CHC-NSC 2018

www.chc-nsc2018.ca

Linking Hydrographic Data Acquisition and Processing to Ocean Model Simulations

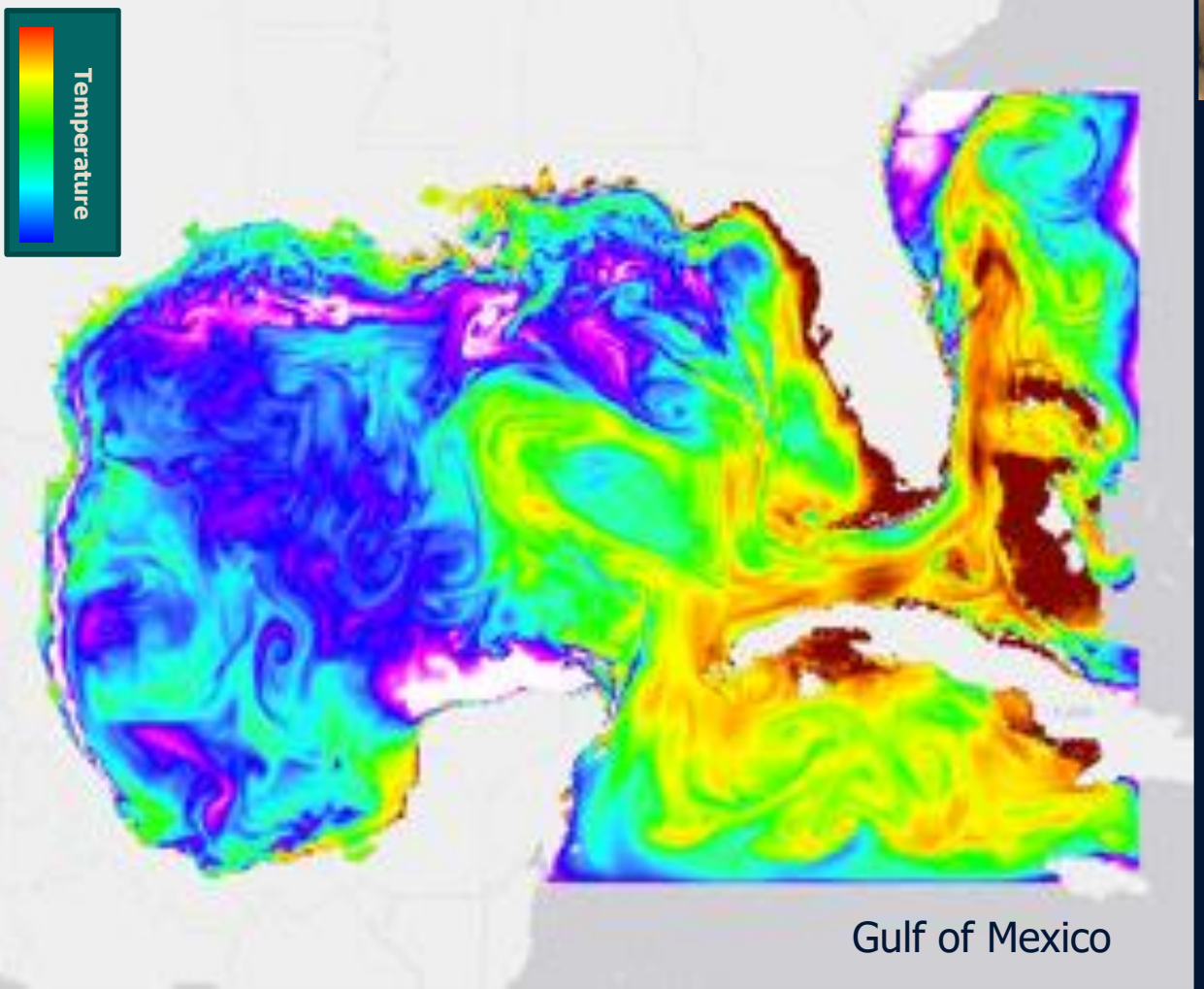
Ian Church

2018

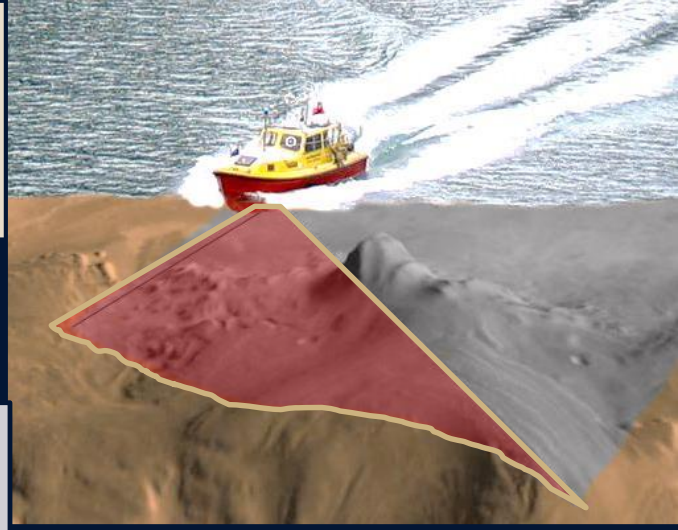
EST. 1785 UNIVERSITY OF NEW BRUNSWICK | Engineering Fredericton

Ocean Modelling

Simulating the Ocean Environment



Gulf of Mexico



Model Output

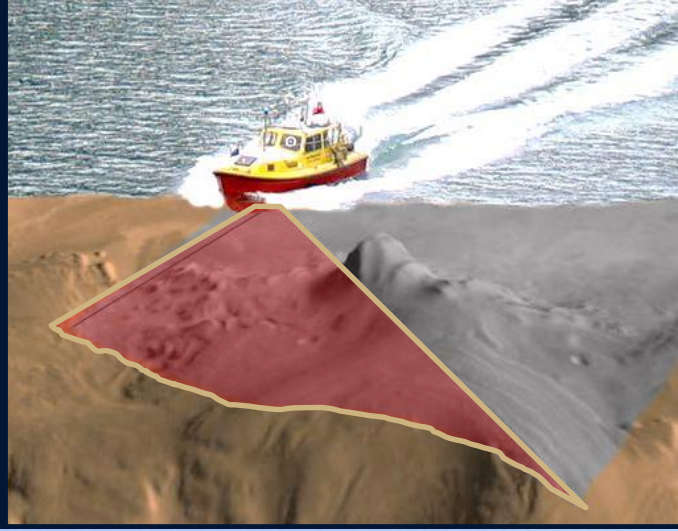
Tides
Currents
Temperature
Salinity

Model Input

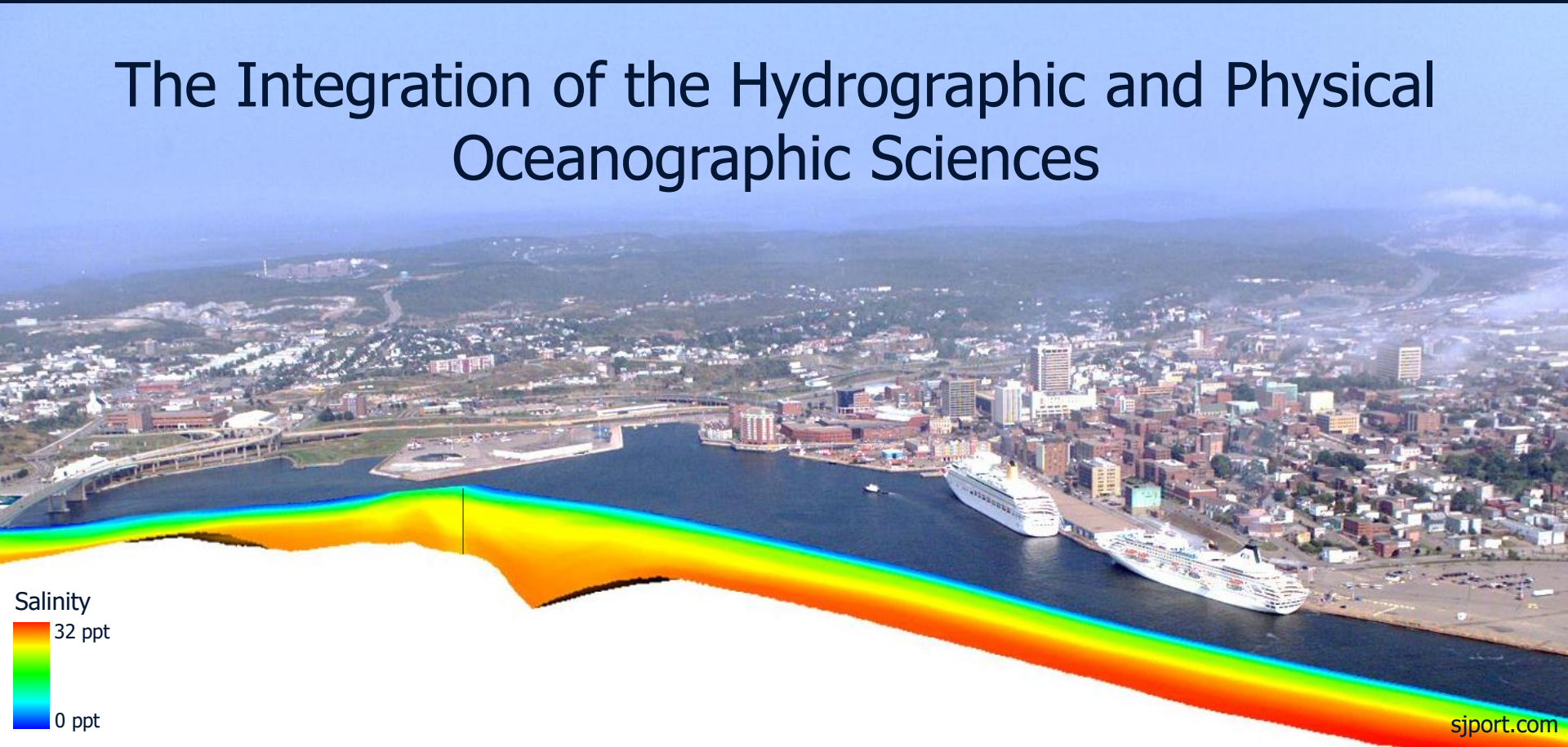
Bathymetry
Coastline
Seafloor Roughness
Sediment Distribution

How can ***Ocean Modelling*** data be used to assist **Ocean Mapping**?

How **Ocean Mapping** data be used to assist ***Ocean Modelling***?



