Inorganic Carbon Dynamics at the Gulf of Alaska Ecosystem Observatory

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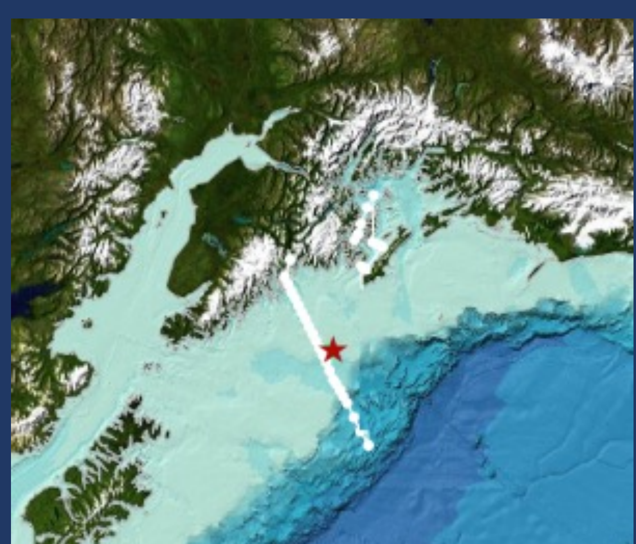
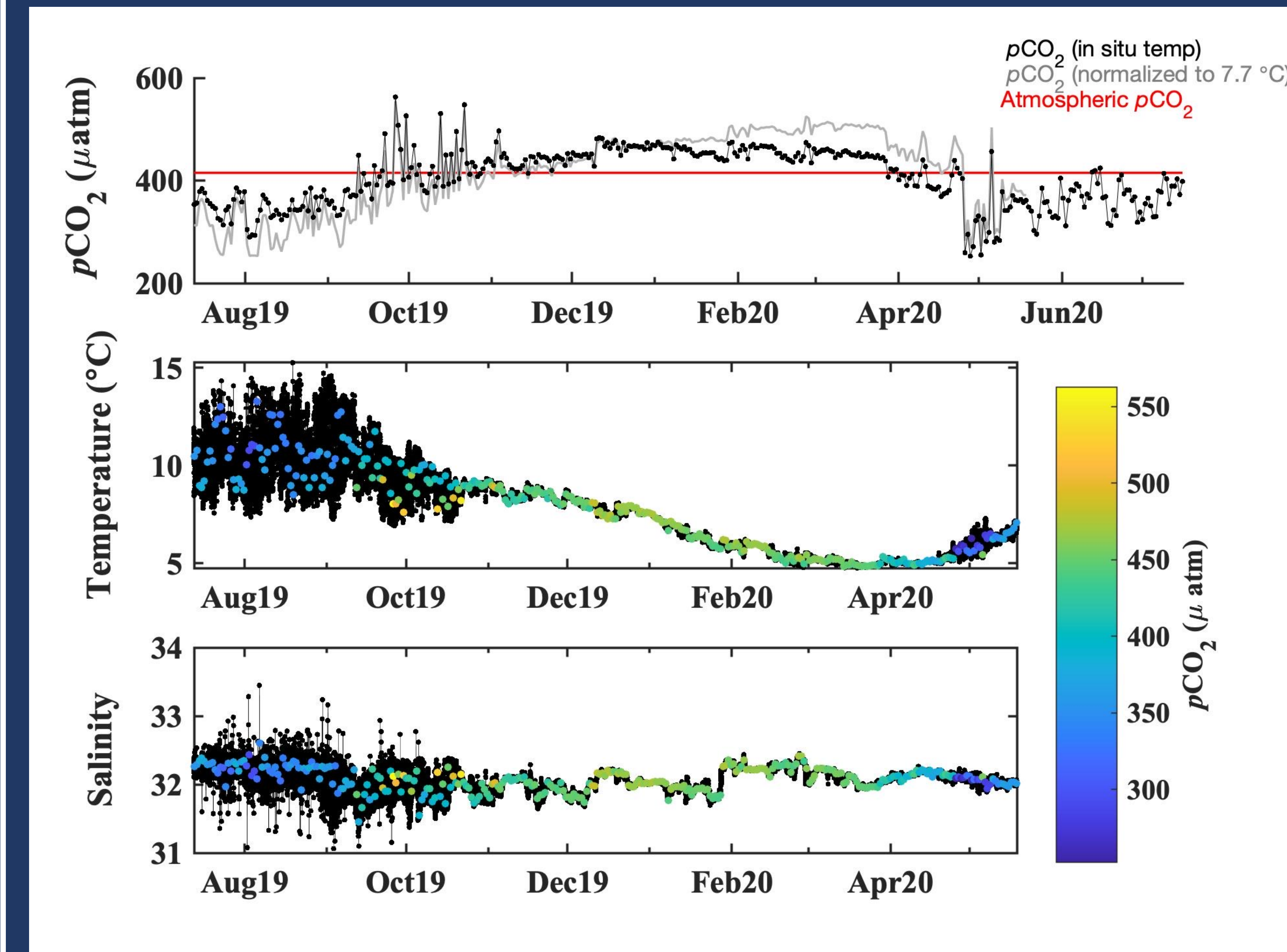
Background

