Apr 26th, 1:30 PM - 3:00 PM

Understanding oxygen dynamics in two Discovery Islands fjords with different oxygen characteristics (oxic vs. hypoxic subsurface waters)

Dr. Laura Bianucci

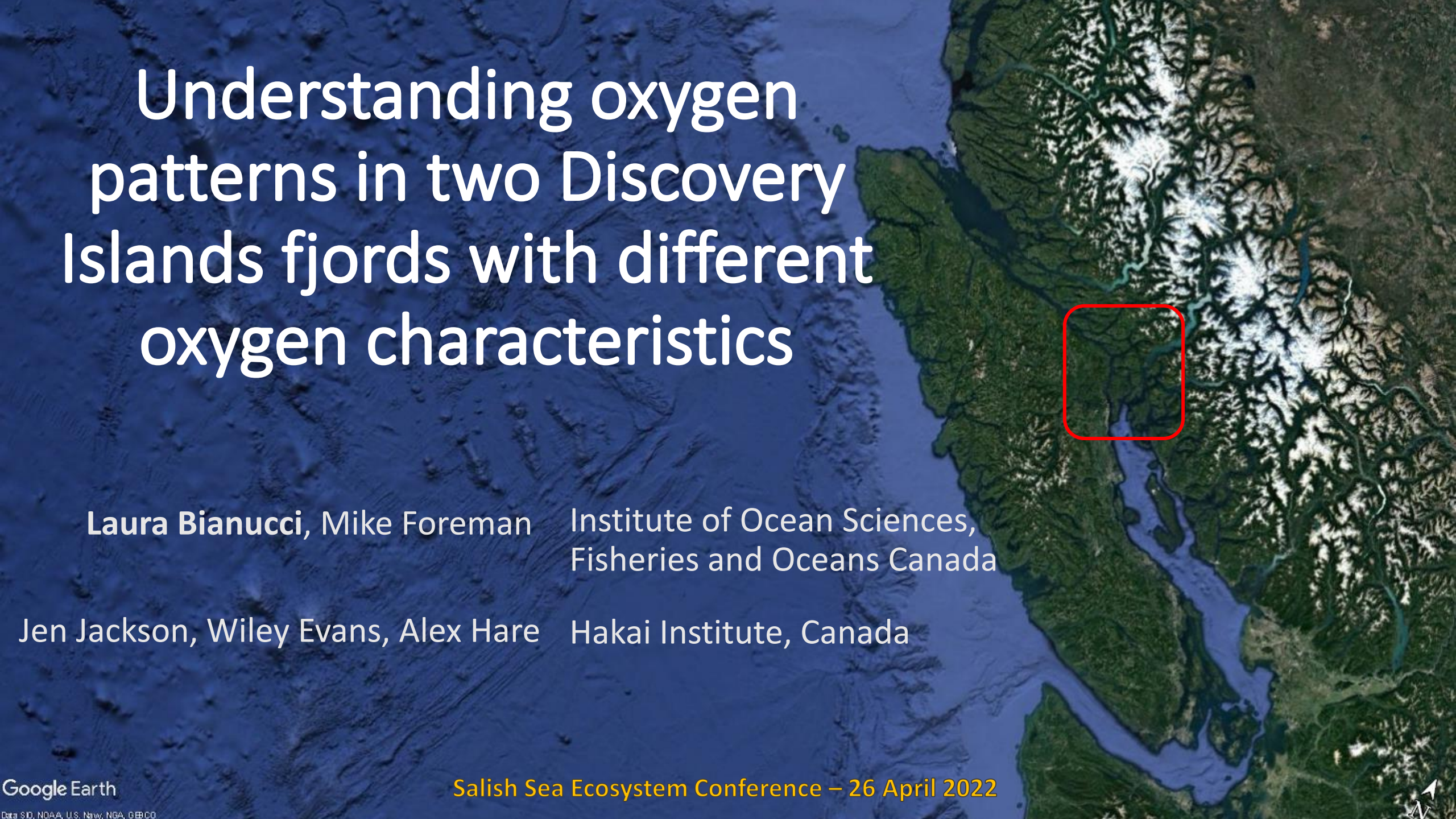
Mike Foreman

Jen Jackson

Wiley Evans

Alex Hare

Understanding oxygen patterns in two Discovery Islands fjords with different oxygen characteristics



Laura Bianucci, Mike Foreman — Institute of Ocean Sciences, Fisheries and Oceans Canada

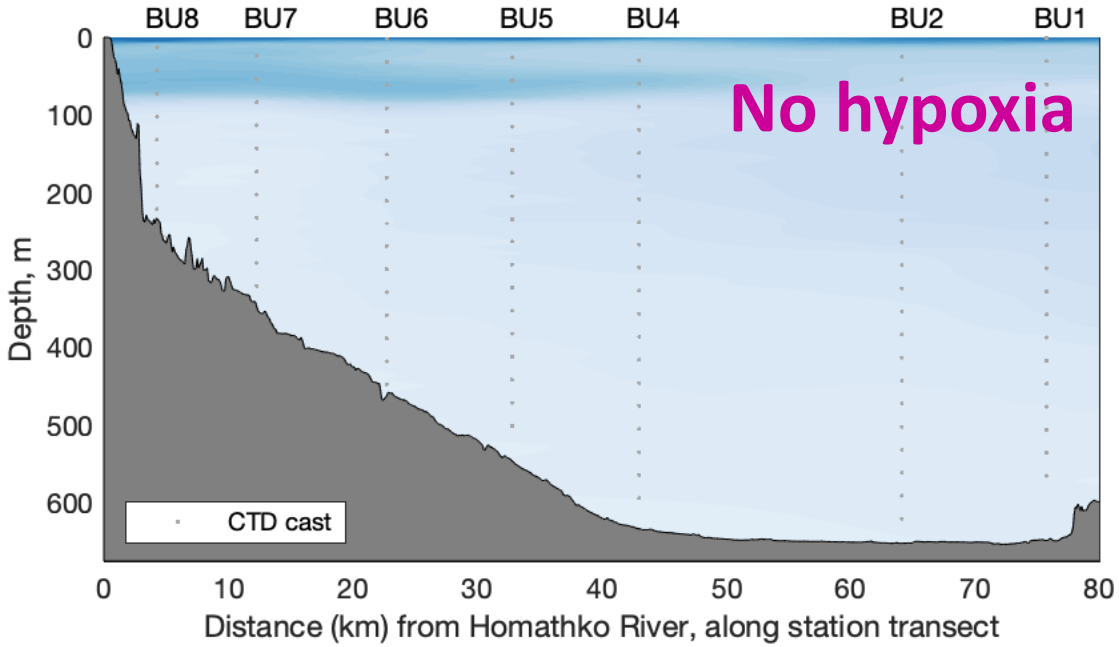
Jen Jackson, Wiley Evans, Alex Hare — Hakai Institute, Canada

Salish Sea Ecosystem Conference – 26 April 2022

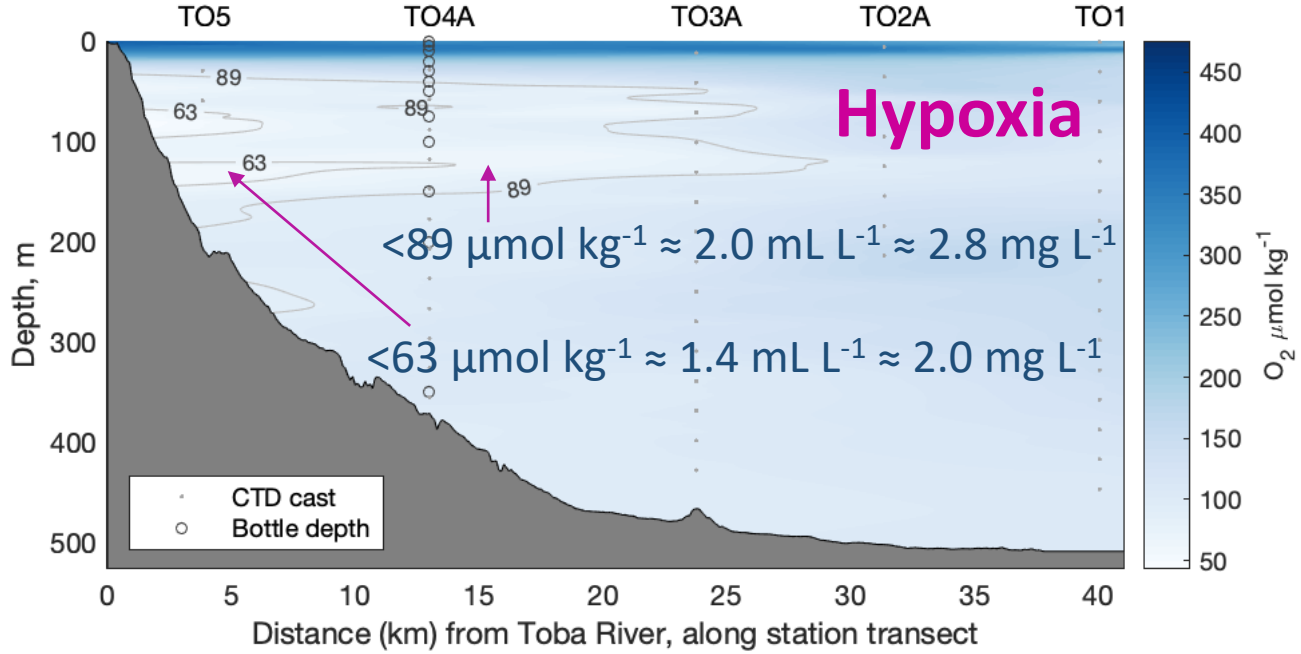
Why study O_2 in Discovery Islands?

