Apr 26th, 4:00 PM - 4:30 PM

The Salish Sea was Saturated with respect to Aragonite in Pre-Industrial Times

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The Salish Sea was Saturated with respect to Aragonite in Pre-Industrial Times

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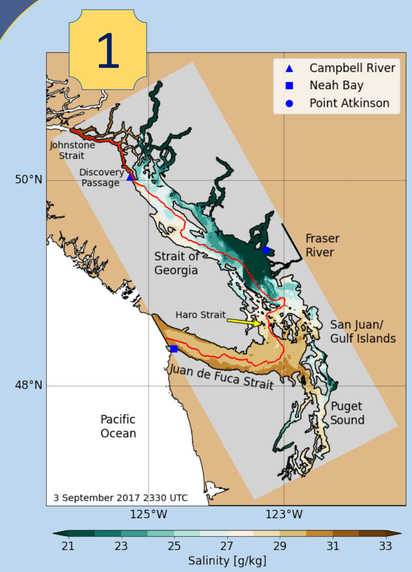
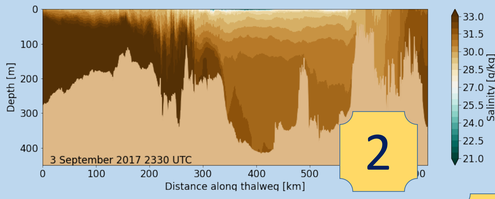


SalishSeaCast is an ocean model of the Salish Sea (domain shown in Fig 1). It is 3-D (view along thalweg [red line in Fig 1] shown in Fig 2) and based on the NEMO community model.

The physical model is coupled to a 10-tracer biological model (Fig 3) and a 2-component carbon model (Fig 4).



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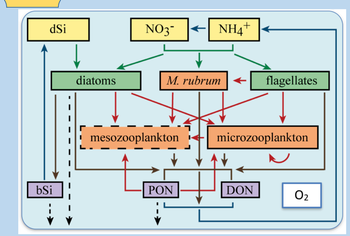

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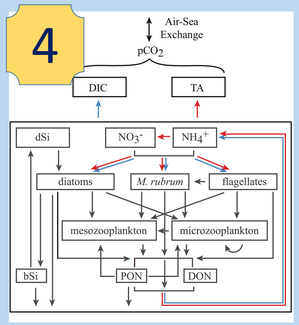
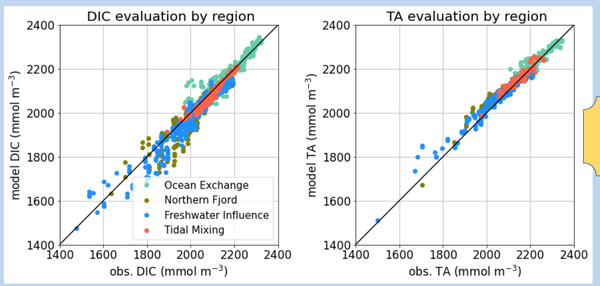


SalishSeaCast is accurate (Fig. 5) based on salinity matched, year day matched observations.

Units (µM)	Bias	RMSE	Willmott Score
Dissolved Inorganic Carbon (DIC)	-15	62	0.97
Total Alkalinity (TA)	12	63	0.98



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From the model we can calculate a DIC budget. The budget relative to a mean DIC concentration of 2050 µM (Fig 6) shows the dominance of the open boundaries.

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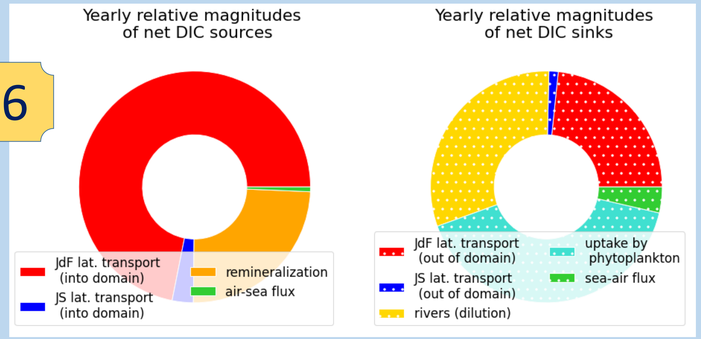
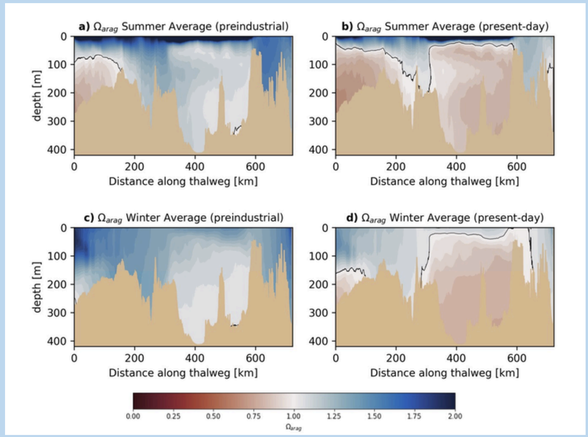


