Port Scale Forecast Models on the Atlantic Coast of Canada

Coastal Ocean and Shelf Seas Task Team Meeting

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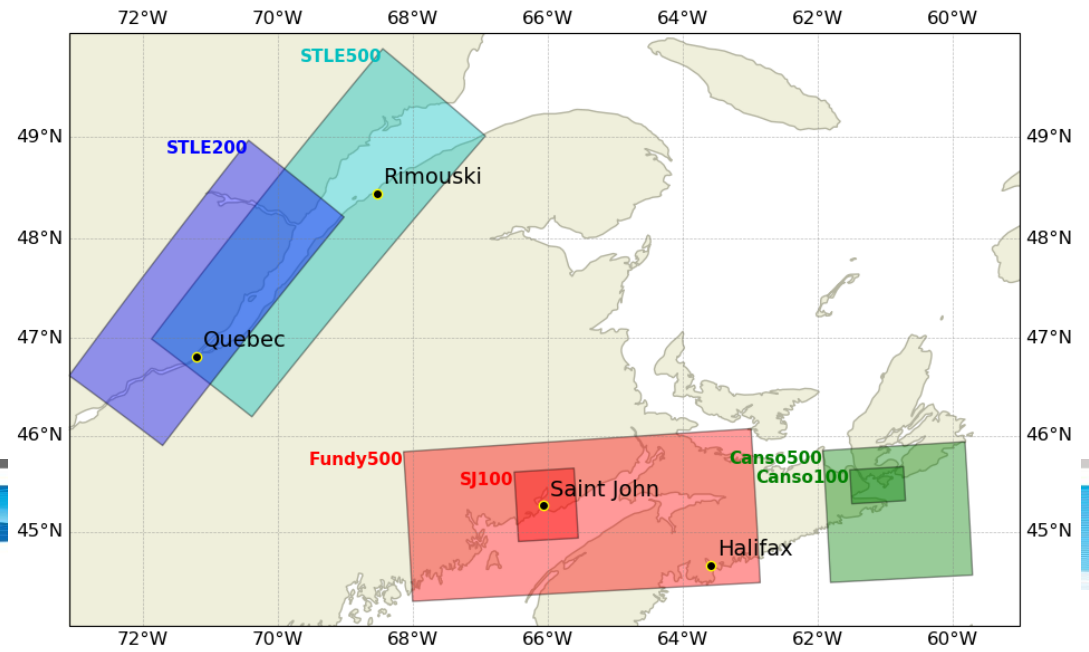
Stephanne Taylor[1], Adam Drozdowski[1], Simon St-Onge Drouin[2], Rachel Horwitz[1], Michael Dunphy[3], Maxim Krassovski[3], Hauke Blanken[3]

Fisheries and Oceans Canada
1: Bedford Institute of Oceanography, Dartmouth, Nova Scotia
2: Maurice Lamontagne Institute, Mont-Joli, Quebec
3: Institute of Ocean Sciences, Sidney, British Columbia

Domain and Configuration

- Downscaled circulation models developed for six Canadian ports using common tools, setup, configuration and codebase (NEMO 3.6+)
  - Pacific coast models already presented by Michael Dunphy
  - St. Lawrence Estuary already presented by Simon St. Onge
  - Port of Saint John and Strait of Canso presented here
- Two level system: 500m outer domain provides OBC for 100m inner domain
- Forcing mostly from ECCC systems
  - OBC from CIOPS-E (~2 km)
  - Tidal forcing from WebTide (SJ)
  - Atmosphere from HRDPS (~2.5 km)
  - Saint John river from gauge data