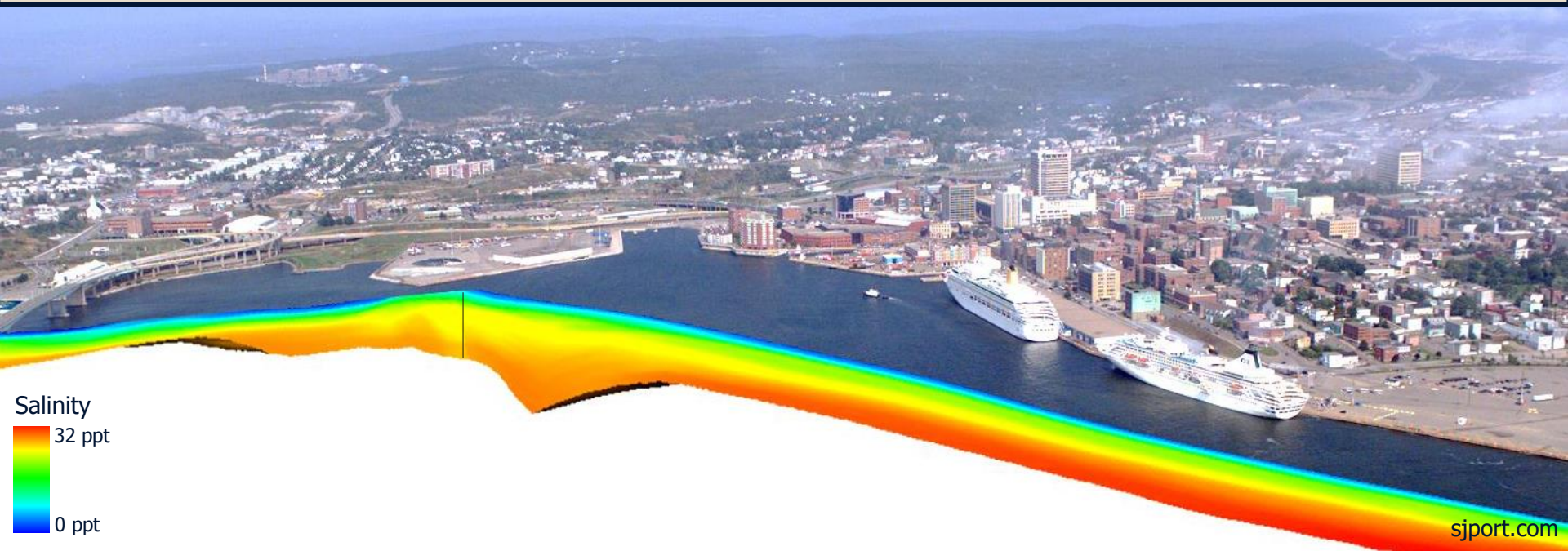
The Integration of the Hydrographic and Physical Oceanographic Sciences



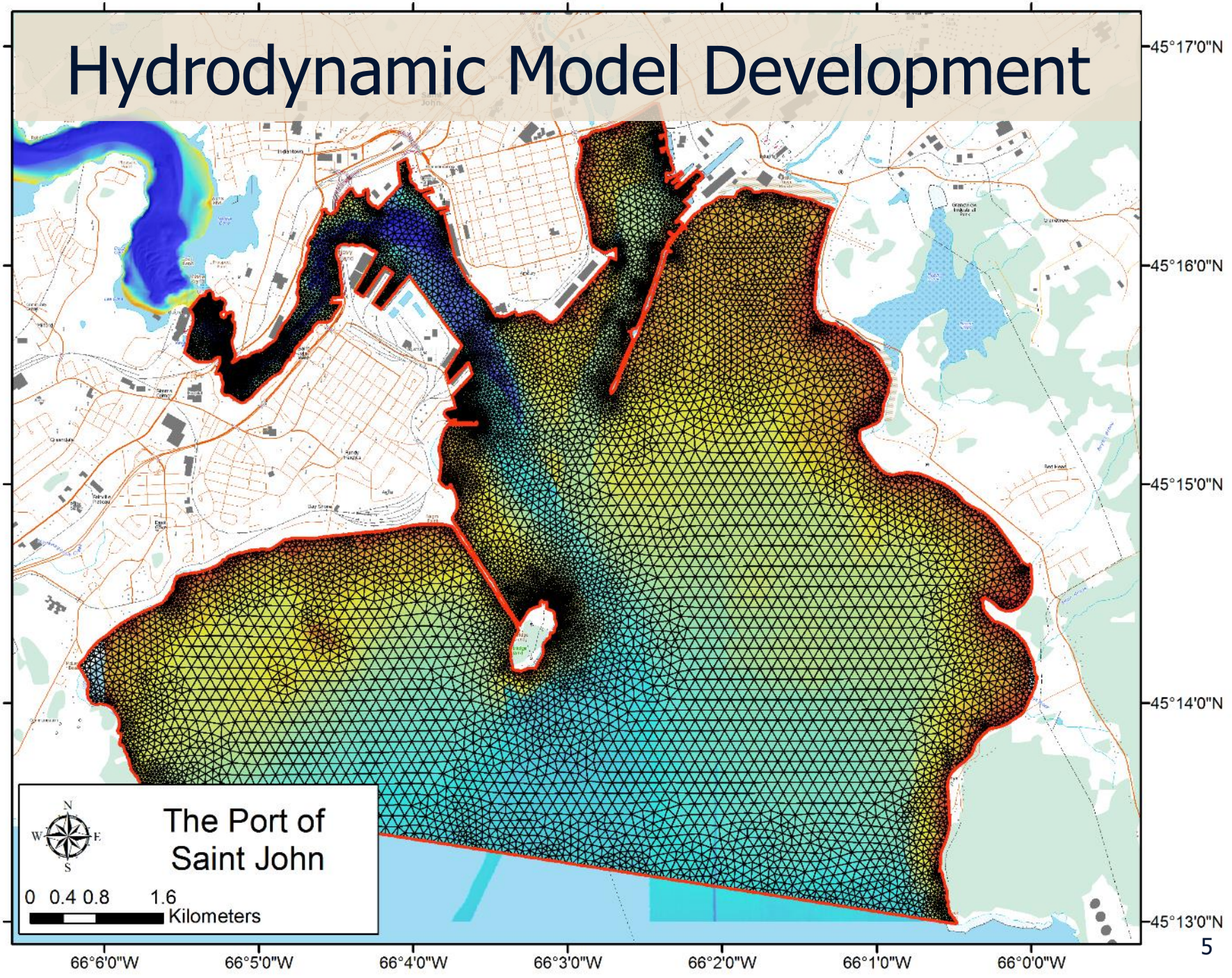
Integrating Hydrodynamic Model Data and Seabed Mapping

Ocean Modelling in a Complex Estuary

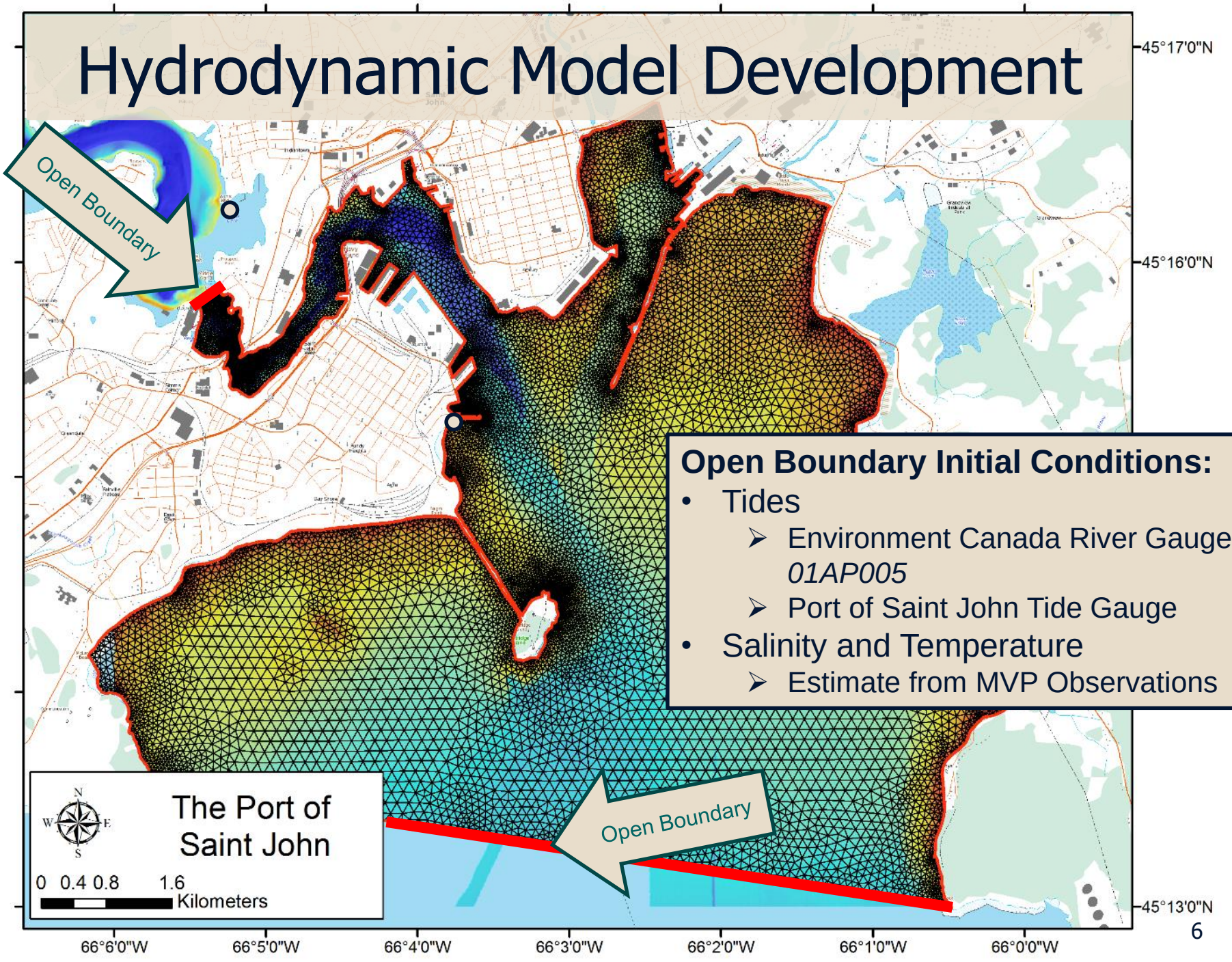
Test Case: Port of Saint John, New Brunswick



Hydrodynamic Model Development

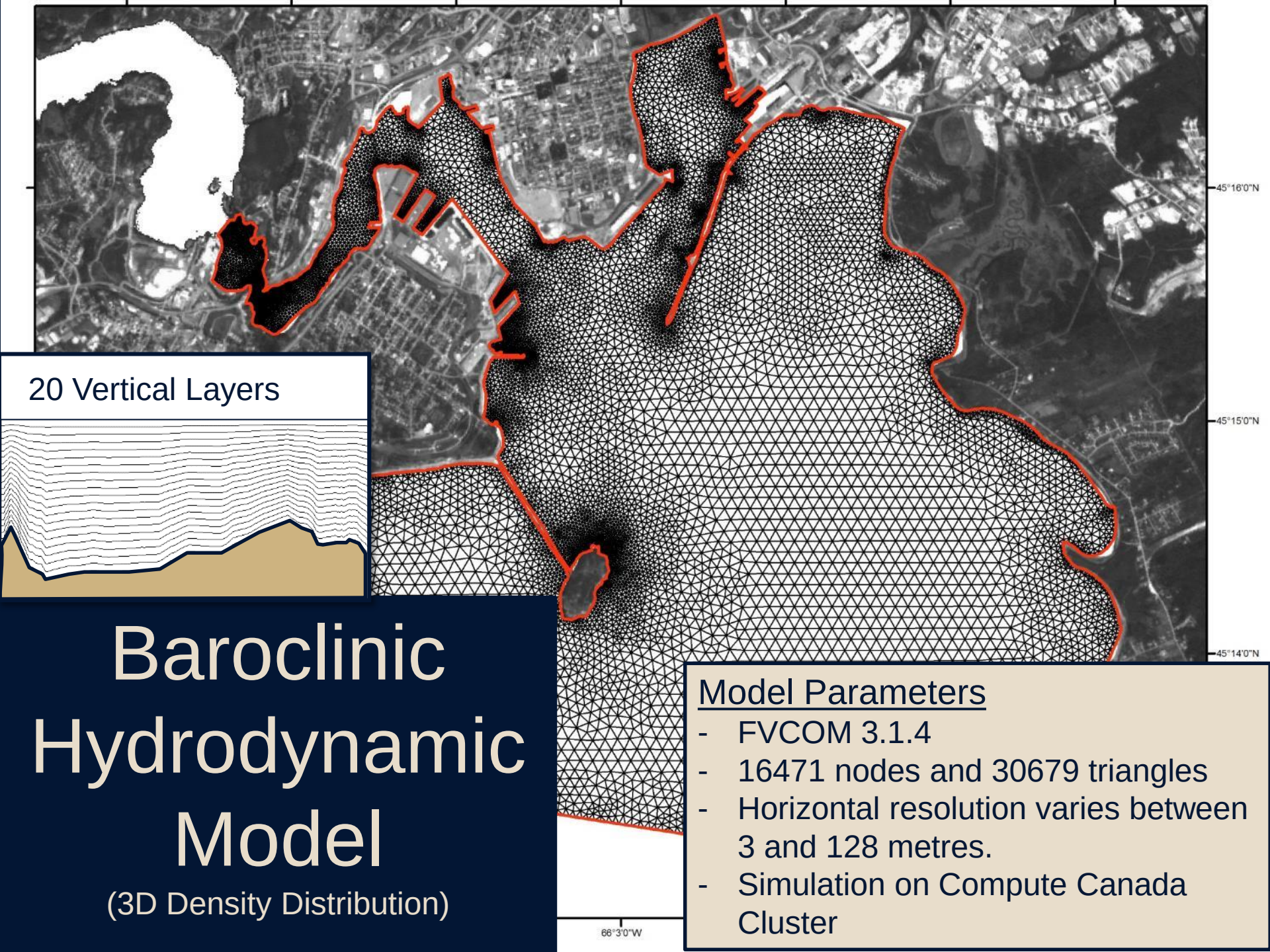


Hydrodynamic Model Development



Open Boundary Initial Conditions:

