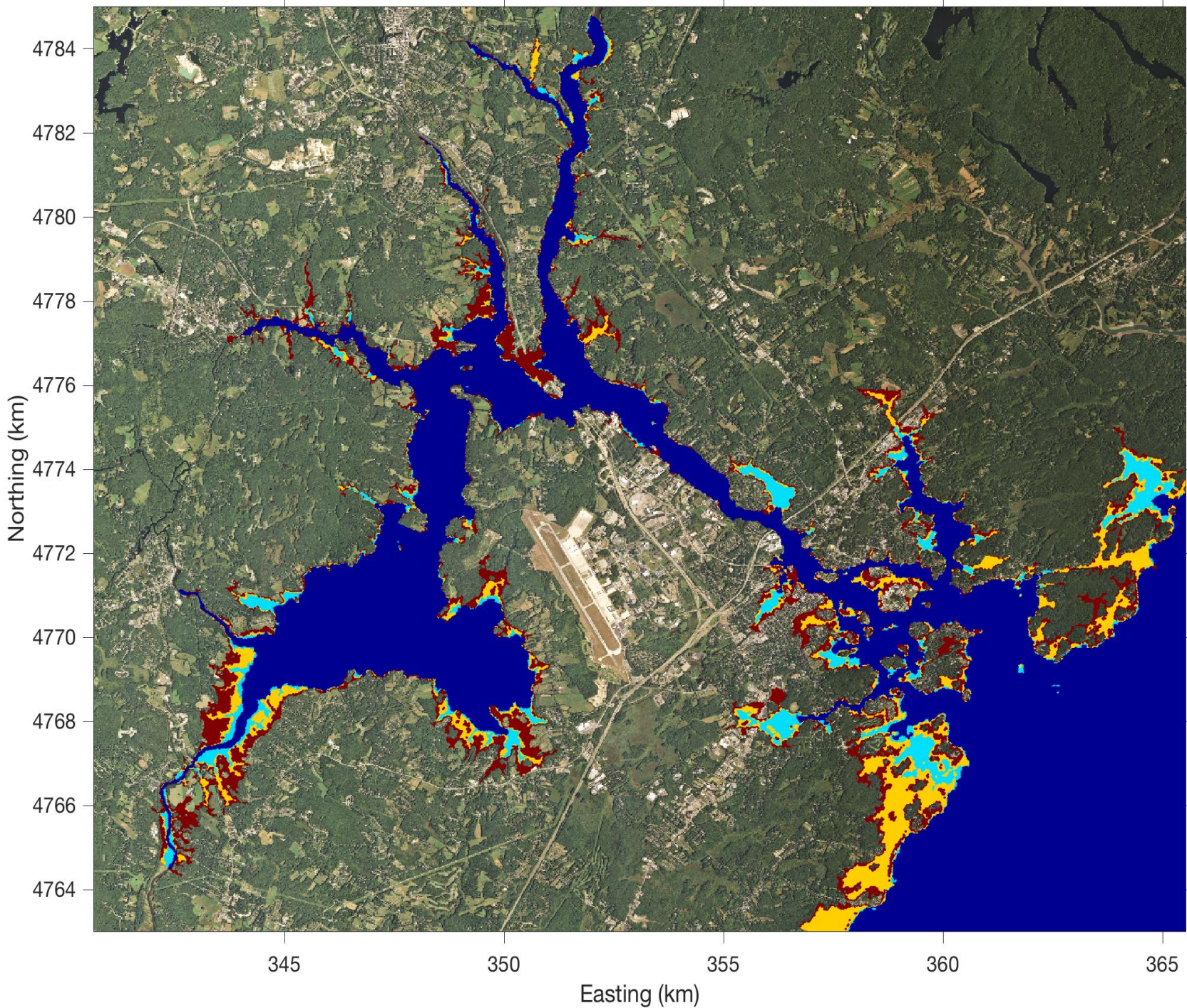
Simulated Inundation Map for Great Bay

Spring Tide
100-Year Storm
2100 SLR High (1.92 m)

Areal inundation (km²)
(fractional change):

SLR No Surge	No SLR Surge	SLR Surge
-----------------	-----------------	--------------

77.17 (1.32)	70.46 (1.21)	86.8 (1.49)
-----------------	-----------------	----------------



Max Water Level change along center channel Great Bay