- Sensors are located at **22m depth** at the Gulf of Alaska Ecosystem Observatory
- Contros HydroC sensor measures ***p*CO_2** every **24 hours**
- **Salinity and temperature** measured every **15 minutes**
- *p*CO_2, where noted, is normalized to the average temperature 7.7°C using an exponential relationship which neglects the influence of total alkalinity and salinity.



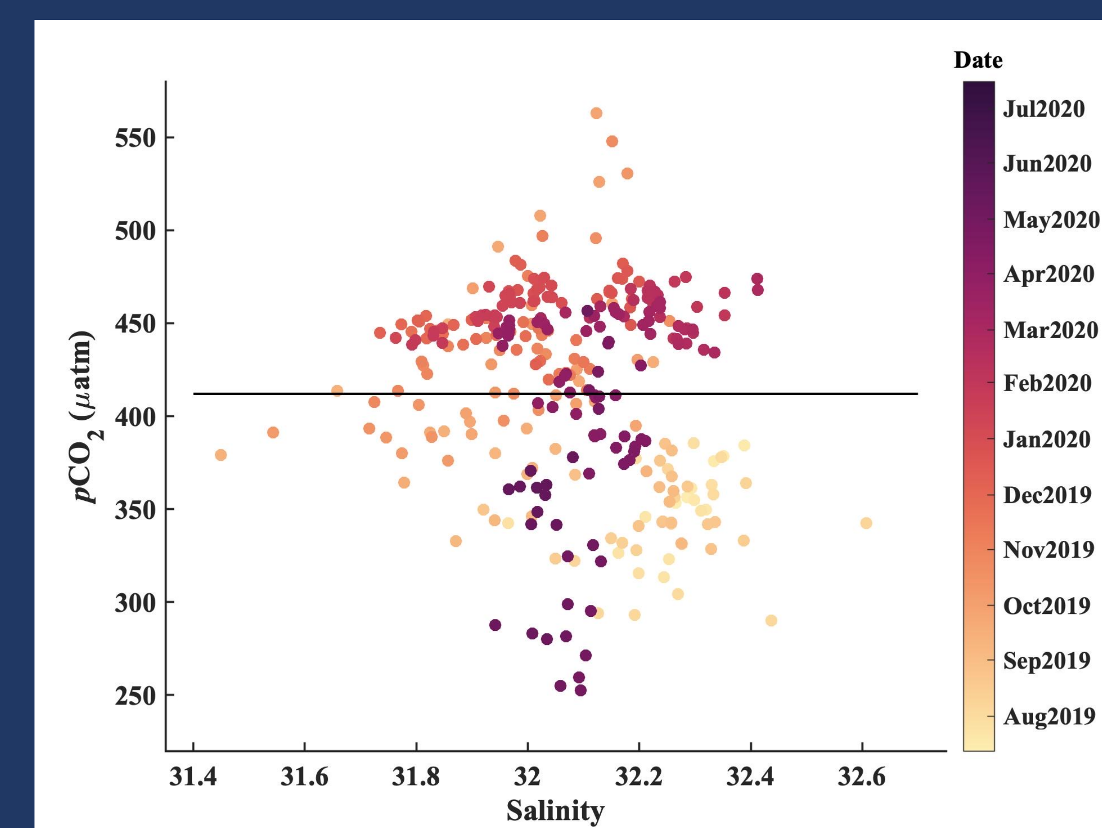


Low *p*CO_2 in summer, high *p*CO_2 in winter

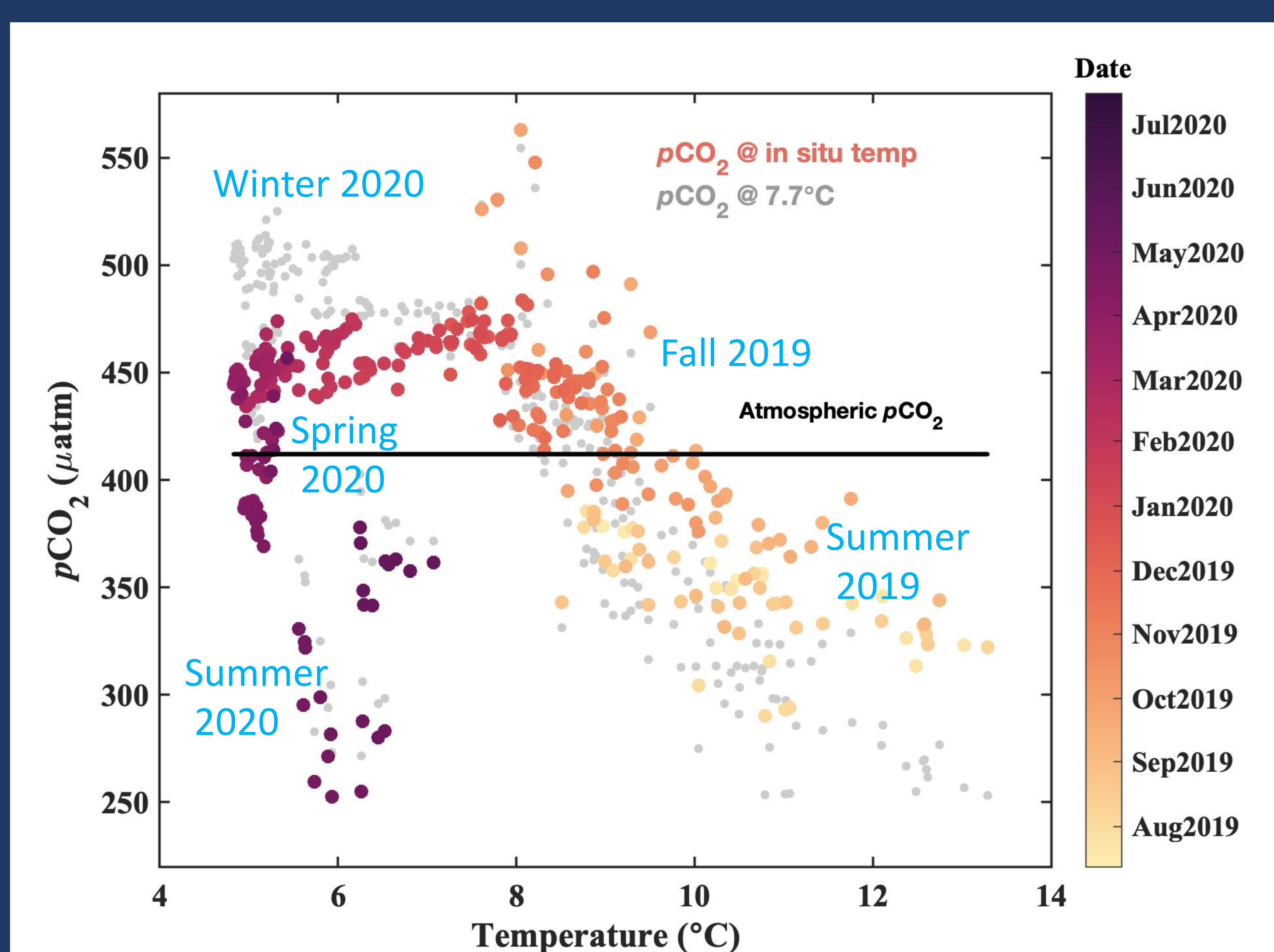
- **Atmospheric *p*CO_2 > oceanic *p*CO_2** from April – October because photosynthesis consumes inorganic carbon
  - **Minimum in-situ *p*CO_2** observed in April
- **Oceanic *p*CO_2 > atmospheric *p*CO_2** from October –April due to wintertime mixing of CO_2-rich deep water

✵**High variability** in salinity, temperature and *p*CO_2 in summer and fall months because the mixed layer depth is varying around the sensor depth at 22m

Freshwater is not a major driver of *p*CO_2, or its influence is obscured by other drivers:



Temperature, mixing and primary productivity control *p*CO_2:



Fall 2019

- **Highest *p*CO_2 spikes in October**
  - May be due to remineralization of organic matter as summertime biological production dies off

Winter 2020

- **In-situ *p*CO_2 declines due to the direct physical effects of decreasing temperature.** Temperature-normalized *p*CO_2 increases due to continued mixing and remineralization

Spring 2020

- *p*CO_2 decreases as temperatures increase
  - Decreased mixing allows bloom formation

Summer 2019 & 2020

- Temperature-normalized *p*CO_2 is **similarly low** throughout summer months
- What combination of mixing & primary productivity explains this, since production generally decreases later in summer as nutrients become limited?

Future work

- Use pH and oxygen sensor measurements for fuller understanding of biogeochemistry and ocean acidification conditions
- What is the relationship between *p*CO_2, chlorophyll, and mixed layer depth?
- How much interannual variability is observed?

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