- In 2019, Bute and Toba Inlets showed different oxygen characteristics

Bute Inlet - 26 Jun 2019



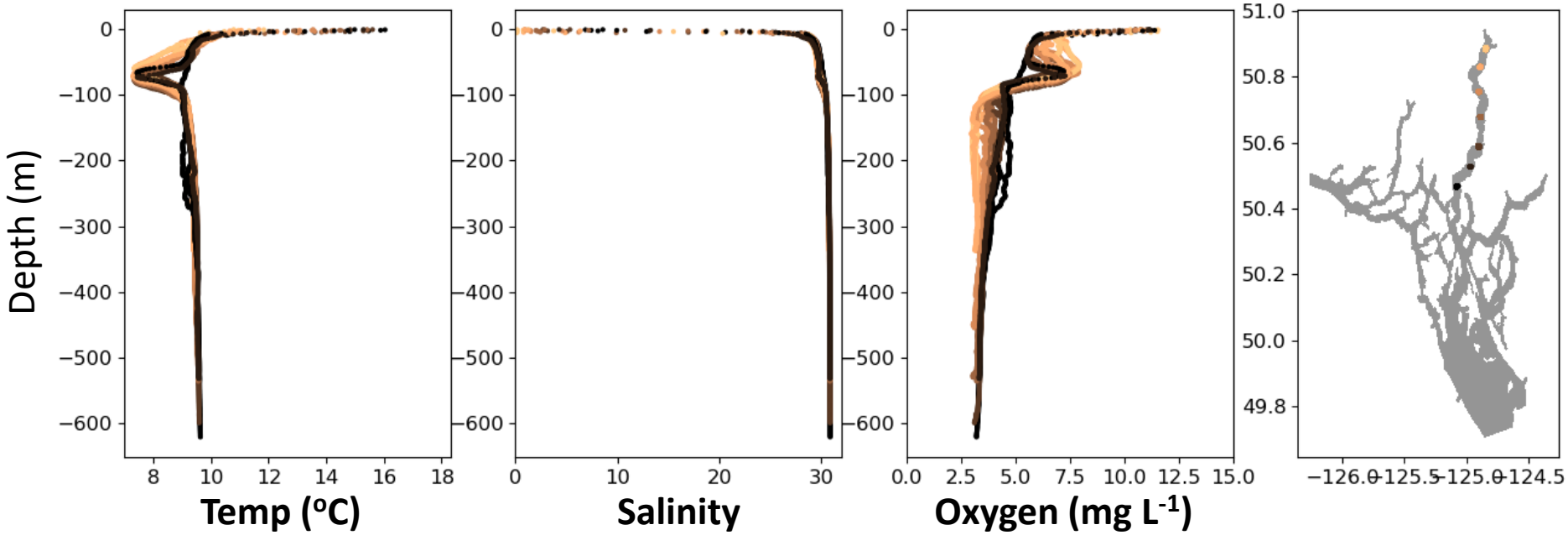
Toba Inlet - 24 Jun 2019



Observed oxygen and temperature patterns

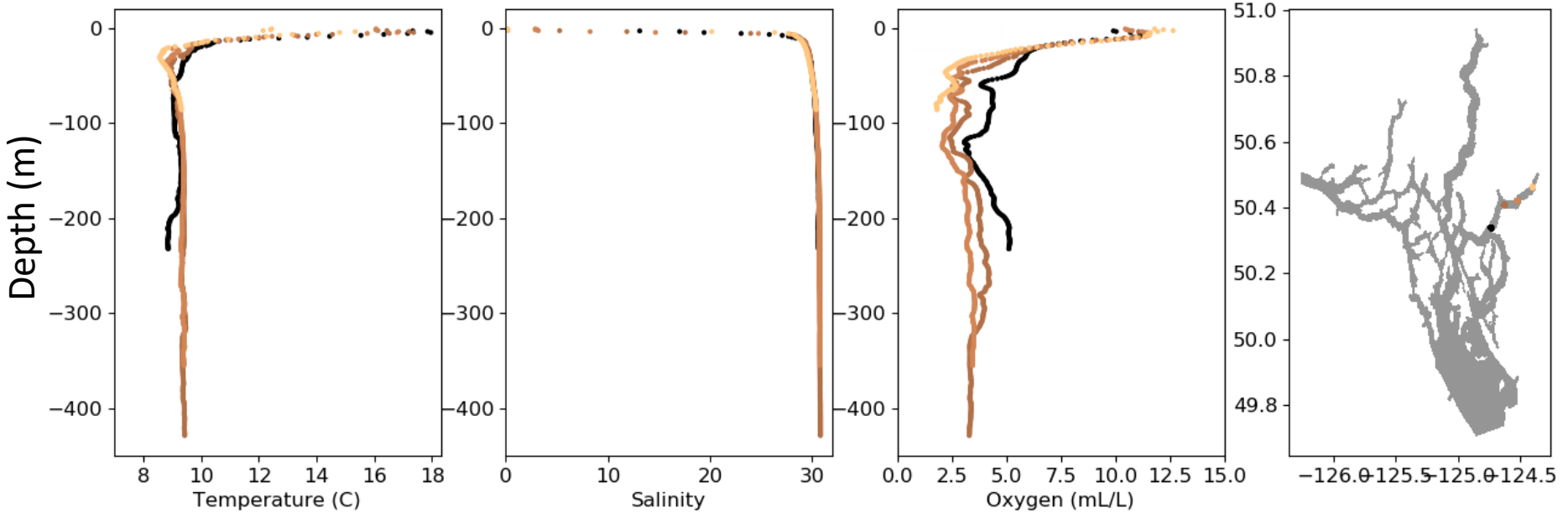
Bute

12 Jun 2019
26 Jun 2019



Toba

24 Jun 2019



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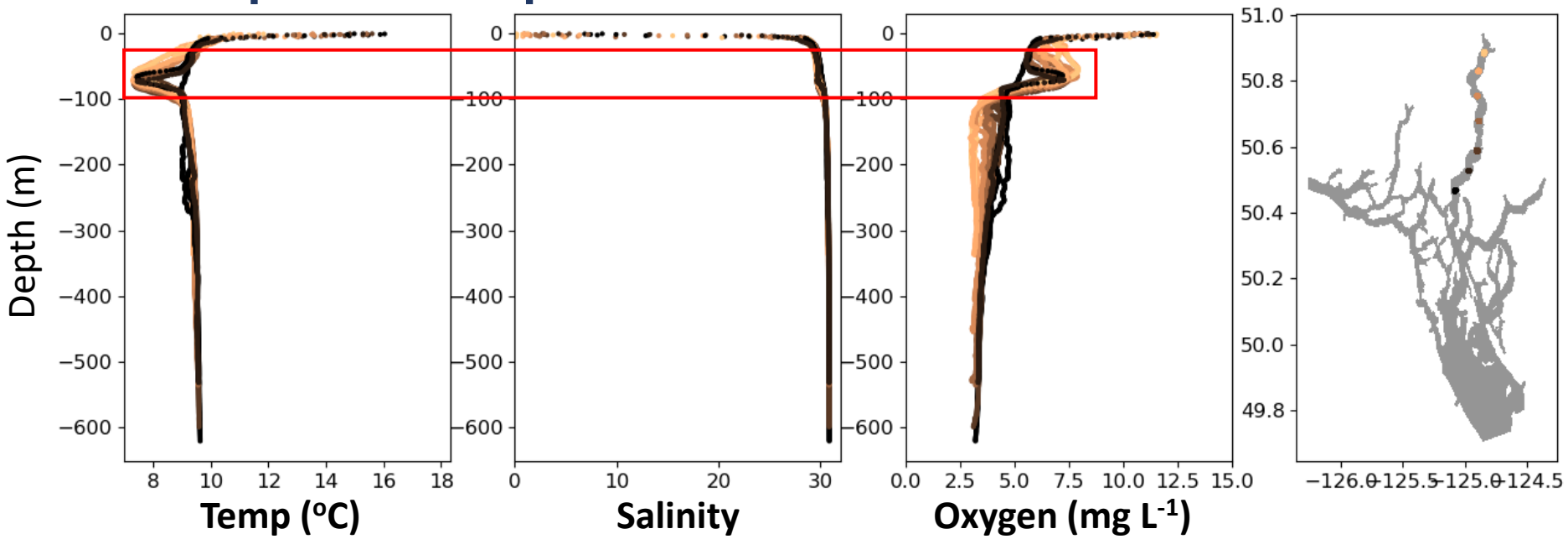
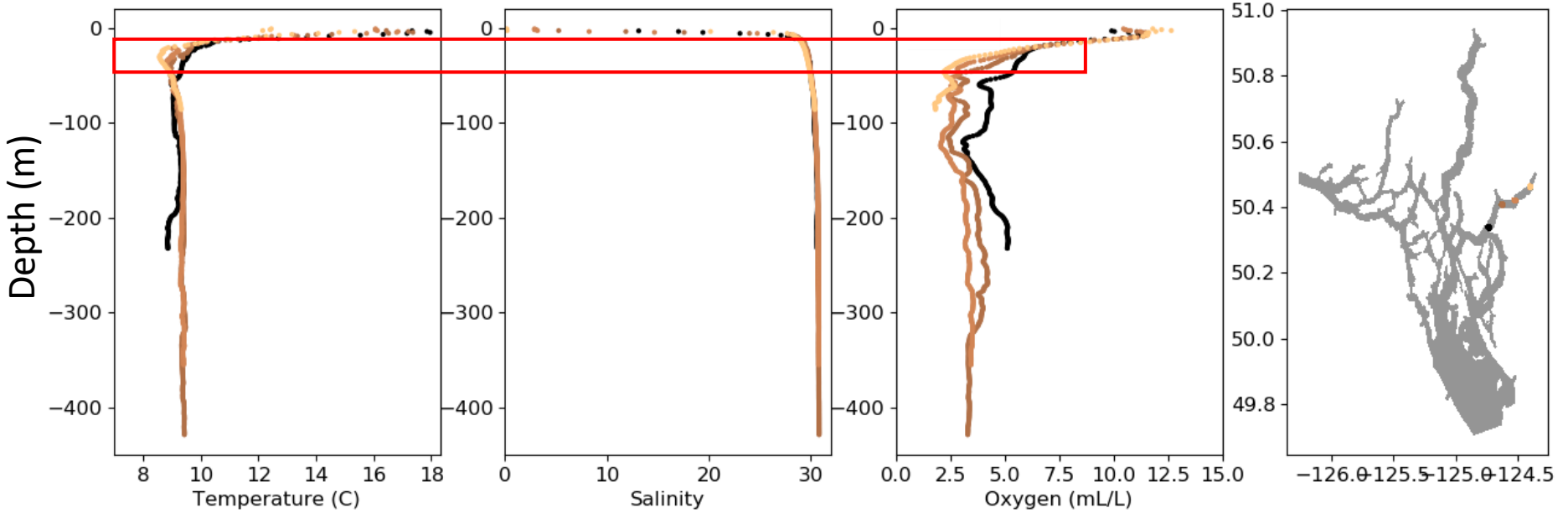


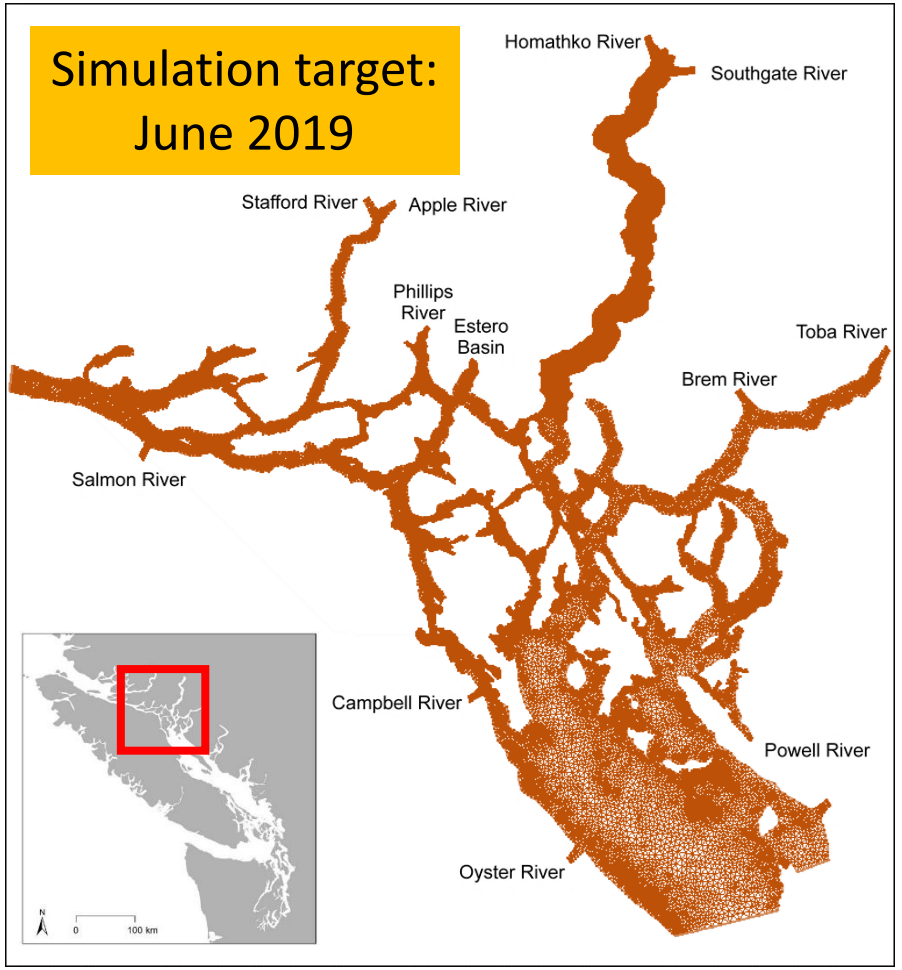
Toba

24 Jun 2019



Physical Model: FVCOM