- Tides
  - Environment Canada River Gauge *01AP005*
  - Port of Saint John Tide Gauge
- Salinity and Temperature
  - Estimate from MVP Observations



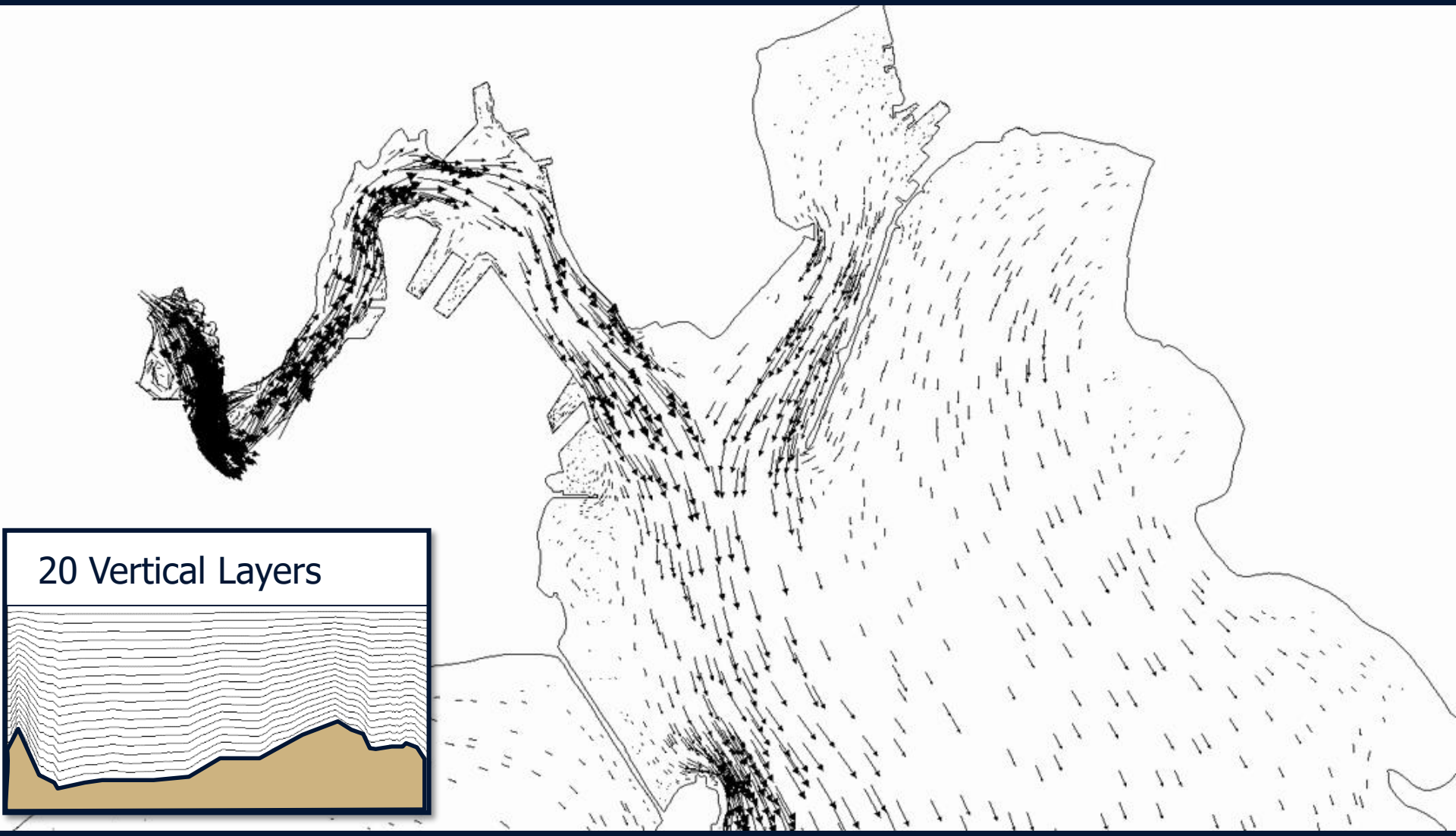
Baroclinic Hydrodynamic Model

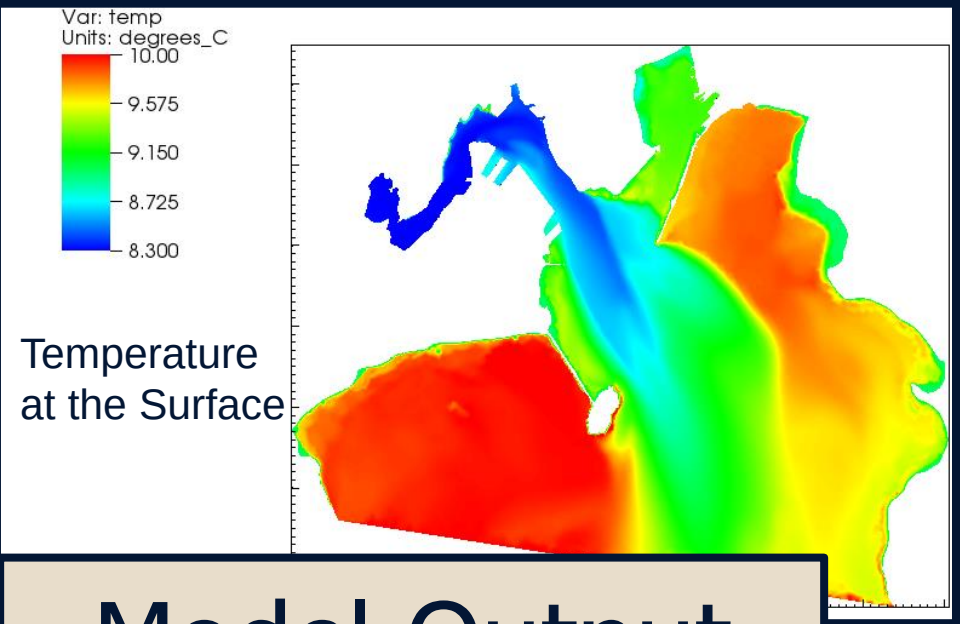
(3D Density Distribution)

Model Parameters

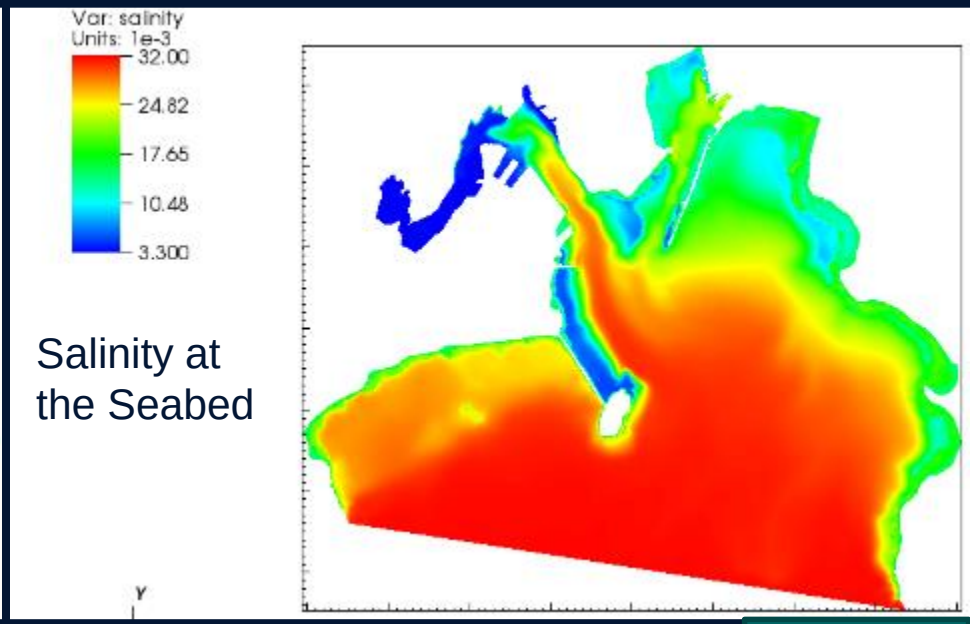
- FVCOM 3.1.4
- 16471 nodes and 30679 triangles
- Horizontal resolution varies between 3 and 128 metres.
- Simulation on Compute Canada Cluster

Surface Current Velocities



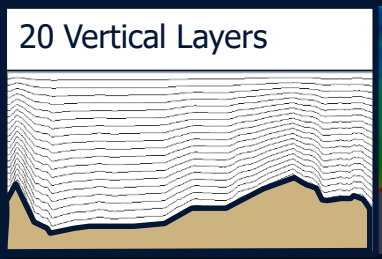


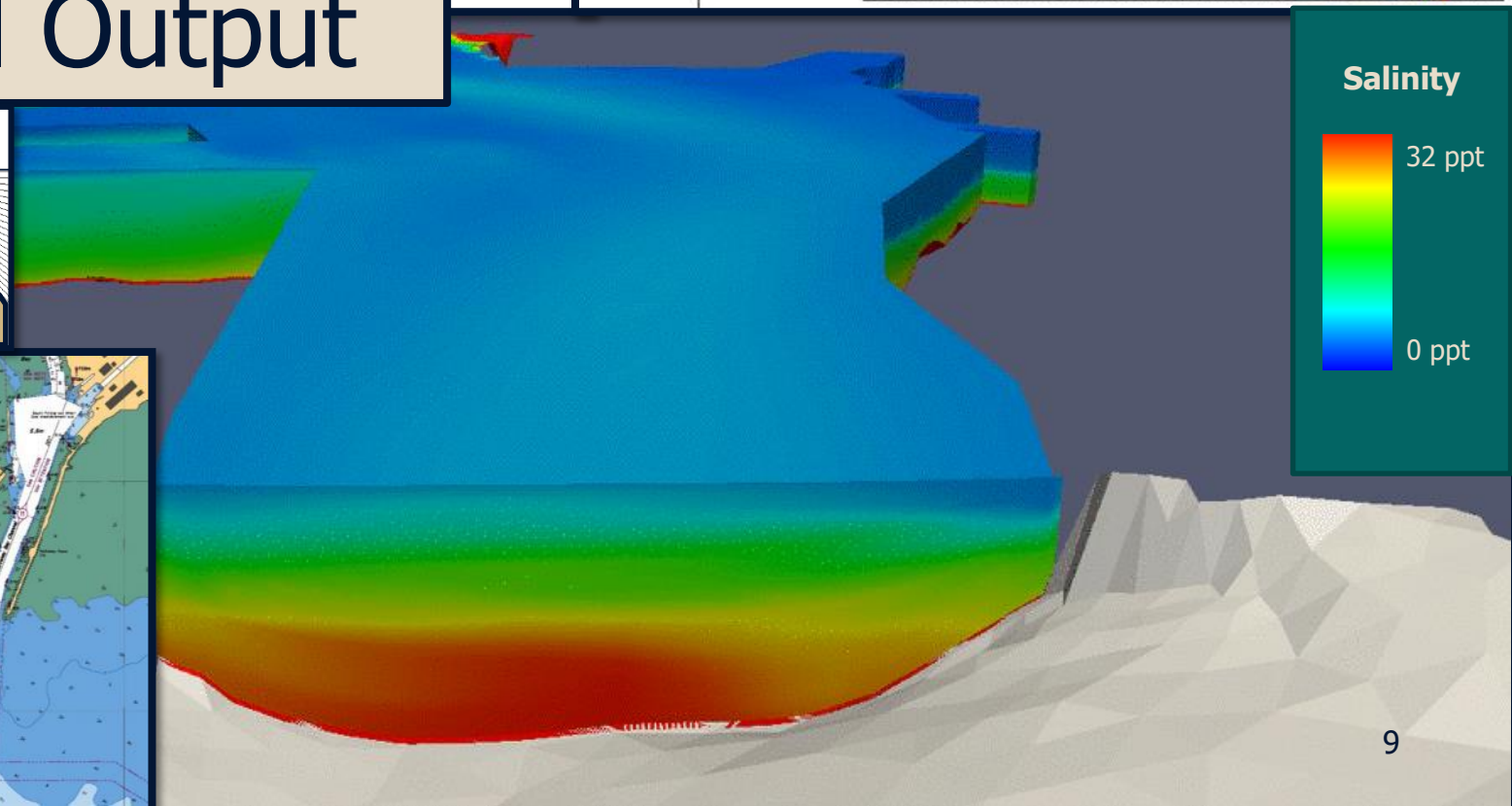
Temperature at the Surface



Salinity at the Seabed

Model Output



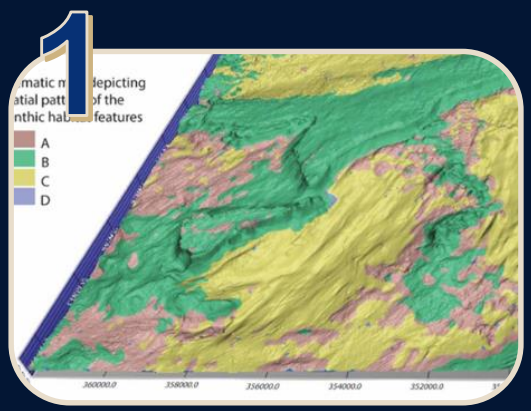


Ocean Modelling & Hydrography

Time	Presentation
Wednesday 14 h 00 - 14 h 20	*Canada's Continuous Vertical Datum (CVD)* Marlene Jeffries, Canadian Hydrographic Service
Thursday 09 h 10 - 09 h 30	*Dynamic Information in Support of Safe and Efficient Navigation in Canada.* Louis Maltais, Canadian Hydrographic Service