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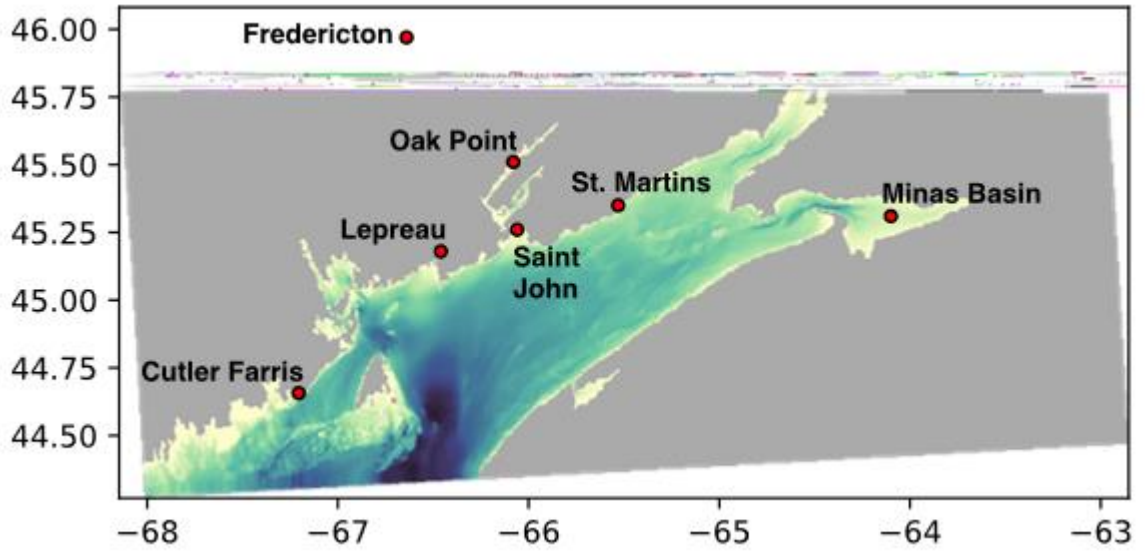
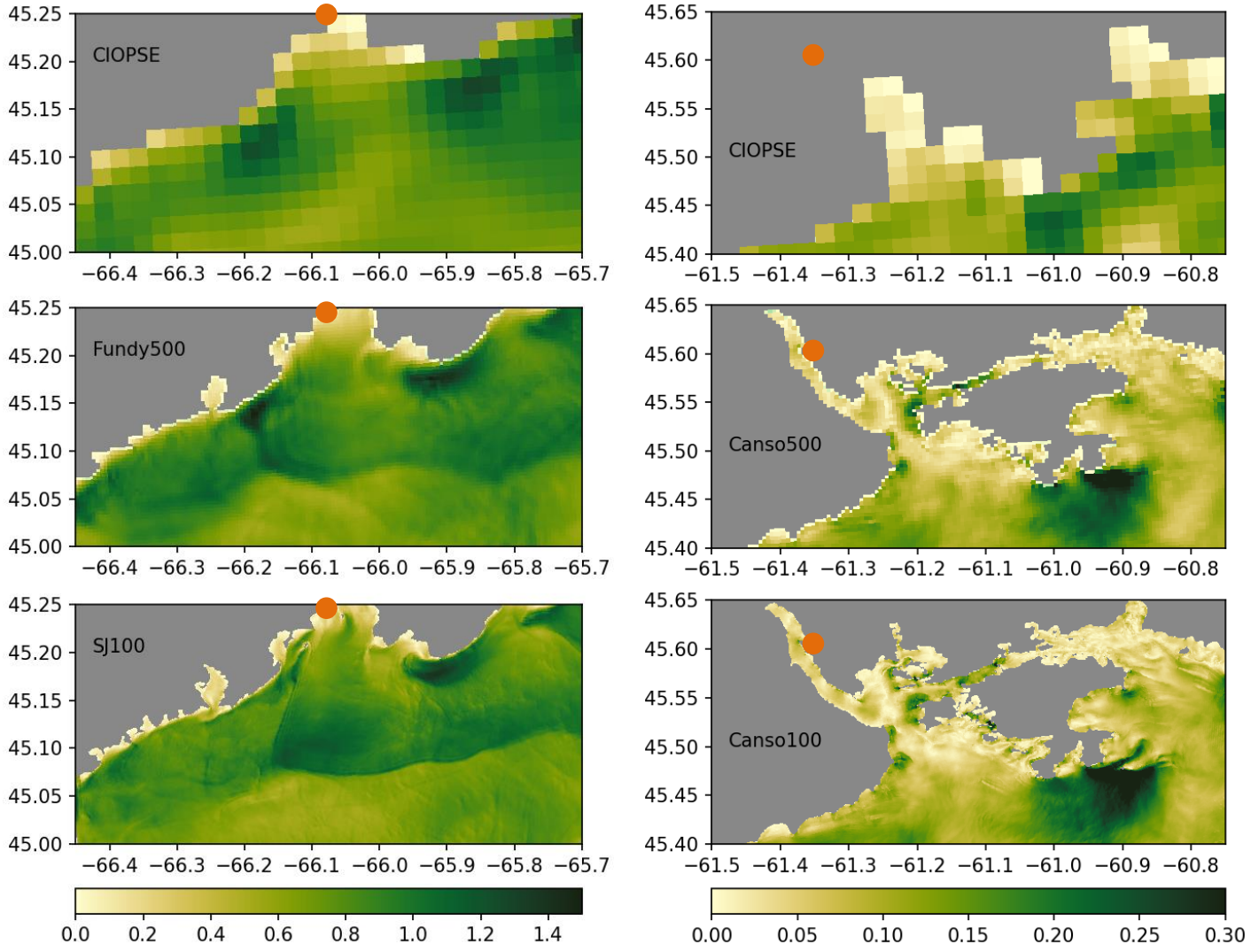