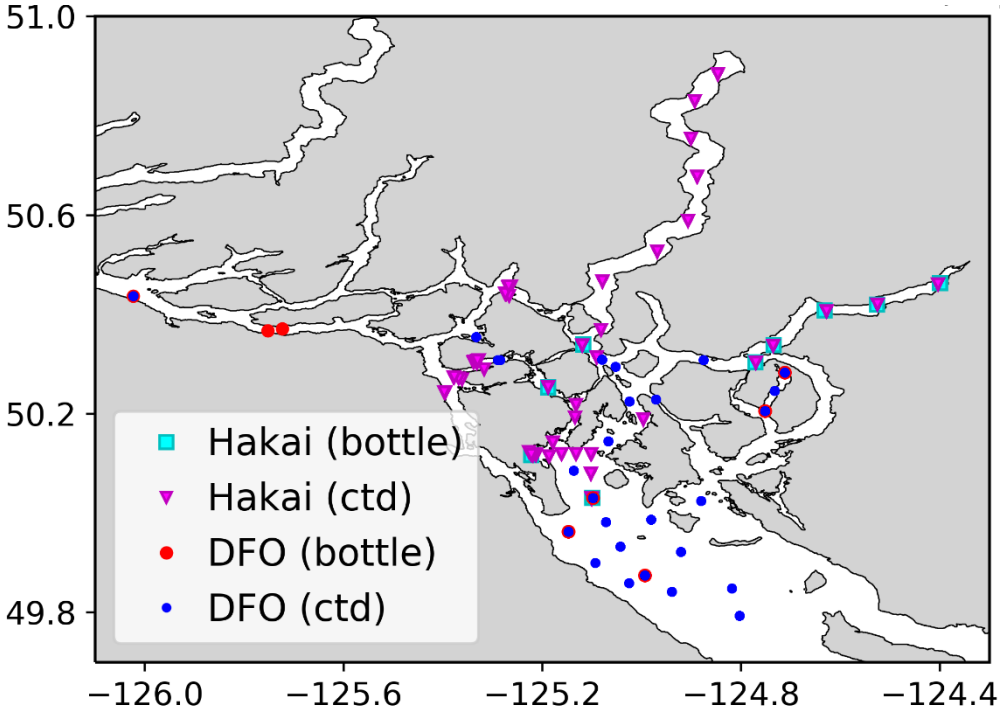
- **F**inite **V**olume **C**ommunity **O**cean **M**odel, v4.1 *(Chen et al. 2006)*
- Unstructured triangular grid (~41K nodes)
  Horizontal resolution: 20 m to 1 km
- 20 terrain-following sigma levels
  Vertical resolution: 1 cm to 100 m
- Winds and surface fluxes: **H**igh **R**esolution (1 km) **D**eterministic **P**rediction **S**ystem
- Initial, open boundary conditions:
  Observations + SalishSeaCast (Soontiens et al. 2016)
- Rivers: 12 (discharge available in 4; no temperature observations)