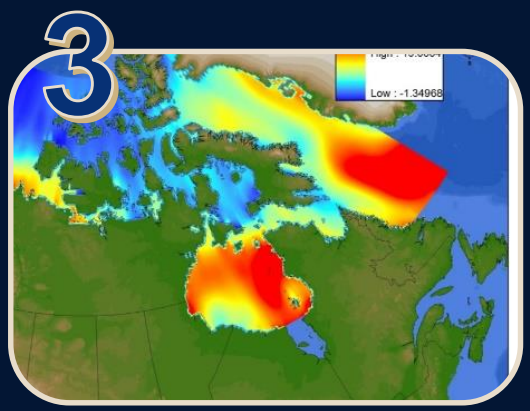
Canadian Hydrographic Service Model Derived Products

- Vertical Datum (CVD)
- Tides and Currents (OPP)



Habitat Mapping

Data Sharing



Crowd Sourced Bathymetry

Current Research

WHAT IS HAPPENING NOW

EST. 1785
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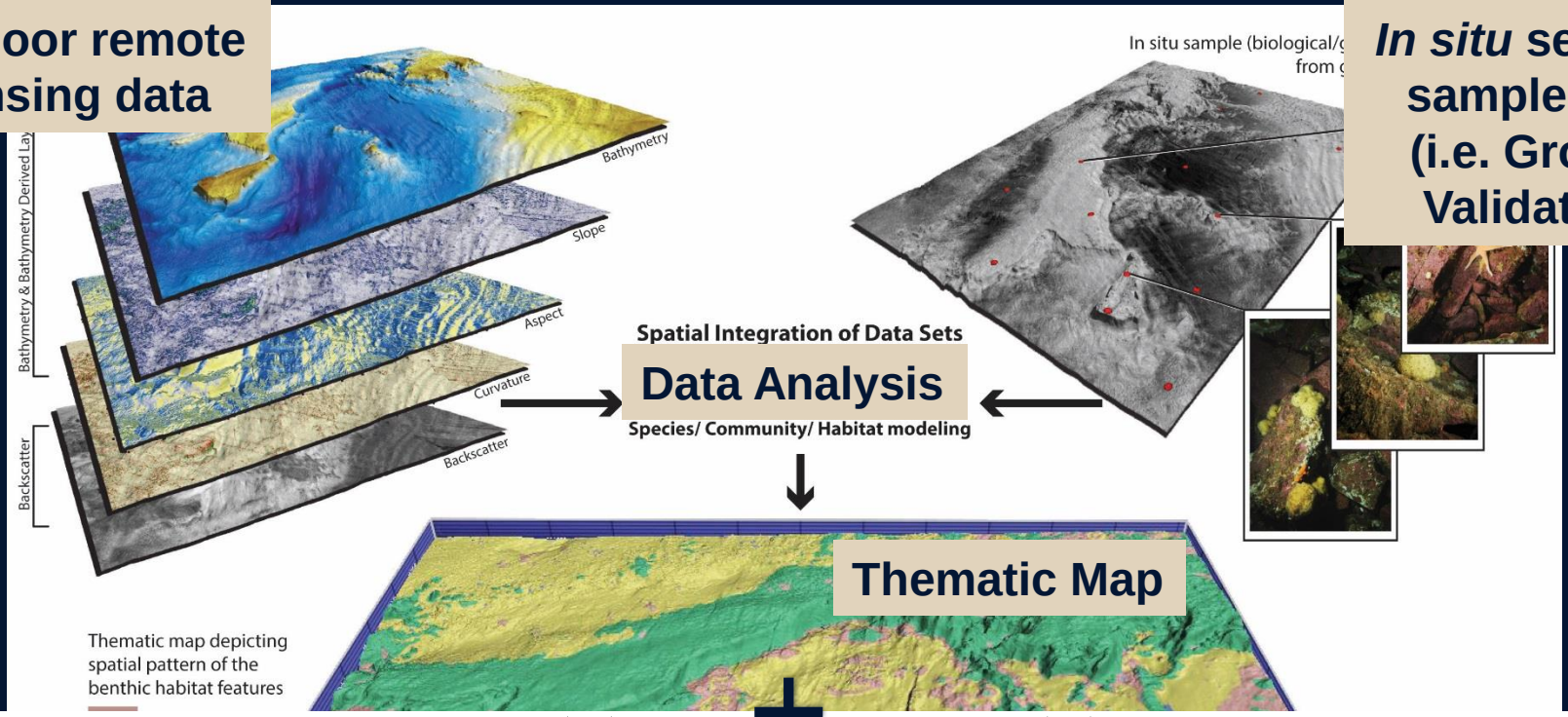
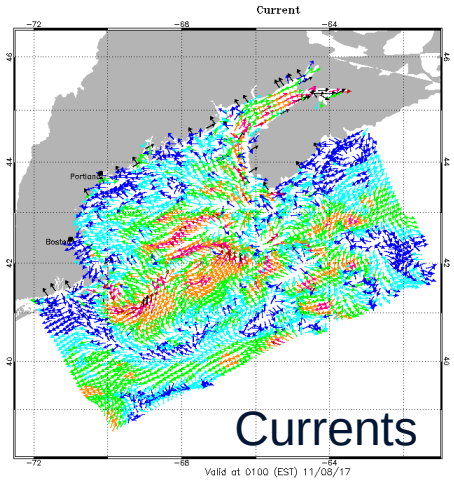
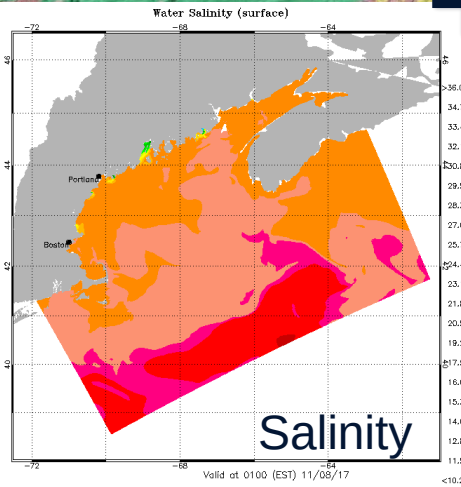
1 Bay of Fundy Habitat Mapping + Oceanographic Modelling

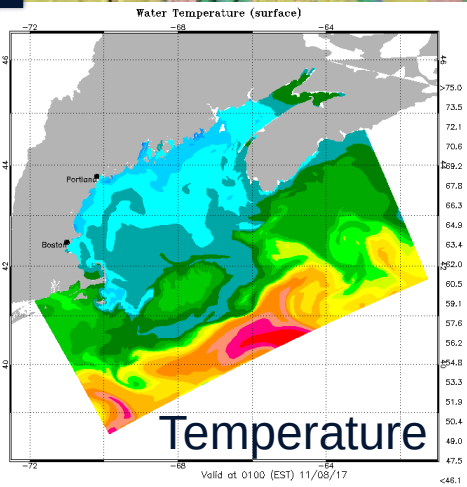
Seafloor remote sensing data

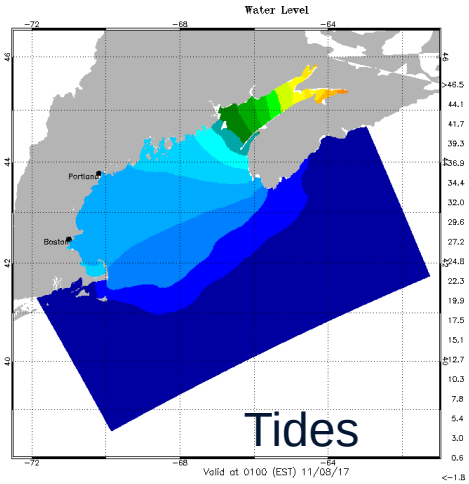
In situ seafloor sample data (i.e. Ground Validation)