Motivation

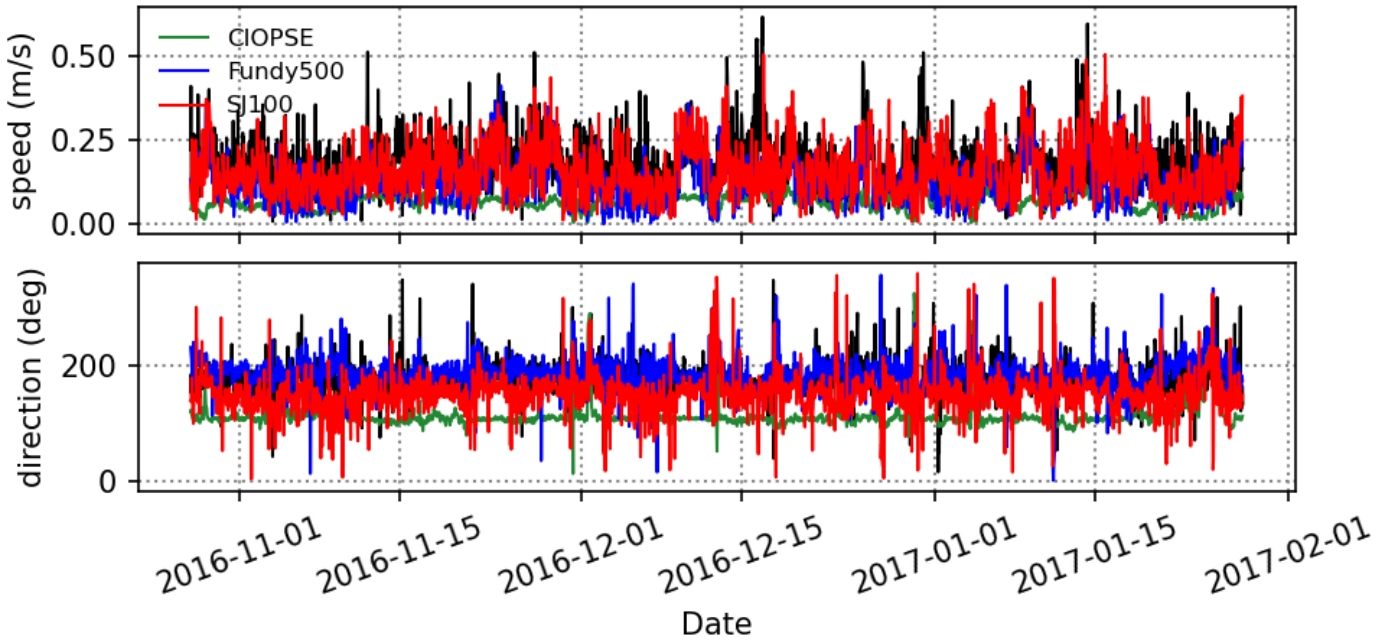
- Built to provide data to feed e-navigation and emergency response applications
  - Near-surface processes key
  - Surface currents need to be skillful
- Existing operational models cannot resolve fine details in coastline, harbour geometry
- Features in speed sharpen and strengthen as resolution increases