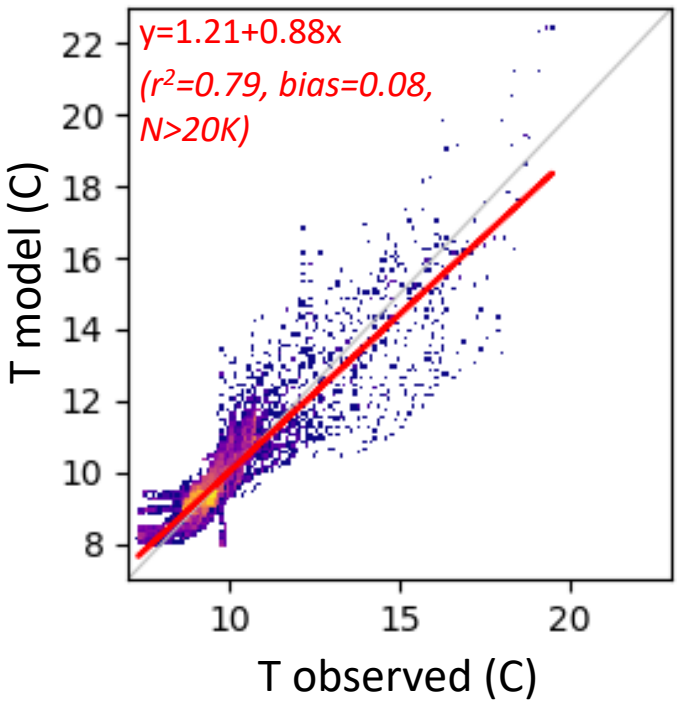
Model Evaluation: Physics

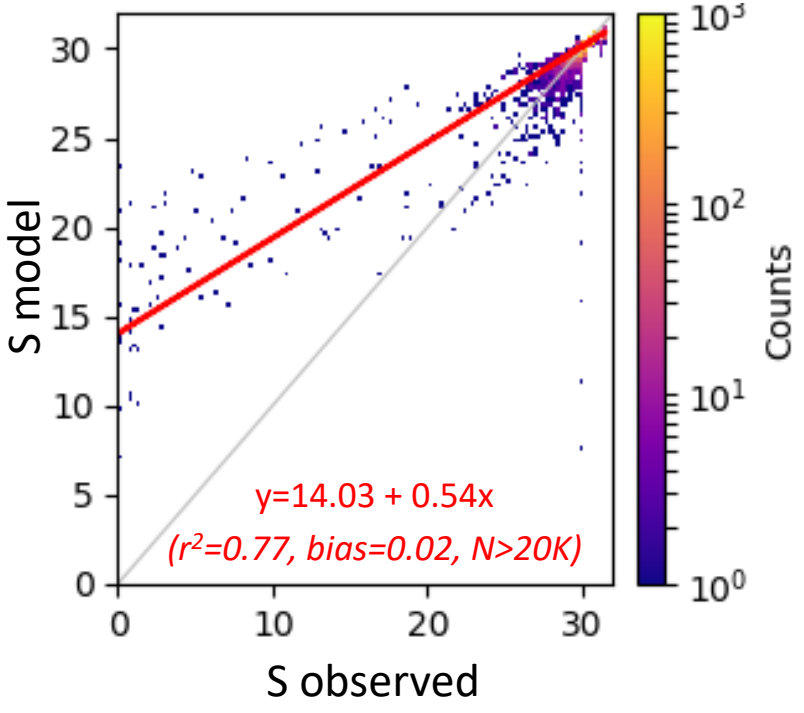
Simulation: 24 May to 27 June 2019

Location observations



Model vs Observations in whole domain





Bute

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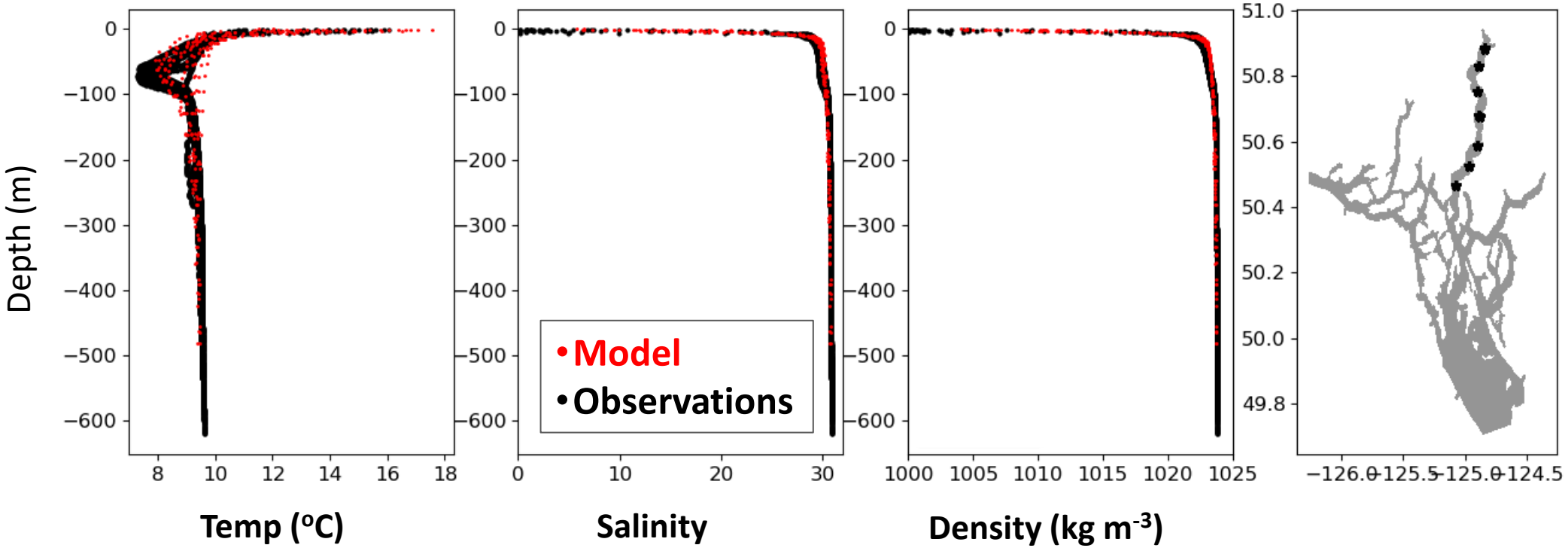