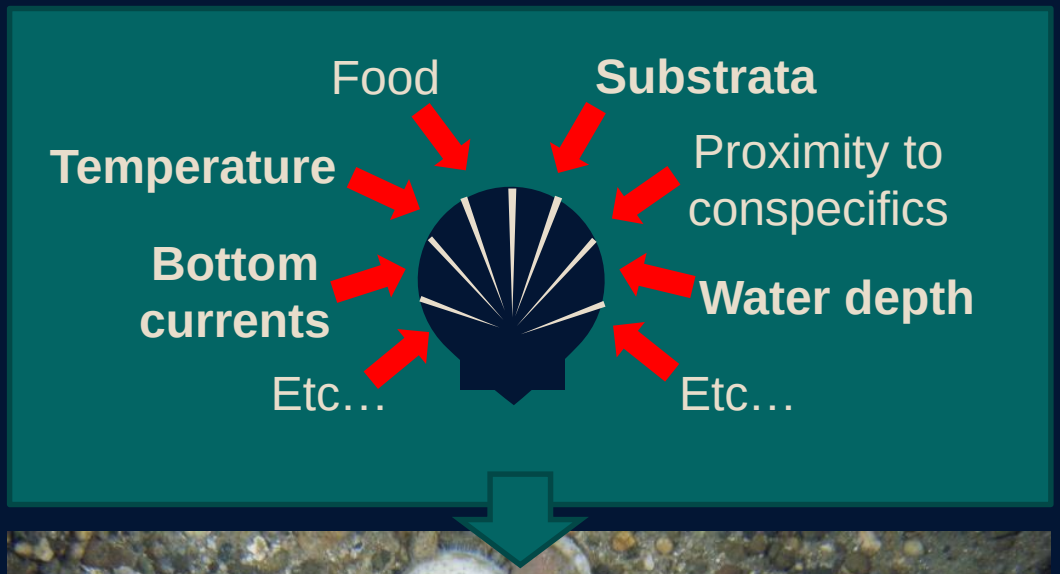


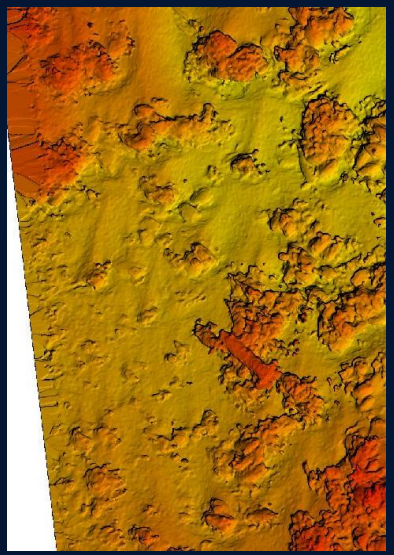
Habitat Mapping

NSCC / UNB

Bay of Fundy

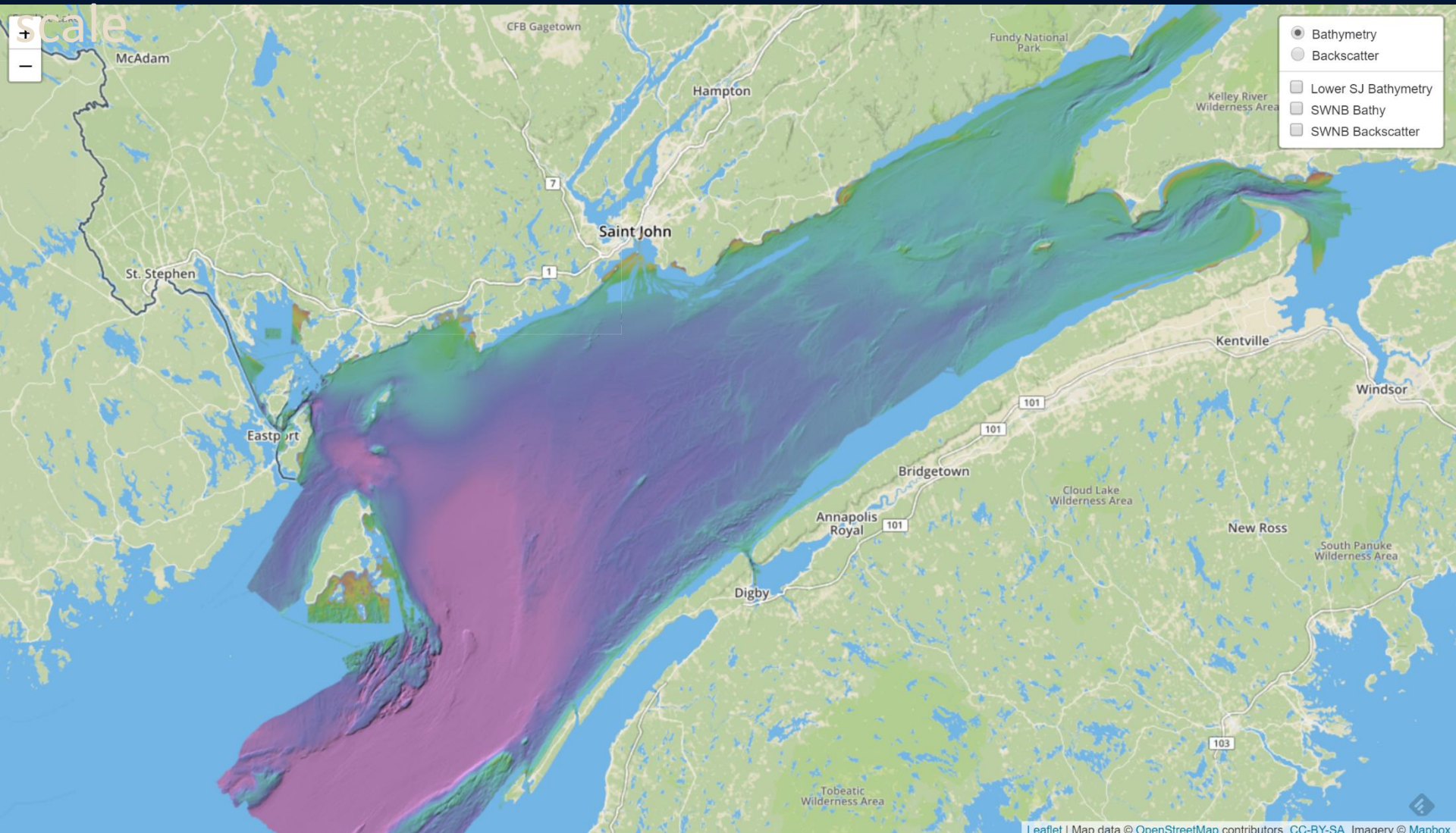
Dr. Craig Brown





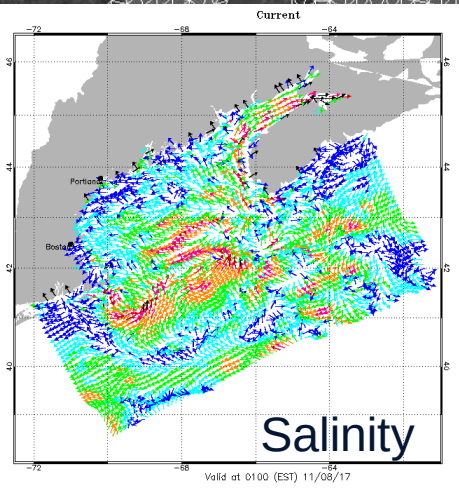
4k Drop Camera System

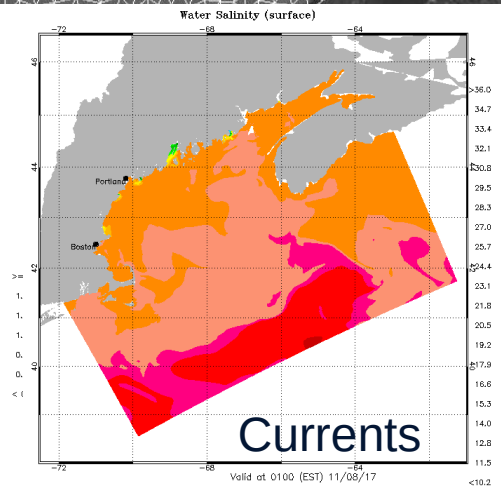
Develop methods to integrate **down-scaled baroclinic ocean circulation** and tidal current model simulations with MBES data into the habitat mapping methodology at fine spatial scale

