Marine CO₂ system variability along the Inside Passage of the Pacific Northwest coast of North America determined from an Alaskan ferry

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Supplemental Figure S1: Combined standard uncertainty in $\Omega_{\text{arag}}$ (left) and pH (right) as a function of pCO$_2$ (µatm) and TA (µmol/kg). pCO$_2$ is computed across a range of TCO$_2$:TA ratios in each panel, with the gray line equalling a ratio of 0.85 and the black line being unity.
**Supplementary Figure S2:** Comparison between estimated and derived alkalinity from two ferry ride-along cruises between November 11 to 17, 2017 and August 25 to 31, 2018. Panel a shows alkalinity estimated using the alkalinity-salinity relationship of (Evans et al., 2015) (gray line; Alk(S)) and alkalinity calculated from discrete pCO$_2$ and TCO$_2$ measurements (red circles; Bottle Alk) from the first cruise in November 2017. Panel b is Bottle Alk minus Alk(S), with the gray horizontal lines as two times the RMSE of the Evans et al. (2015) relationship (34 µmol kg$^{-1}$). Panel c shows Alk(S) and Bottle Alk from the second ride-along cruise in August 2018, with Panel d is the difference in these parameters. Alkalinity is over-estimated by ~200 µmol kg$^{-1}$ during the summer melt season in the lowest alkalinity zone of the northern portion of the transit.
Supplementary Figure S3: Map shows distribution of salinity measurements that correspond to BGC-SUMO pH data used to fill missing pCO₂ observations. The insert shows the comparison between BGC-SUMO pH and pH estimated from pCO₂ and the regional salinity-alkalinity relationship. Total number of comparison points is 30527 measurements. RMSE between measured and estimated pH was 0.069, and decreased to 0.048 for seawater measurements with S > 22. The largest offset between directly measured and estimated pH was in seawater with S < 22. 84% of S < 22 seawater was observed north of 57°N in the region during summer months around Juneau and in Lynn Canal. In this region, the estimated alkalinity is too high, which leads to pH and Ω_{arag} being over-estimated and pCO₂ being under-estimated for instances where pH is used to fill missing observations in low S water. However, the region still maintains Ω_{arag} < 1, so accounting for this over-estimation leads to more corrosive conditions.
Supplementary Figure S4: The biophysical component of pCO$_2$ variability (µatm).
Supplementary Figure S5: The temperature component of pCO$_2$ variability (µatm).
Supplementary Figure S6: The salinity component of pCO$_2$ variability (µatm).
Supplementary Figure S7: The combined temperature and salinity components of pCO₂ variability (µatm).
Supplementary Figure S8: Observed pCO$_2$ minus the temperature and salinity components of pCO$_2$ variability (µatm).
Supplemental Figure S9: The age (yr), or time since last contact with the atmosphere, of surface water along the Inside Passage.
Supplementary Figure S10: The contemporary pH values minus the estimated values for 1765 (top) and the estimated values for 2035 minus the 1765 values (bottom).
Supplemental Figure S11: Buffer factors for pCO₂ (top, the Revelle factor), Ω_{arag} (middle), and [H⁺] (bottom) as a function of TCO₂ and TA. The buffer factor is the percentage change in each variable following a change in TCO₂. The dashed line denotes equal TCO₂ and TA across the range of values shown, and is the minimum buffering state (and maximum Revelle factor) for all buffer factors. Average TCO₂ and TA values for summer (white circle) and winter (black circle) are shown to highlight that winter conditions on average are closer to the minimum buffering state, and therefore percentage changes in these values will be greatest during winter.