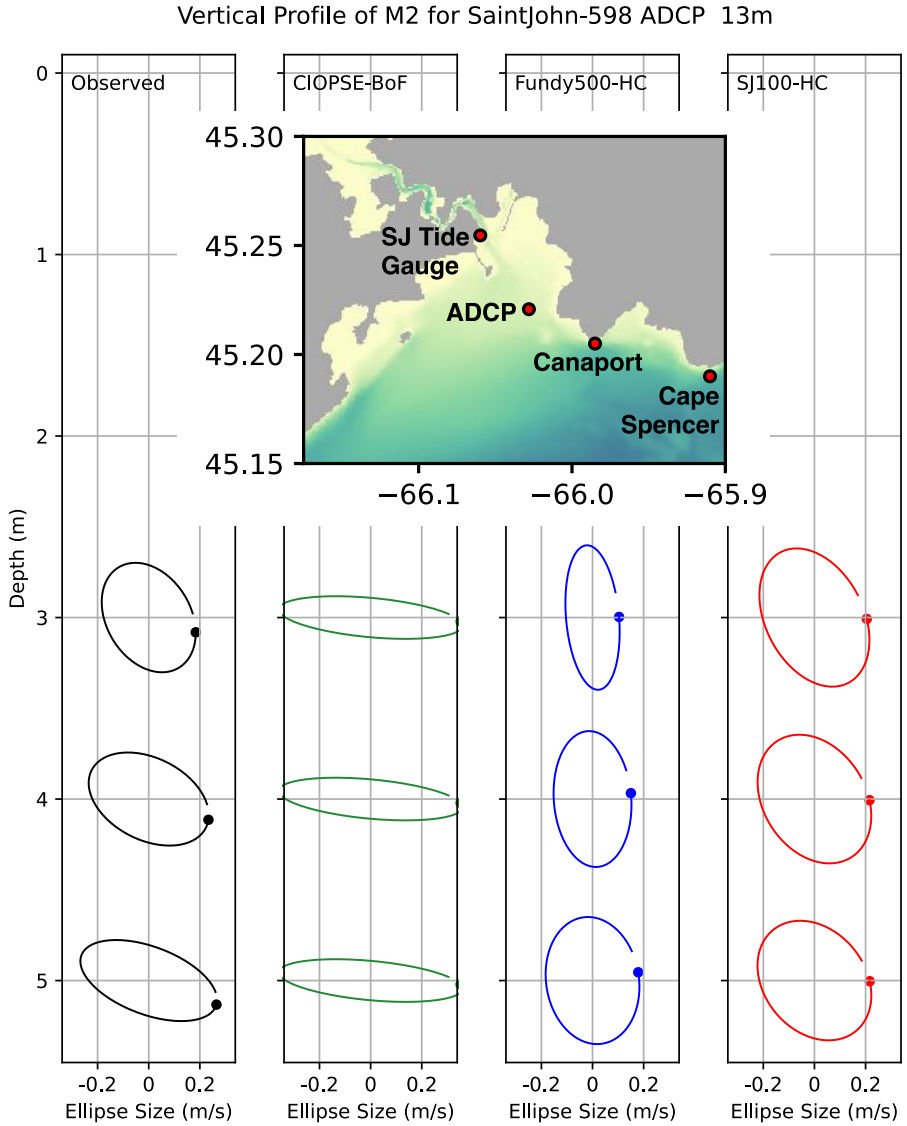
Surface Speed on 2020-06-01 00Z for Saint John and Canso