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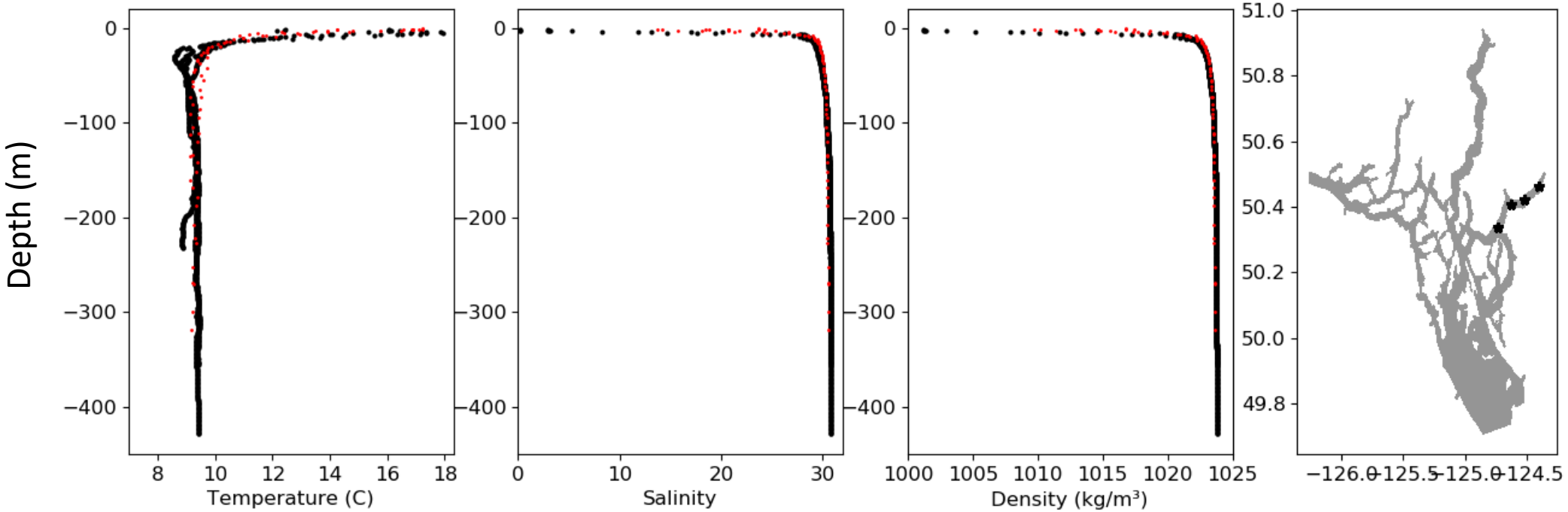
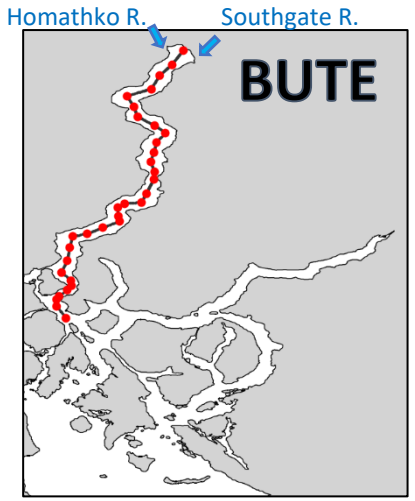
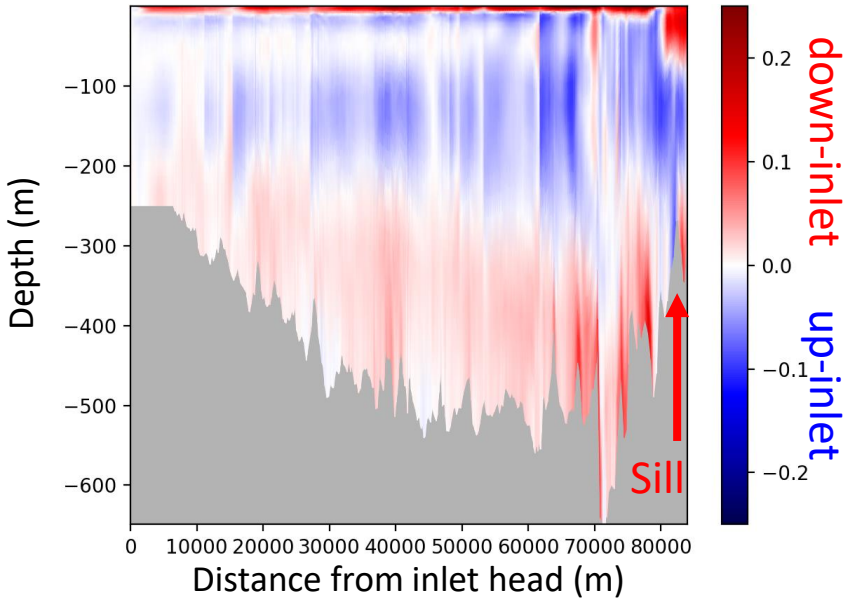
24 Jun 2019





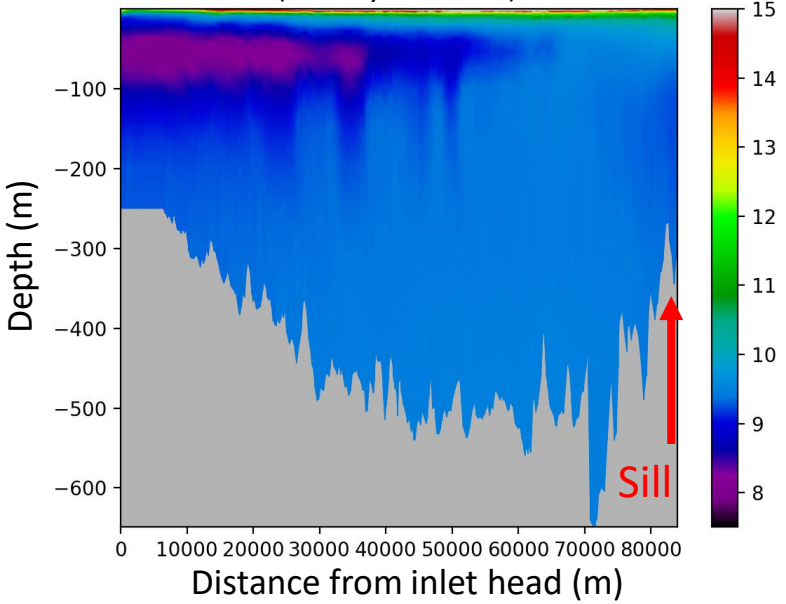
Mean Along-Inlet Velocity (m/s)

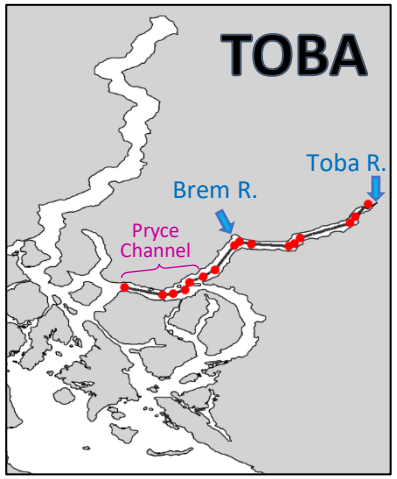
(29 May to 27 Jun)

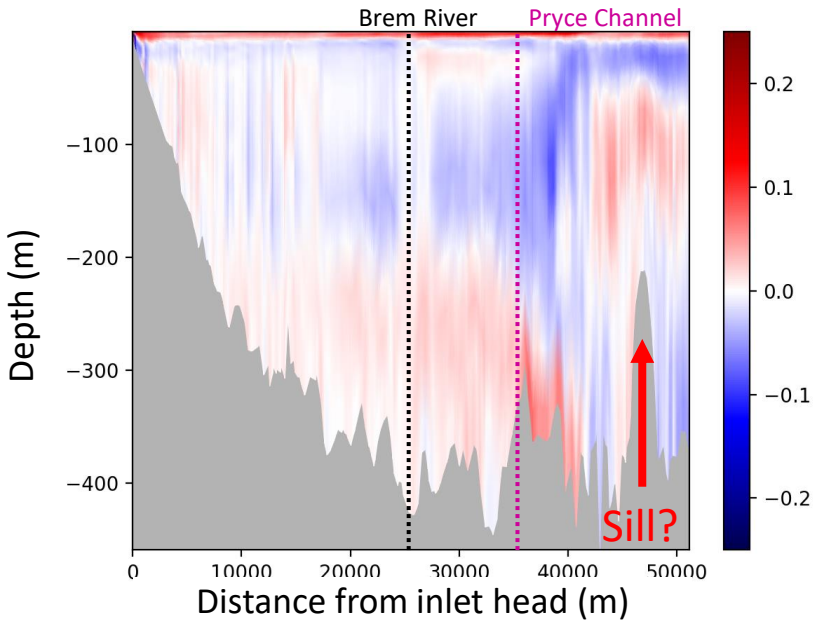


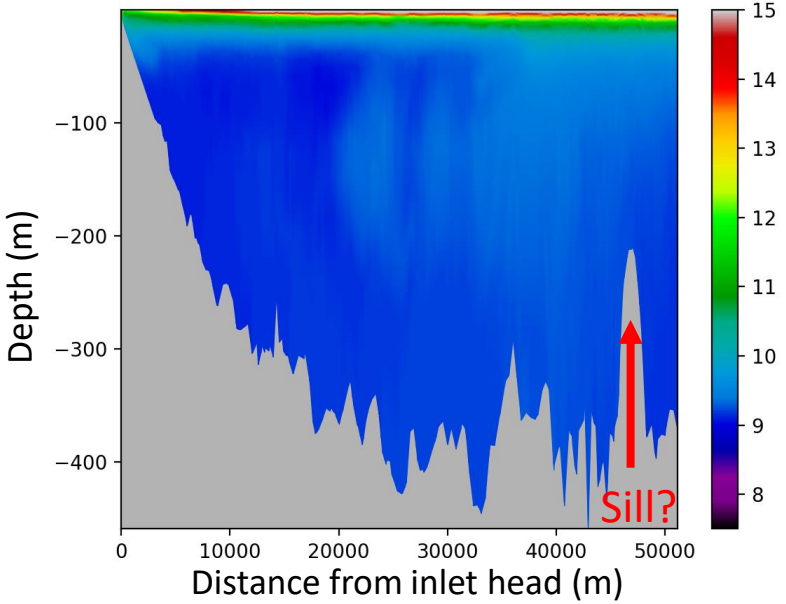
Mean Temperature (°C)