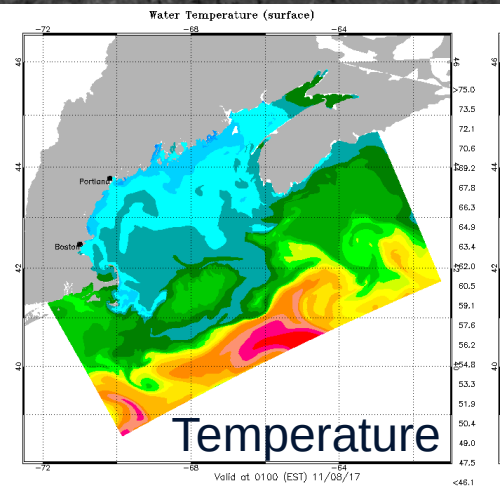


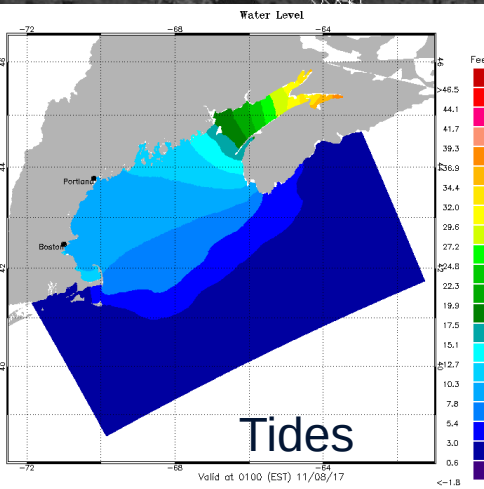
Numerical Modelling

Downscale Focused Operational Models

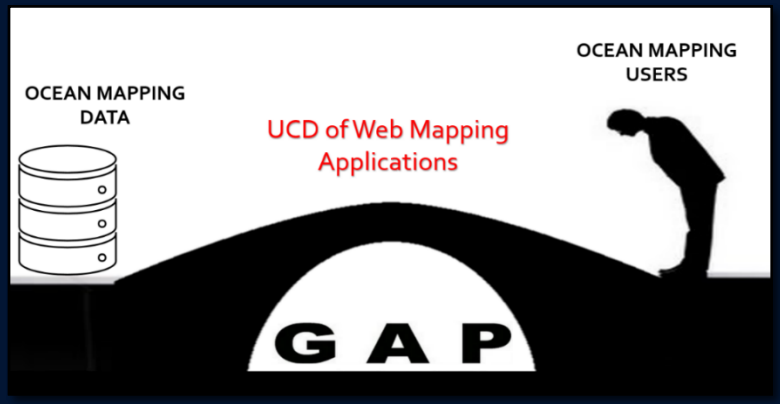






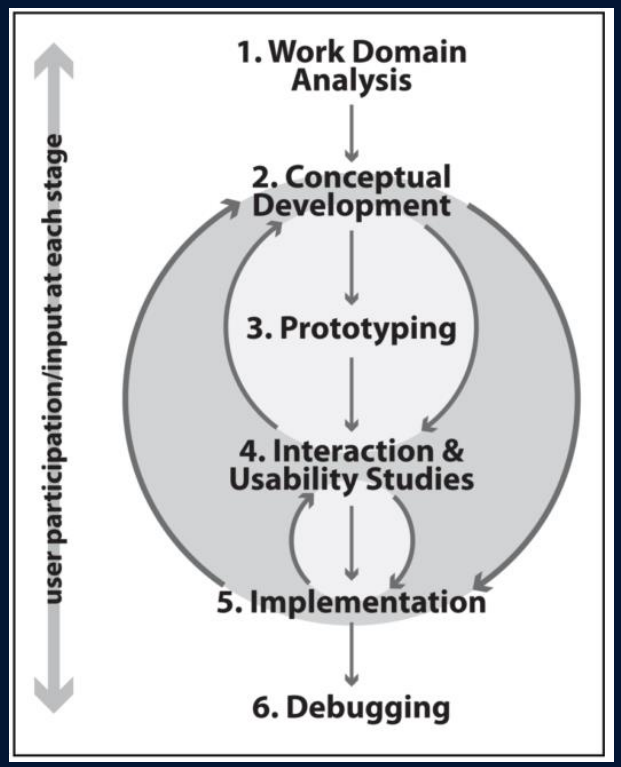


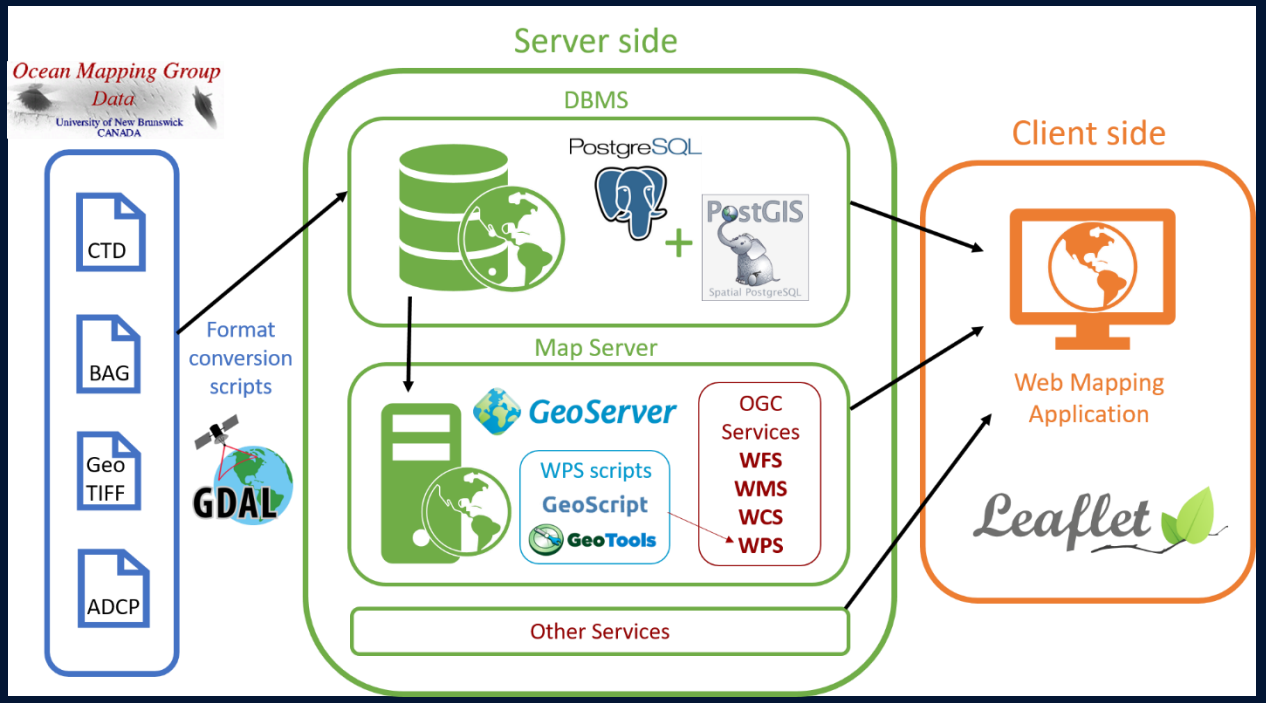
2 Ocean Mapping Data → Modelling

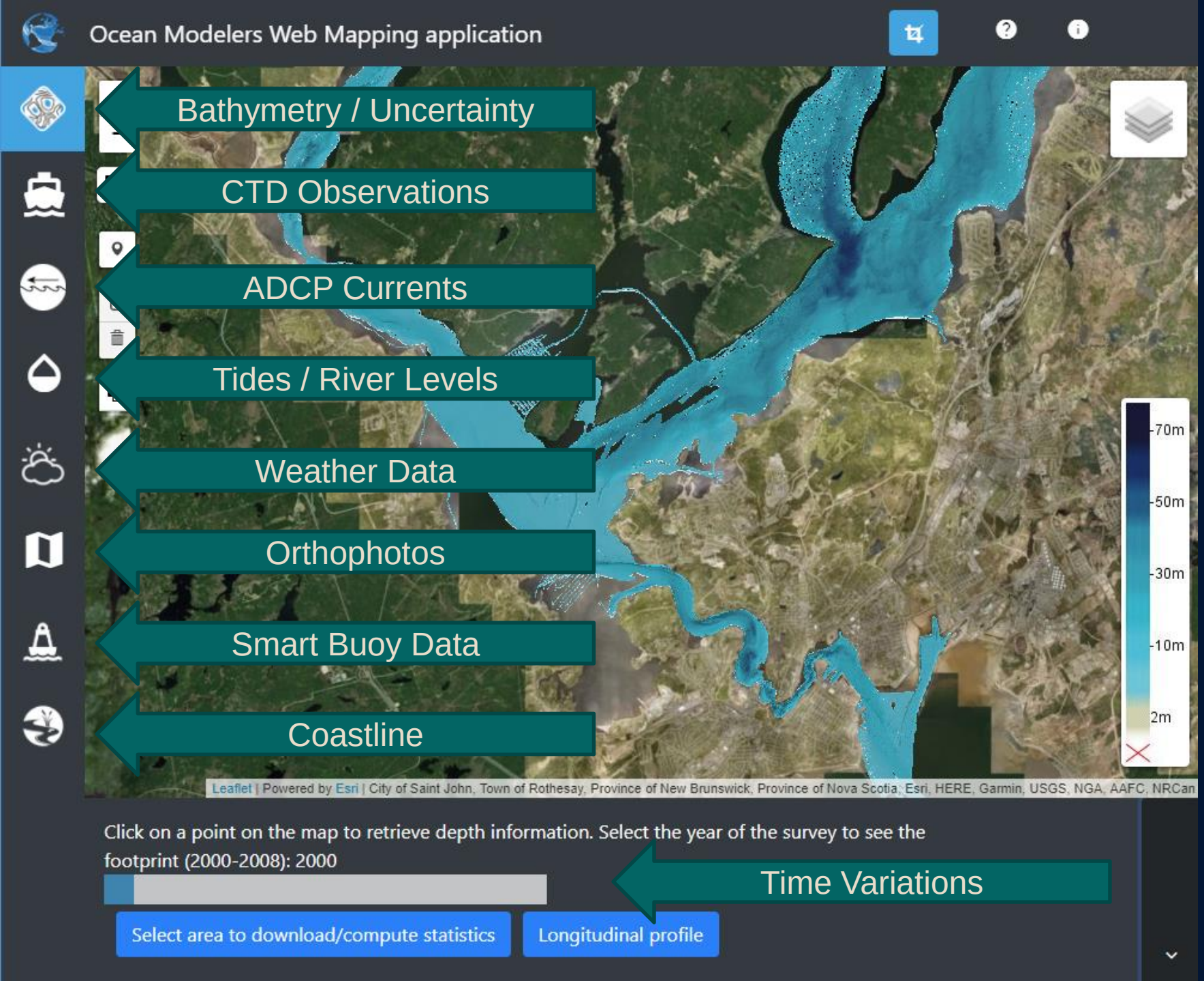


User Centered Design

- UNB MScEng Student – Marta Padilla Ruiz
- Hydrographers produce the data that Modellers need
- Focused online repository for Ocean Modelling
- User survey to the ocean modelling community





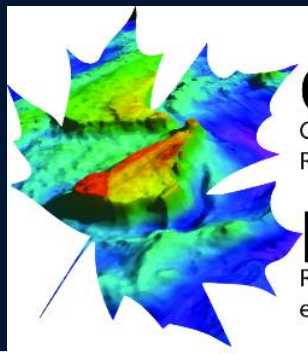


Ocean Mapping Data → Modelling

3

Crowd Sourced Bathymetry / Autonomous Vessel Collection

- MScEng Student – Khaleel Arfeen
- Augmenting CSB or ASV Data
  - Sound Speed Profiles from Regional Operational Models
  - Tidal Prediction & Vertical Datum Establishment
  - Automated Processing



COMREN
Canadian Ocean Mapping Research & Education Network

RéCREH
Réseau Canadien de Recherche et d'Enseignement en Hydrographie

UNB
EST. 1785
UNIVERSITY OF NEW BRUNSWICK

CIDCO

MARINE INSTITUTE

MEMORIAL UNIVERSITY

LASSONDE SCHOOL OF ENGINEERING

YORK UNIVERSITÉ UNIVERSITY

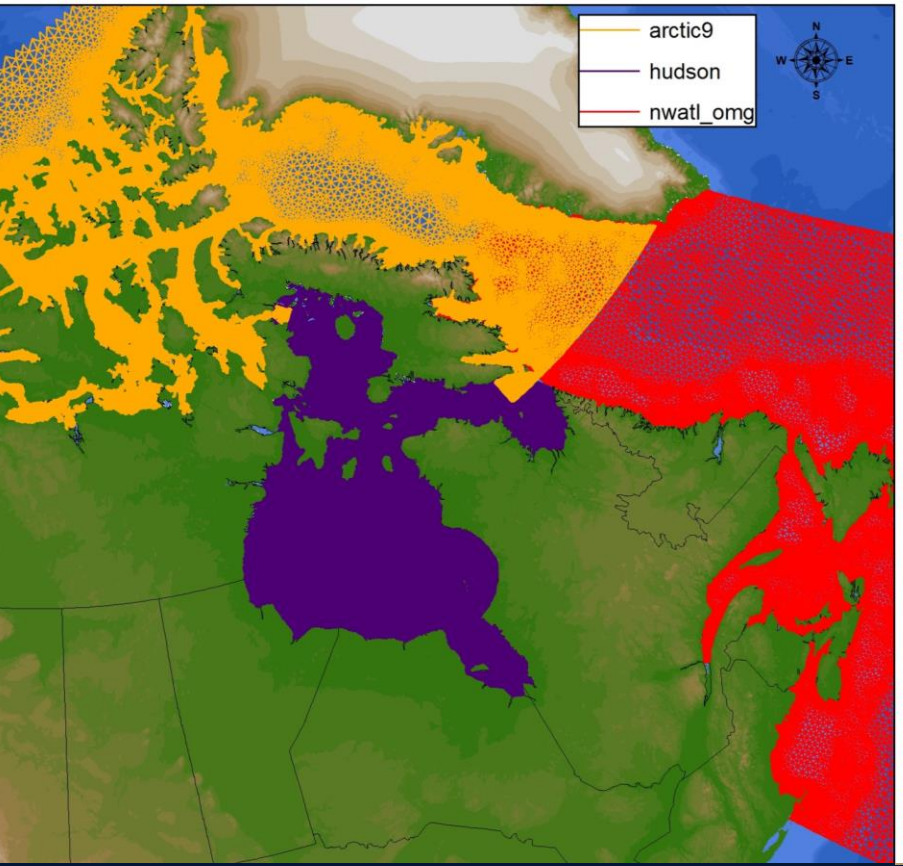
Crowd Sourced Bathymetry / Autonomous Vessel Collection