Currents near Canaport Oil Terminal, Saint John

- Canaport is a relatively high risk location; area needs reliable near surface currents
- Currents not well captured by CIOPS-E
- SJ100 closest match to observations





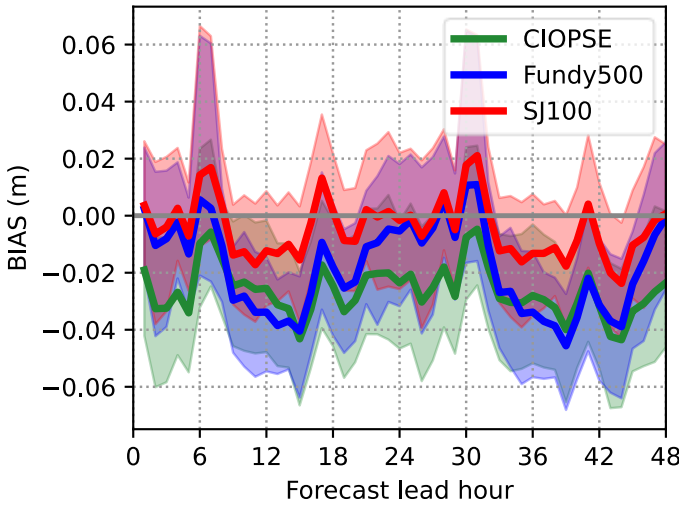
Forecasting Setup

- System provides 48 hour forecasts 4 x daily
- Follows the CIOPS-E and HRDPS forecasting schedule
  - No need to adjust or manipulate forcing data from models
- Need to provide forecast data for the Saint John river gauge data
  - Outflow from river has large impact on harbour surface circulation
  - River boundary at Oak Point (~ 40 km inland) has a mixed tidal-fluvial signal
  - Use NS Tides to provide a forecast by supplying upstream (Fredericton) and downstream (Saint John harbour) signals

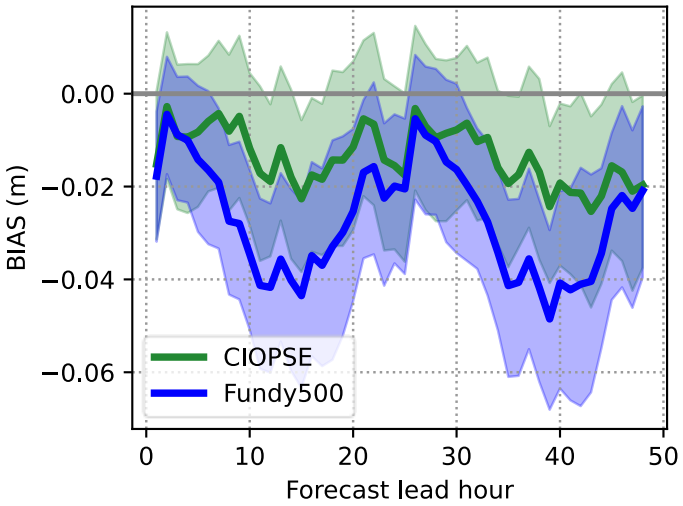
Forecast Surge Water Level

- SJ100 has smallest bias and CRMSE of all three models
- Statistics at Saint John do not significantly degrade over 48 h
- Bias and CRMSE at Cutler Farris comparable to Saint John