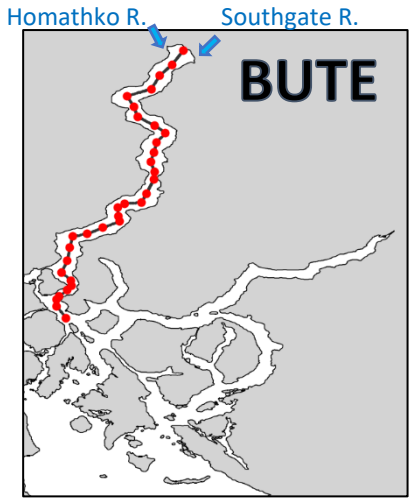
(29 May to 27 Jun)











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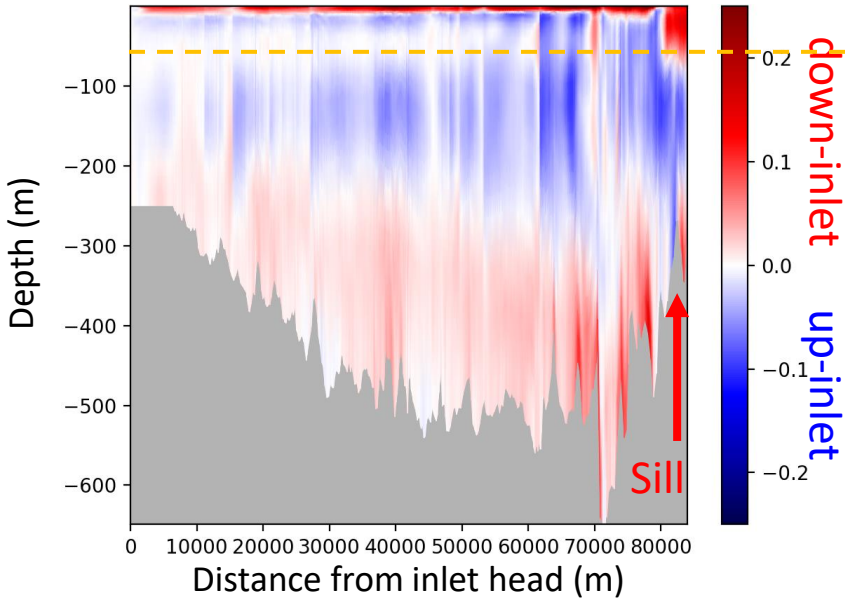

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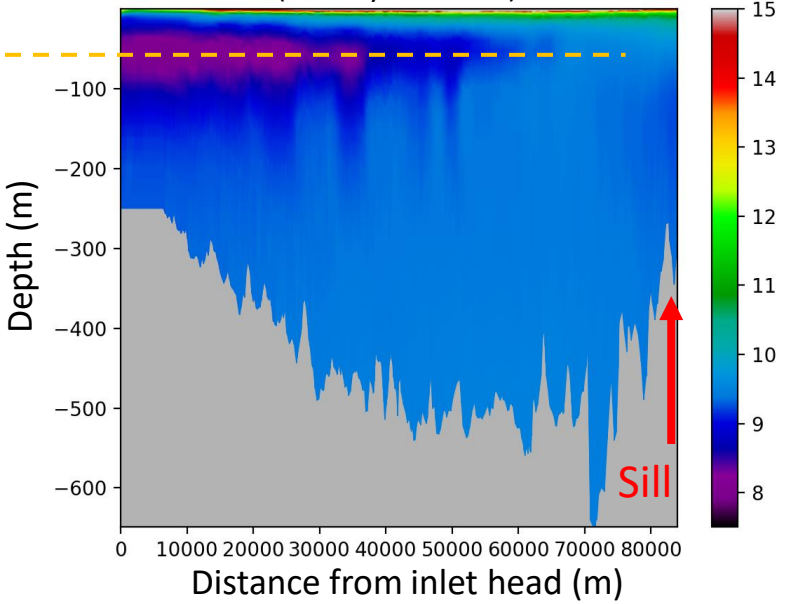