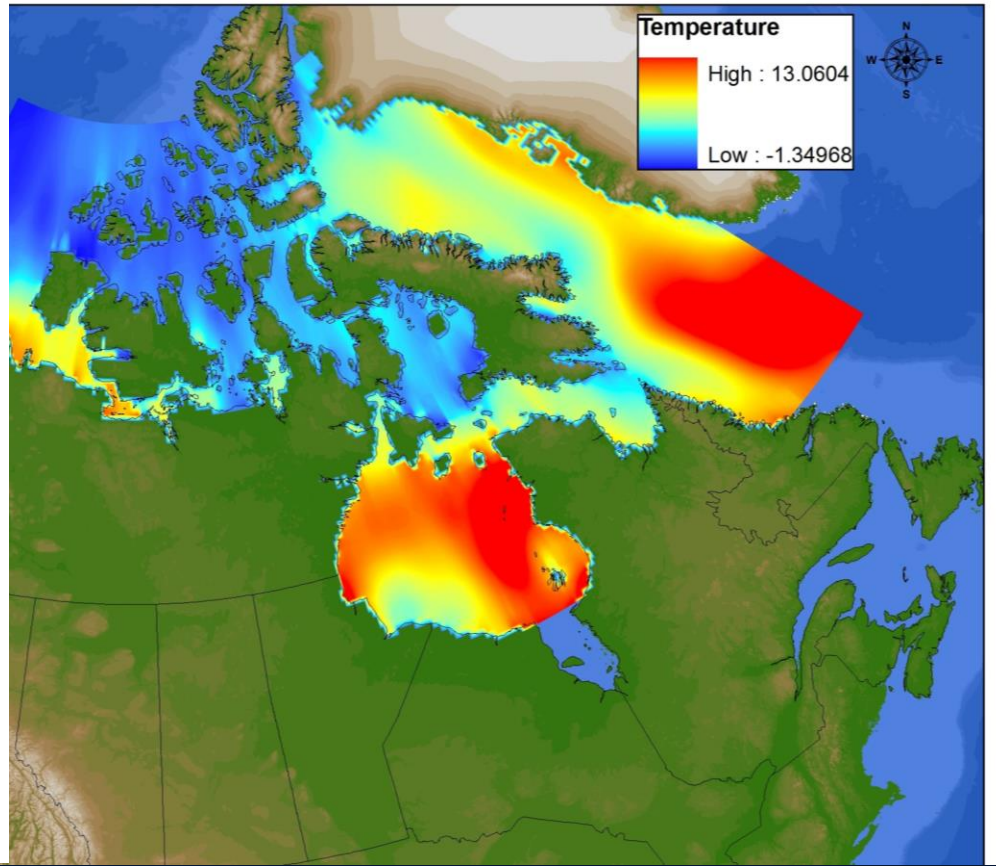
ERS or Tides

- Ocean Models

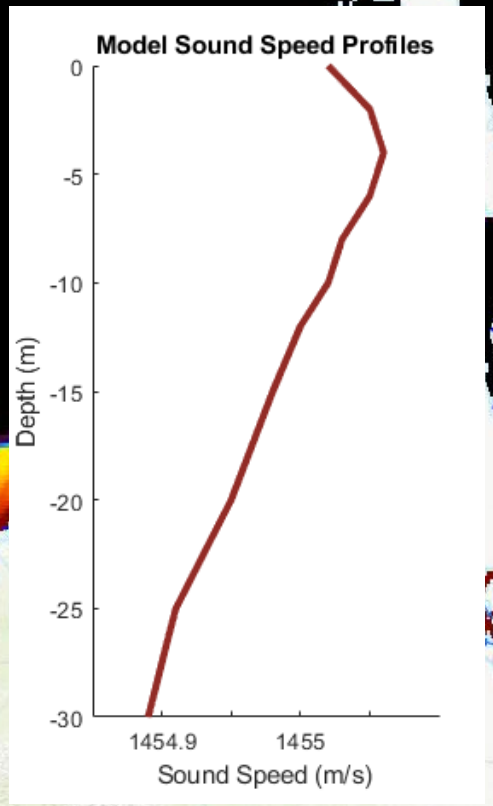
Sound Speed

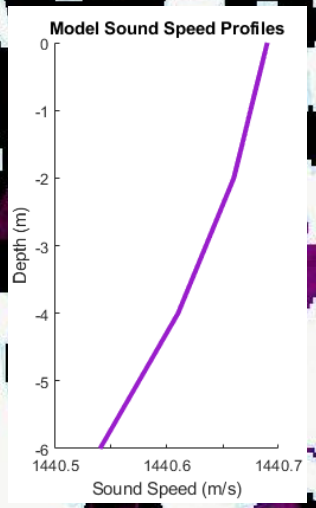
- Ocean Models or Climatologies

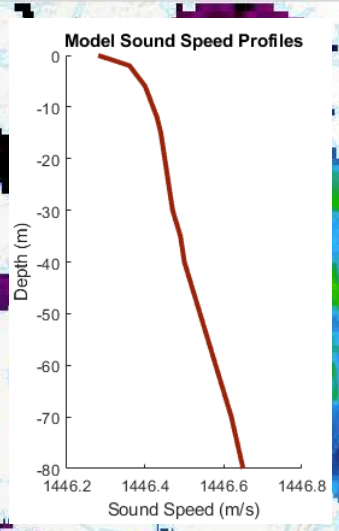


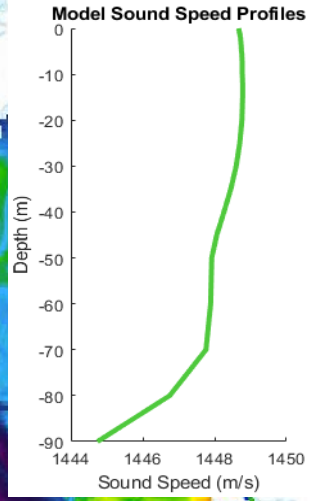


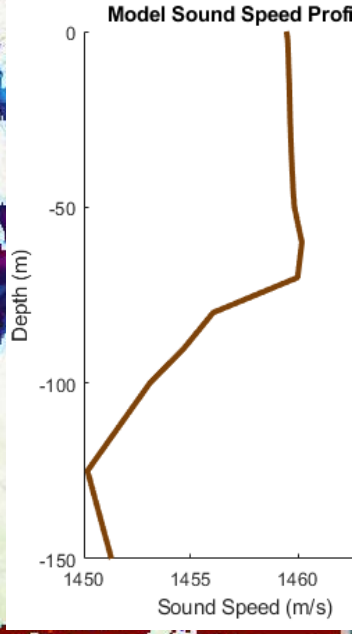
Model Sound Speed to Improve CSB Data

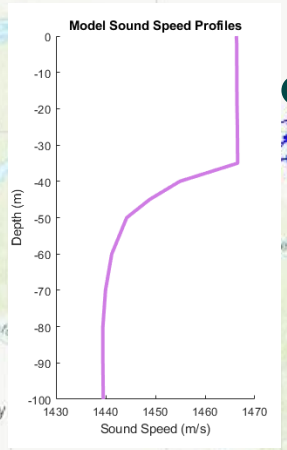


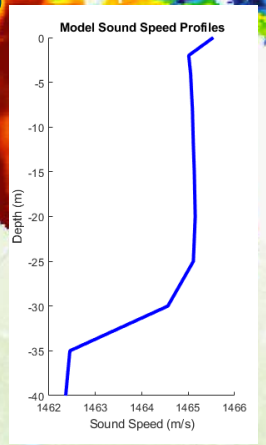


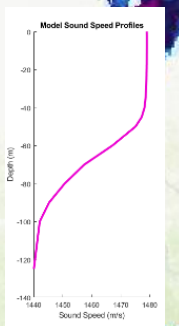




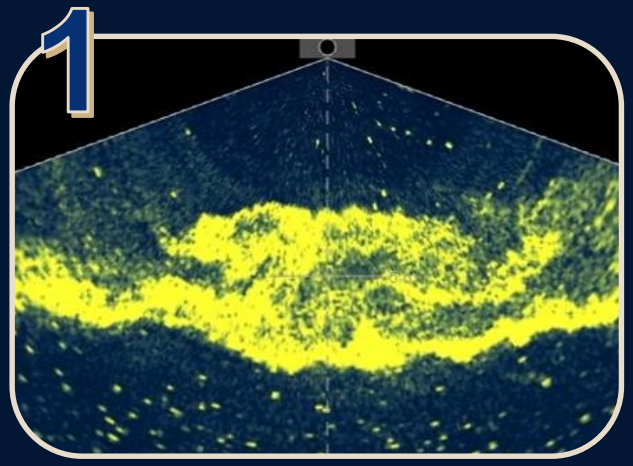




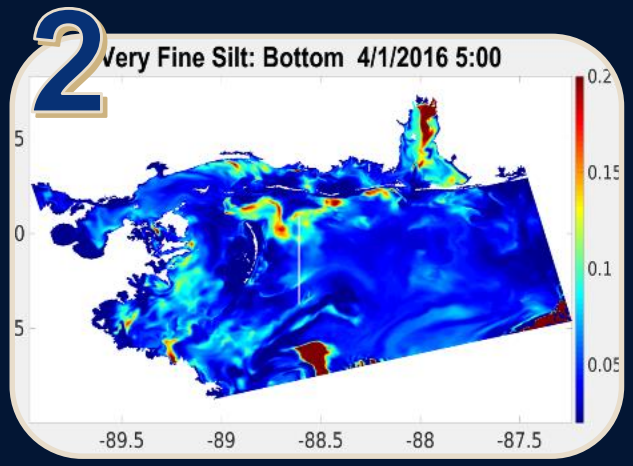




HYCOM HYbrid Coordinate Ocean Model



Water Column Mapping



Seafloor Sediment Dynamics

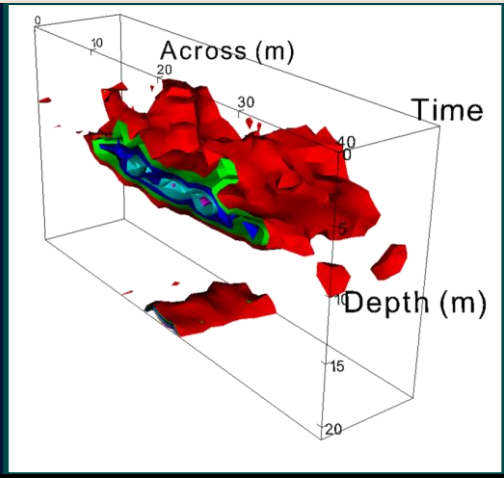
Future Research

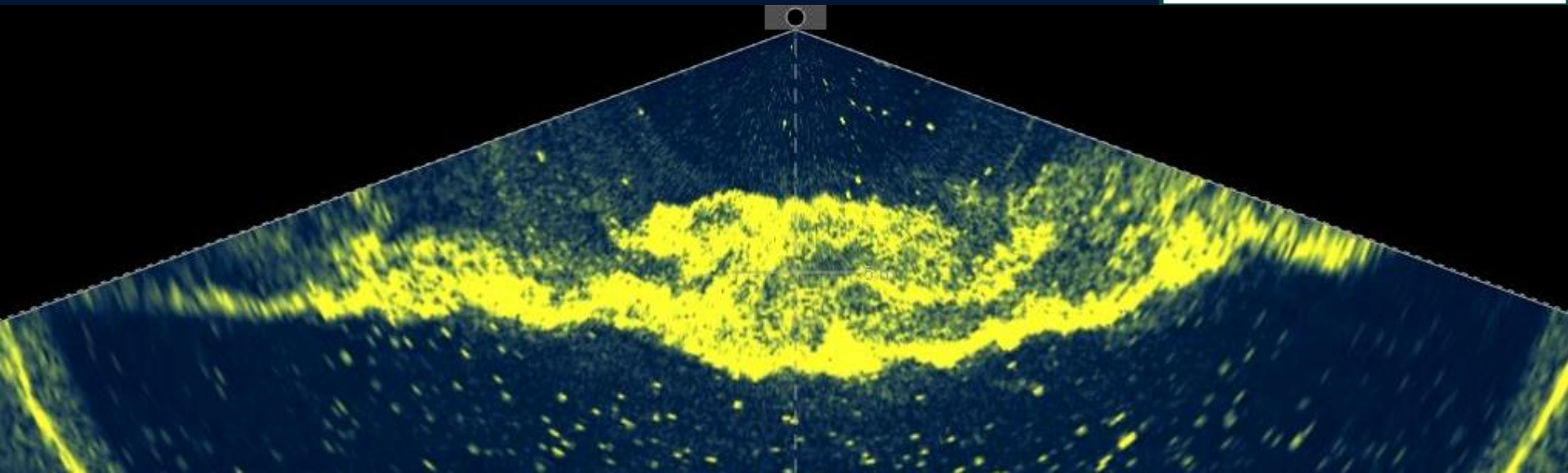
WHERE WE ARE GOING

1 MBES Watercolumn

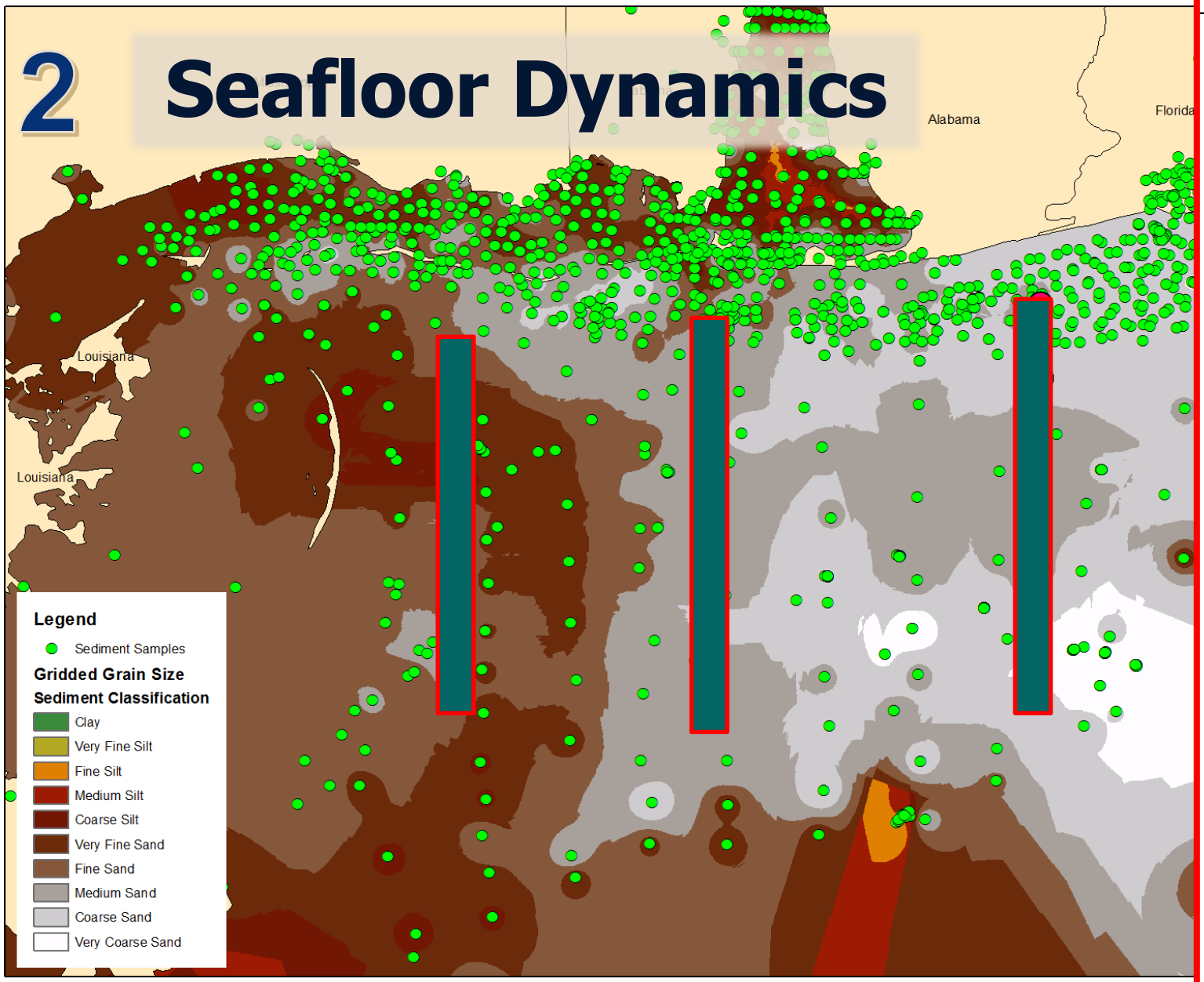
Time	Presentation
Thursday 11 h 10 - 11 h 30	Quantifying the Impact of Internal Wave Activity on Multibeam Bathymetry Lecture Hall - Victoria Convention Centre John Hughes Clarke, UNH
Thursday 11 h 30 - 11 h 50	*Improved Sound Speed Control Through Remotely Detecting Thermocline Undulations* *Lecture Hall - Victoria Convention Centre* *Jose Cordero, UNH*

