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).

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

<table>
<thead>
<tr>
<th>Units (μM)</th>
<th>Bias</th>
<th>RMSE</th>
<th>Willmott Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved Inorganic Carbon (DIC)</td>
<td>-15</td>
<td>62</td>
<td>0.97</td>
</tr>
<tr>
<td>Total Alkalinity (TA)</td>
<td>12</td>
<td>63</td>
<td>0.98</td>
</tr>
</tbody>
</table>

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.

We ran for the present (year 2015) and compared to a pre-industrial run changing only the open boundary conditions and atmospheric pCO2.

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

Profiles of Pre-Industrial Ωarag (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].

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