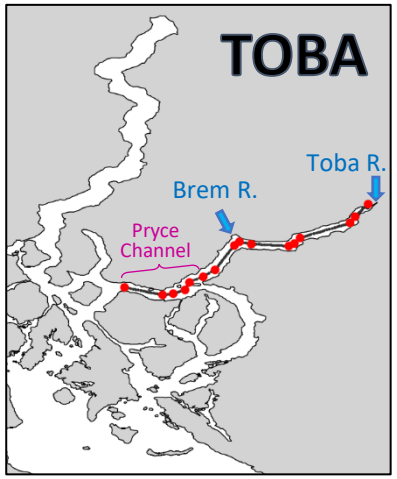

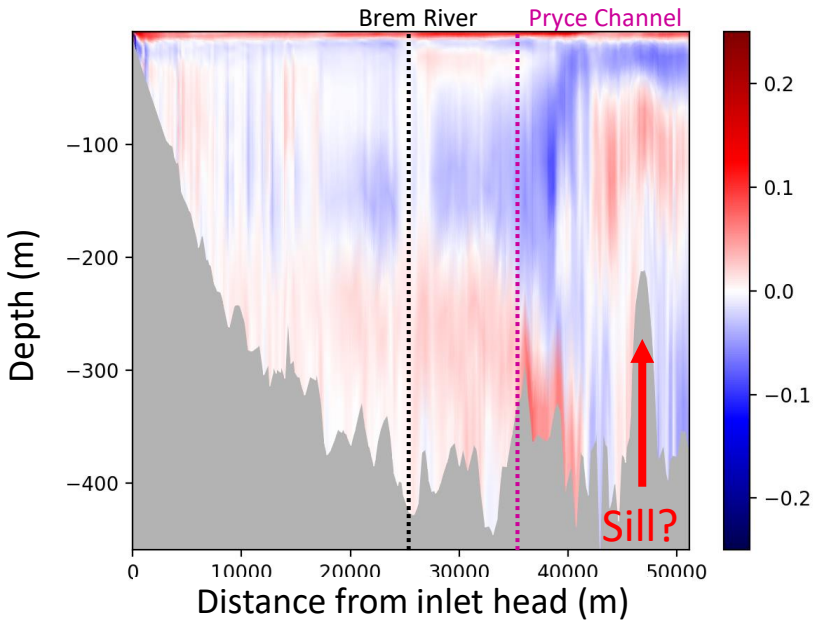

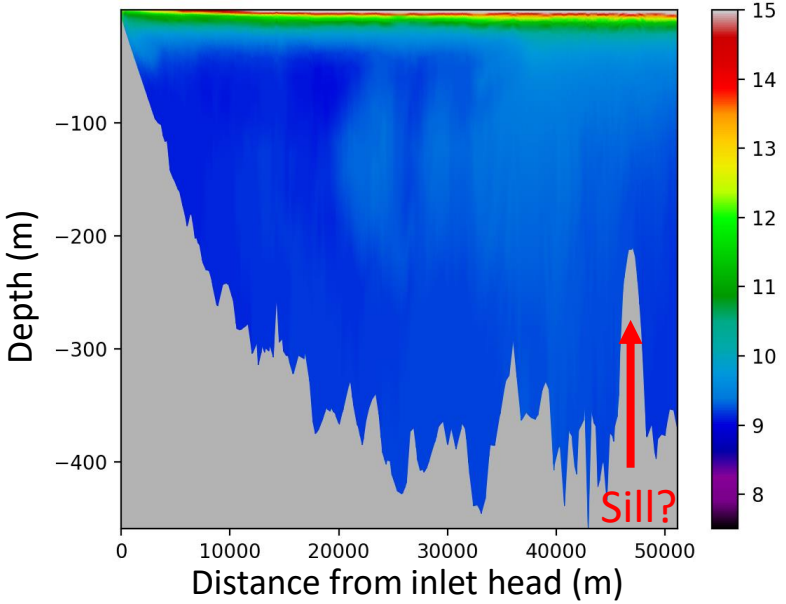

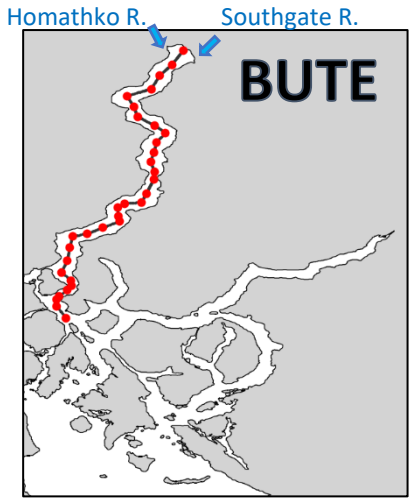

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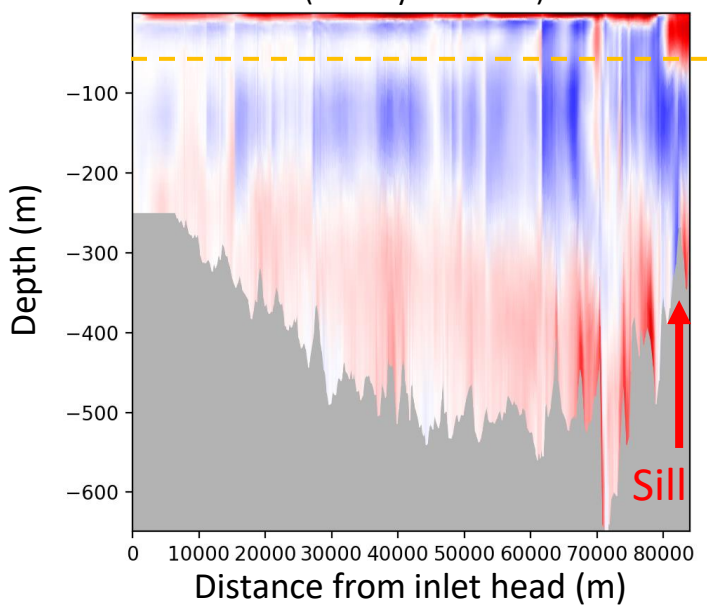

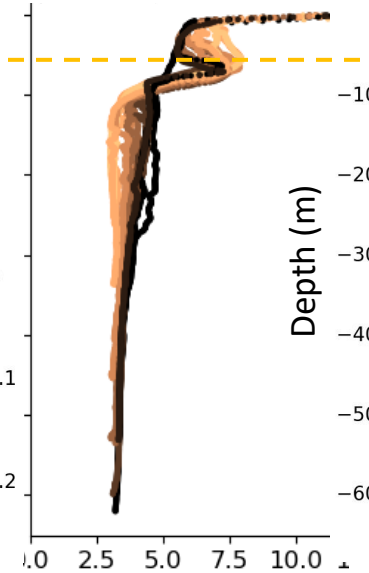

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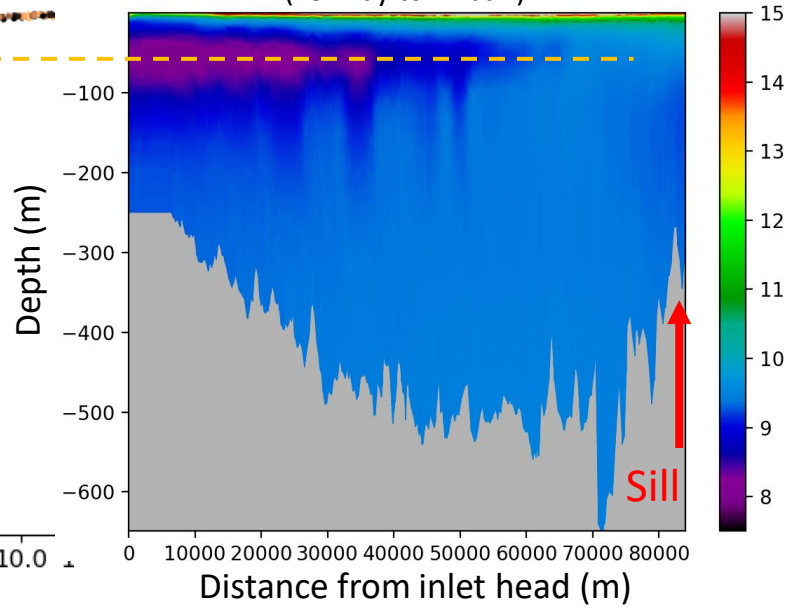
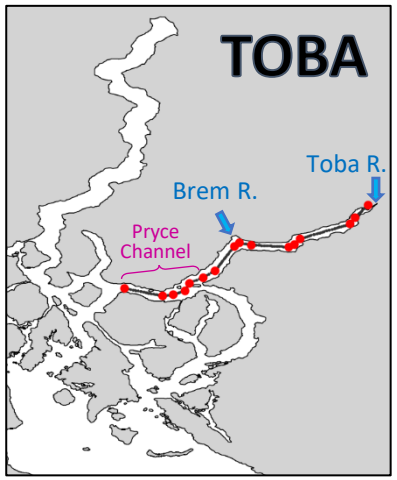
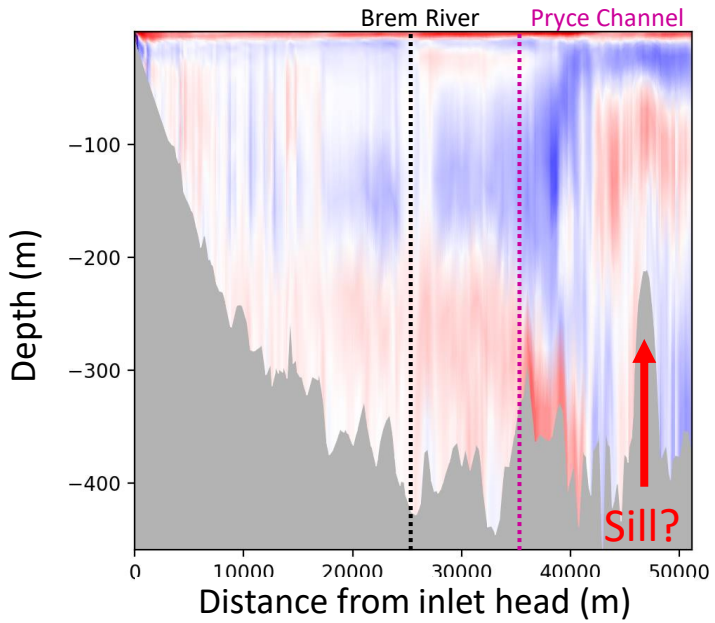
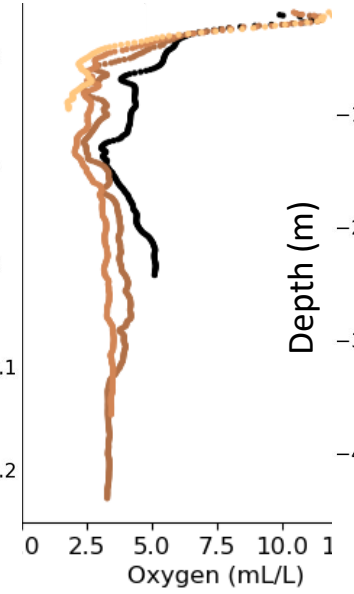
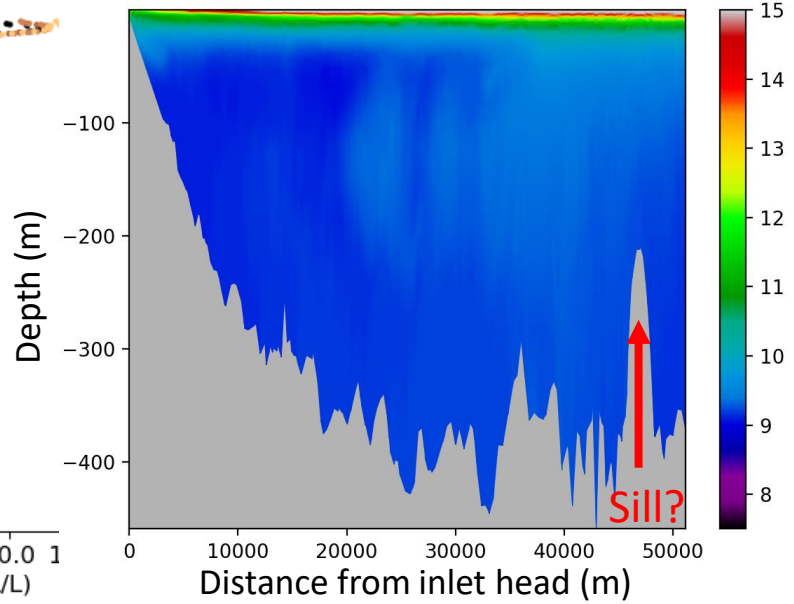