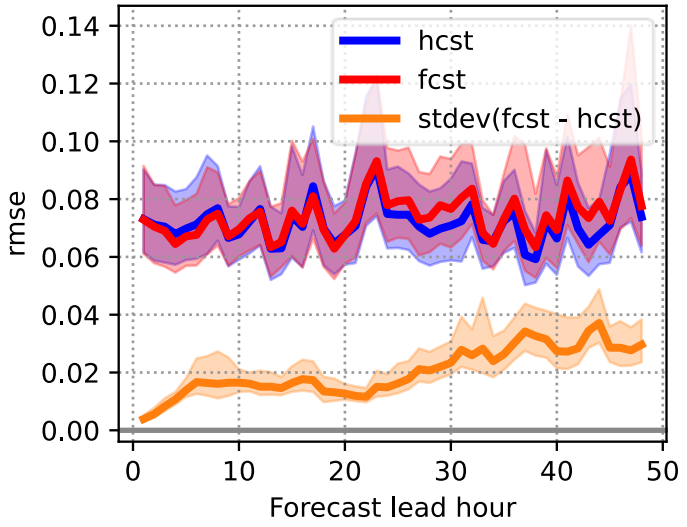
Saint John 00Z Forecasts

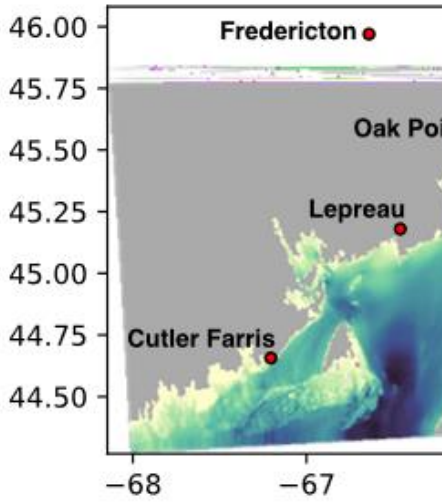


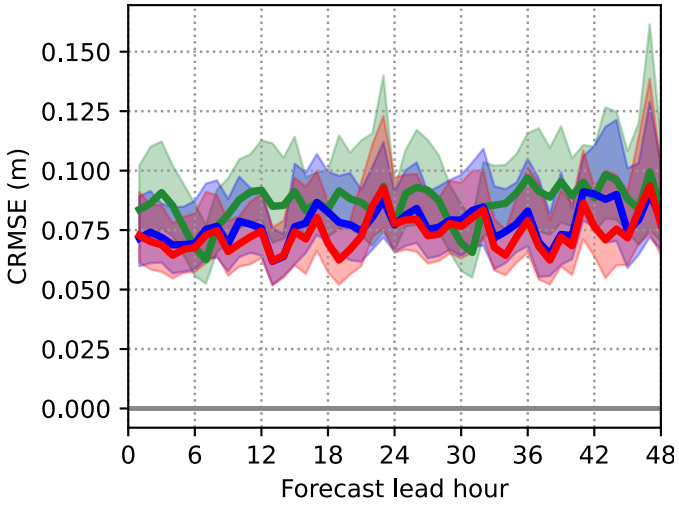
Cutler Farris 00Z Forecasts

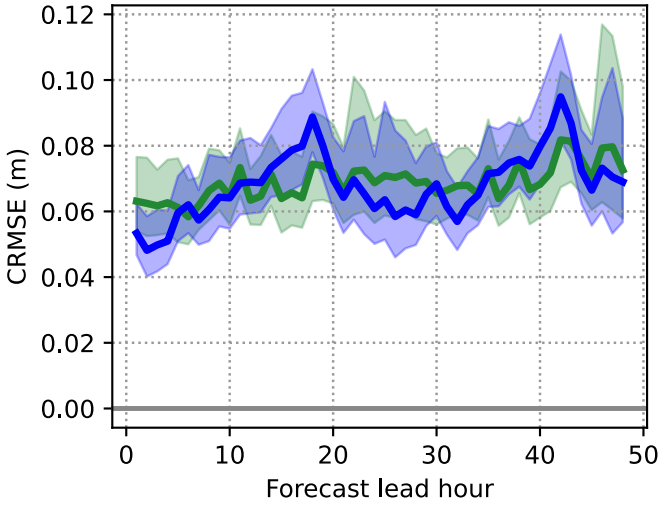


Saint John 00Z RMSE









Summary

- Downscaling coastal operational systems to port-scale is a viable approach
- Increased resolution results in more accurate near-surface currents
- Forecasts produced by these systems do not have substantial error growth over the forecast period
- Development process was lengthy; lots of possible science to be done shortly

Thank you!

stephanne.taylor@dfo-mpo.gc.ca