We ran for the present (year 2015) and compared to a pre-industrial run changing only the open boundary conditions and atmospheric pCO_2.



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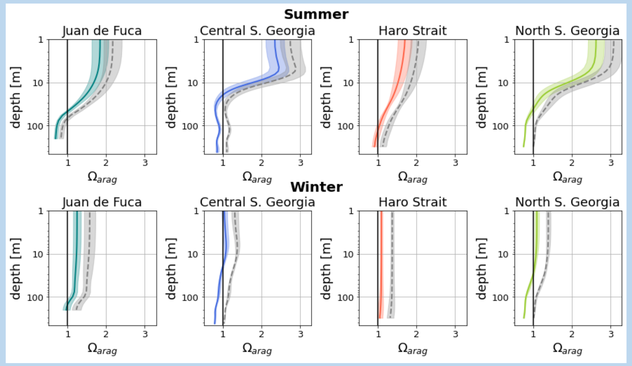
Before the industrial age, the Salish Sea had Aragonite Saturation State (Ω_{arag}) above 1 as a mean for each season, everywhere except at the mouth of JdF (Fig 7).



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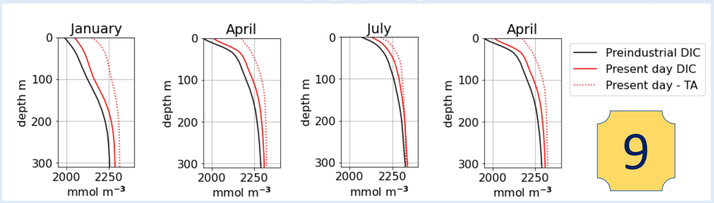
Profiles of Pre-Industrial Ω_{arag} (grey) are distinct from 2015 profiles (colour) in most regions at most depths in both summer and winter (Fig 8). Shading shows 10-90 percentiles of daily values.

Boundary Condition: Details

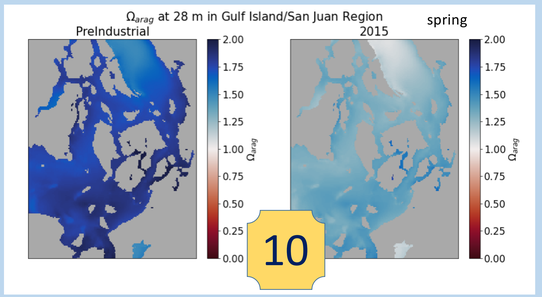
The age of the incoming water (density-matched) is inferred from nearby observations of three transient tracers [1]. We backtrack remineralized carbon to the surface using Apparent Oxygen Utilization and calculate DIC (Fig 9) using the C-star method [2].



9

[1] Sonnerup et al, 2013. *Deep Sea Res.* 72: 61.
[2] Gruber et al, 1996. *Global Biogeochem. Cycles* 10: 809.

Implications: Significant changes are seen in the spring at 28 m depth (Fig 10, 11). Regions with significant freshwater have become undersaturated (Fig 11)



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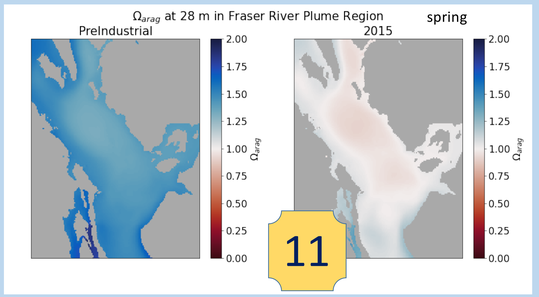

11

Jarnikova T, Ianson D, Allen S, Shao A, Olson E. (2022). Anthropogenic carbon increase has caused critical shifts in aragonite saturation across a sensitive coastal system. Under review at: *Global Biogeochemical Cycles*.