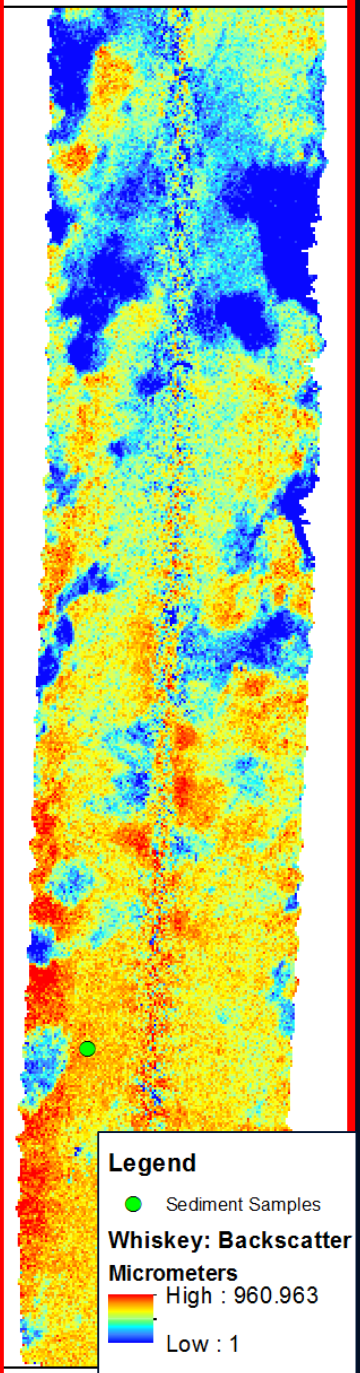
- Multibeam Sonar Watercolumn can provide an indication of the density distribution
- Mechanisms for validation





2 Seafloor Dynamics

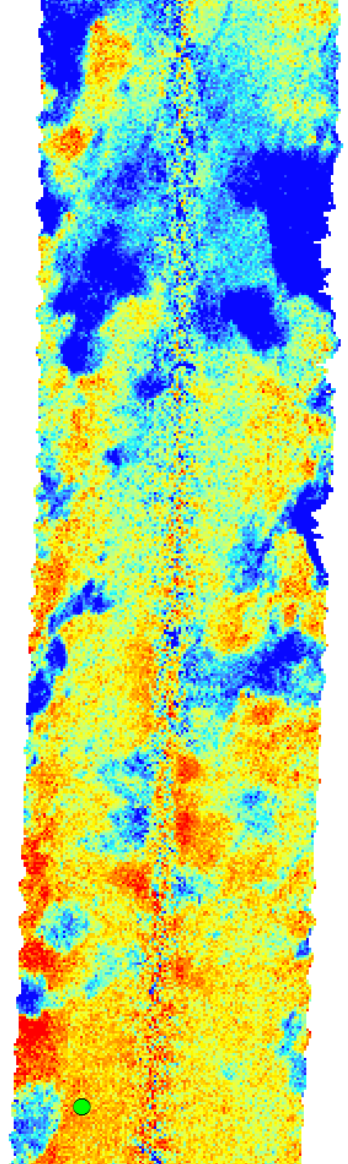


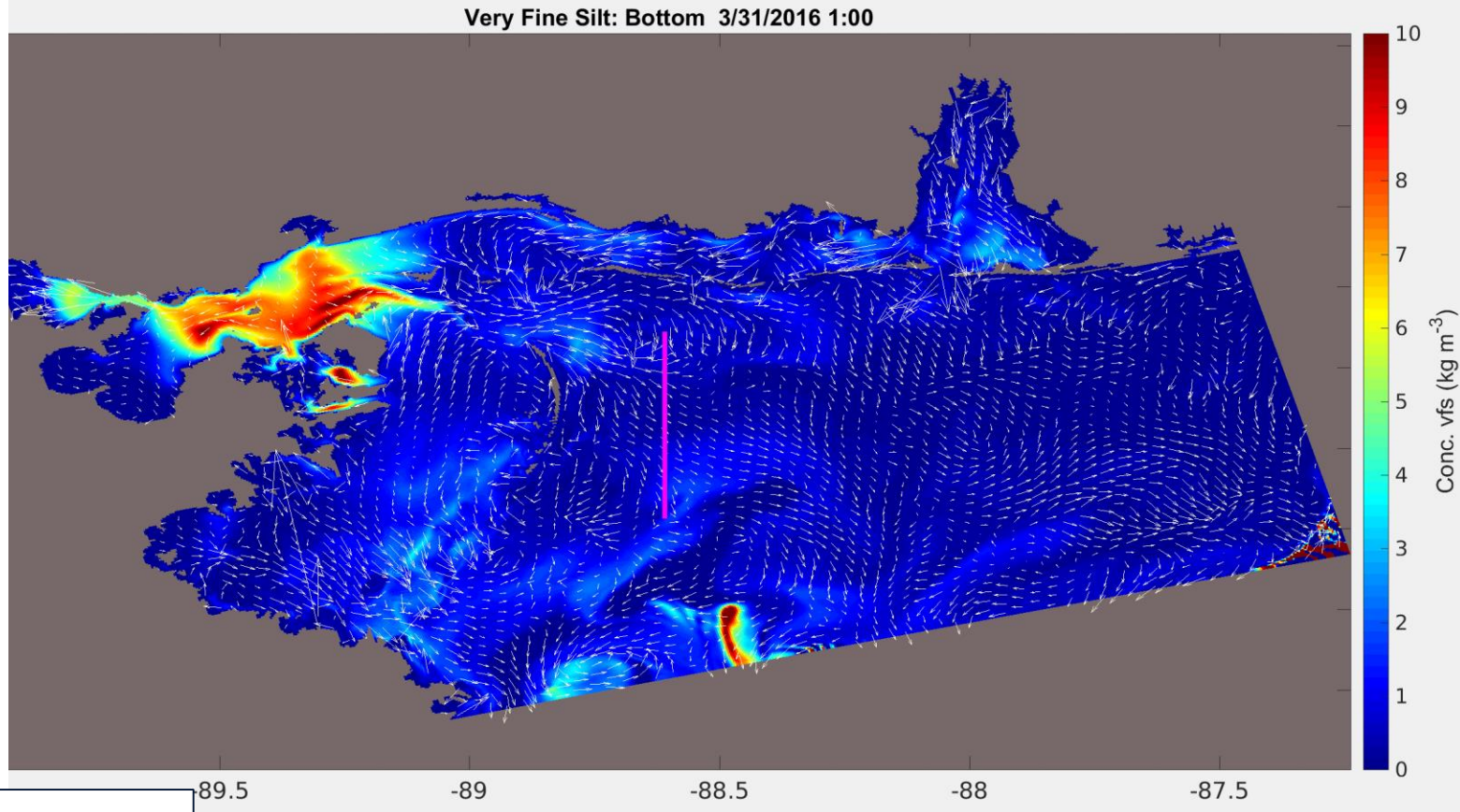


Combining Sediment Samples with Seabed Backscatter Data

Sediment Distribution

Predicting Dynamic Seafloors
Sediment + Oceanographic Dynamics





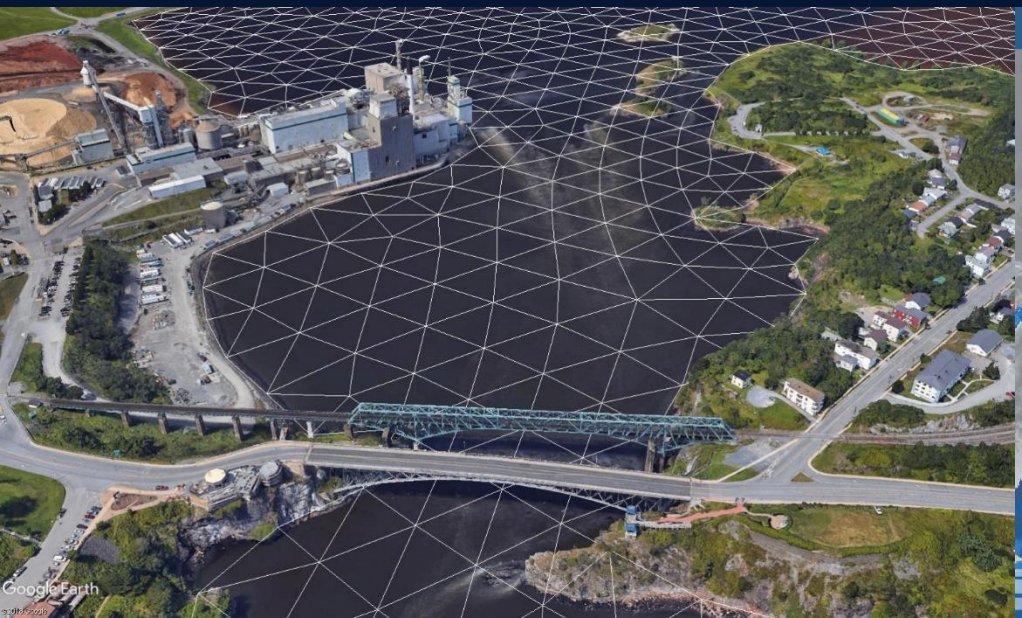
Research Analysis by USM
PhD Student **Stephan O'brien**

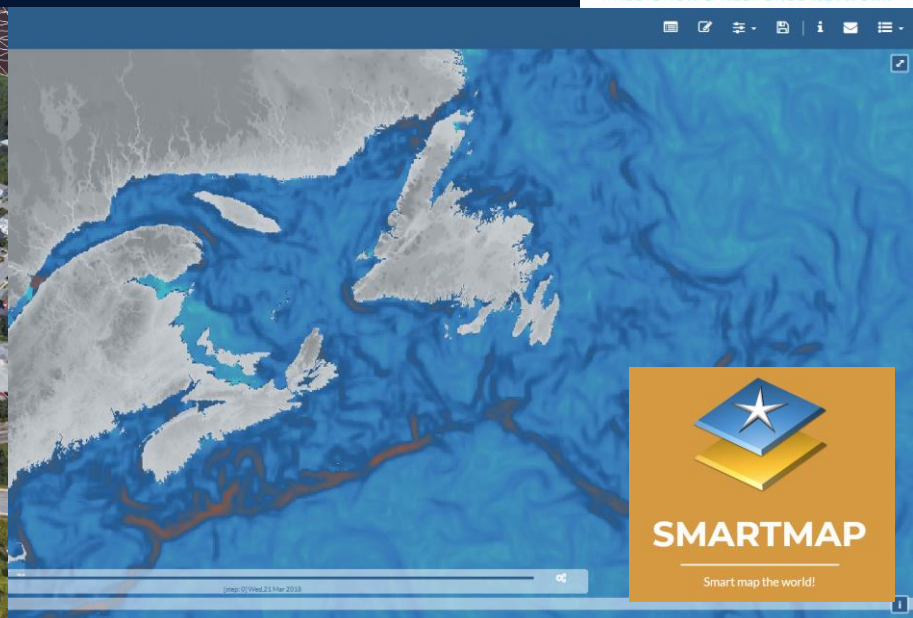
Consortium
CONCORDE
Coastal River-Dominated Ecosystems

Conclusion

Open Coastal Model Simulations

- Encourage Canadian agencies creating numerical model simulations to make those results available online using standard formats
- Include density (baroclinic) structure in any operational models for dynamic navigation products
- A strong link between ocean mapping and modelling: Should be a two way communication





MEOPAR
MARINE ENVIRONMENTAL OBSERVATION PREDICTION & RESPONSE NETWORK

CHC-NSC 2018

www.chc-nsc2018.ca

Questions?

UNB EST. 1785 UNIVERSITY OF NEW BRUNSWICK | Engineering Fredericton

COMREN
Canadian Ocean Mapping Research & Education Network

RéCREH
Réseau Canadien de Recherche et d'Enseignement en Hydrographie

http://www.omg.unb.ca/