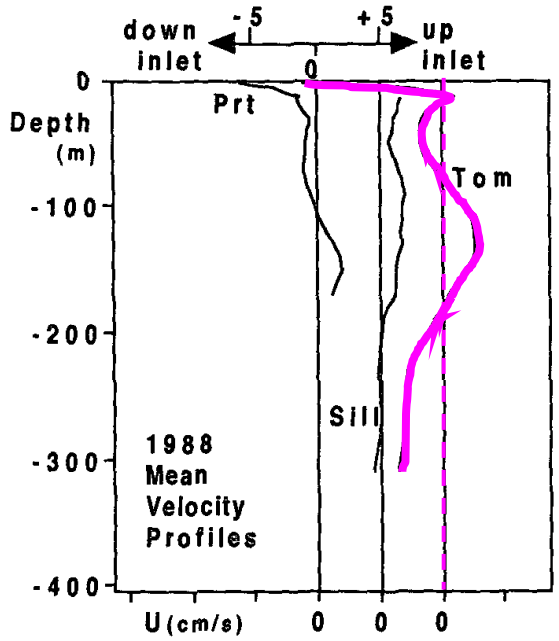




Previous studies show 4-layer flow in summer

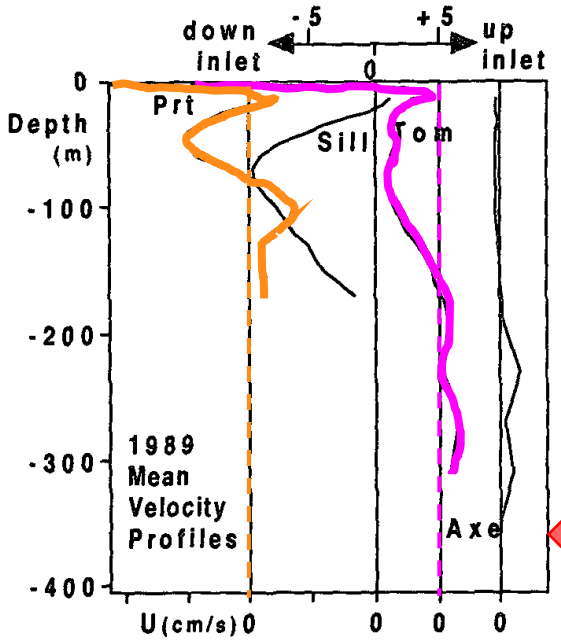
Knight Inlet

Baker and Pond, J. Phys. Oc. (1995)



Mean Along-Inlet Velocities (cm/s)

1-month dataset in spring 1988



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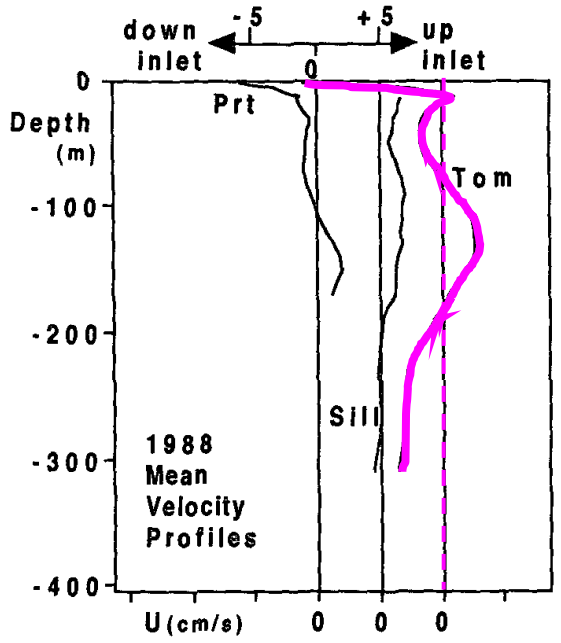

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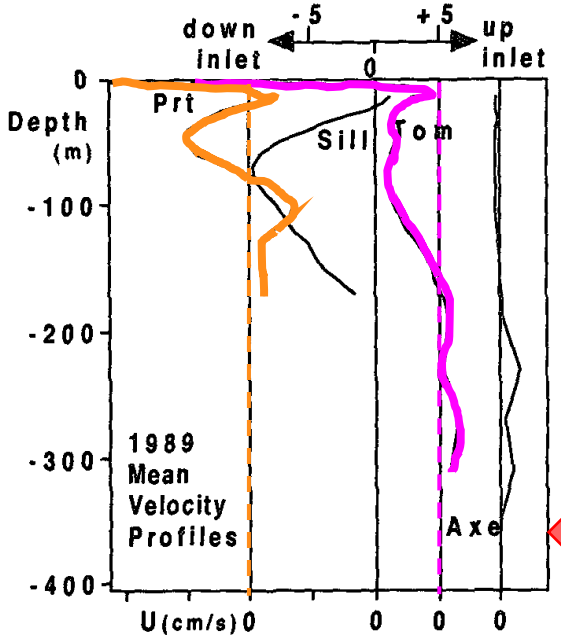


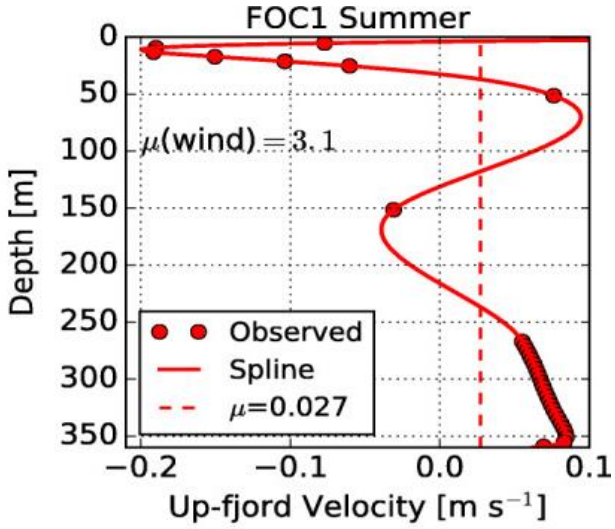
Mean Along-Inlet Velocities (cm/s)

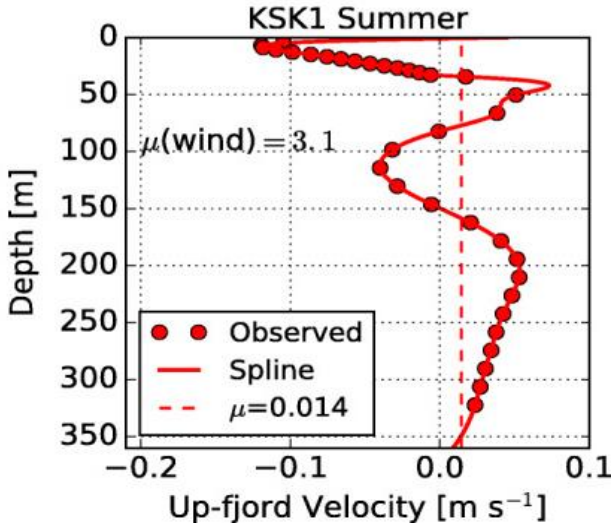
1-month dataset in summer 1989

Douglas Channel

Wan et al., JGR:Oceans (2017)

Mean Summer 2015 Along-Fjord Velocity (m/s)





Thank you!

Laura.Bianucci@dfo-mpo.gc.ca

Summary and Future Work

- **In the model, Bute Inlet shows a 4-layered flow in summer, consistent with studies in other BC fjords**
  - The transition between layers (mean along-inlet velocity ≈ 0) is stable, which allows previously entrained waters (low T, high O_2) to remain at the entrainment depth
- **In contrast, Toba Inlet does not show the same clear layering underneath the surface estuarine circulation**
  - This is consistent with the low O_2 feature being more spread out in the water column
- **Lots of work to do!**
  - Topography and initial conditions need to be improved. Also, river temperature/discharge.
  - Run biogeochemical model once hydrodynamic model is improved. Run longer simulations.
  - Can we explain the observed O_2 differences between Toba and Bute?