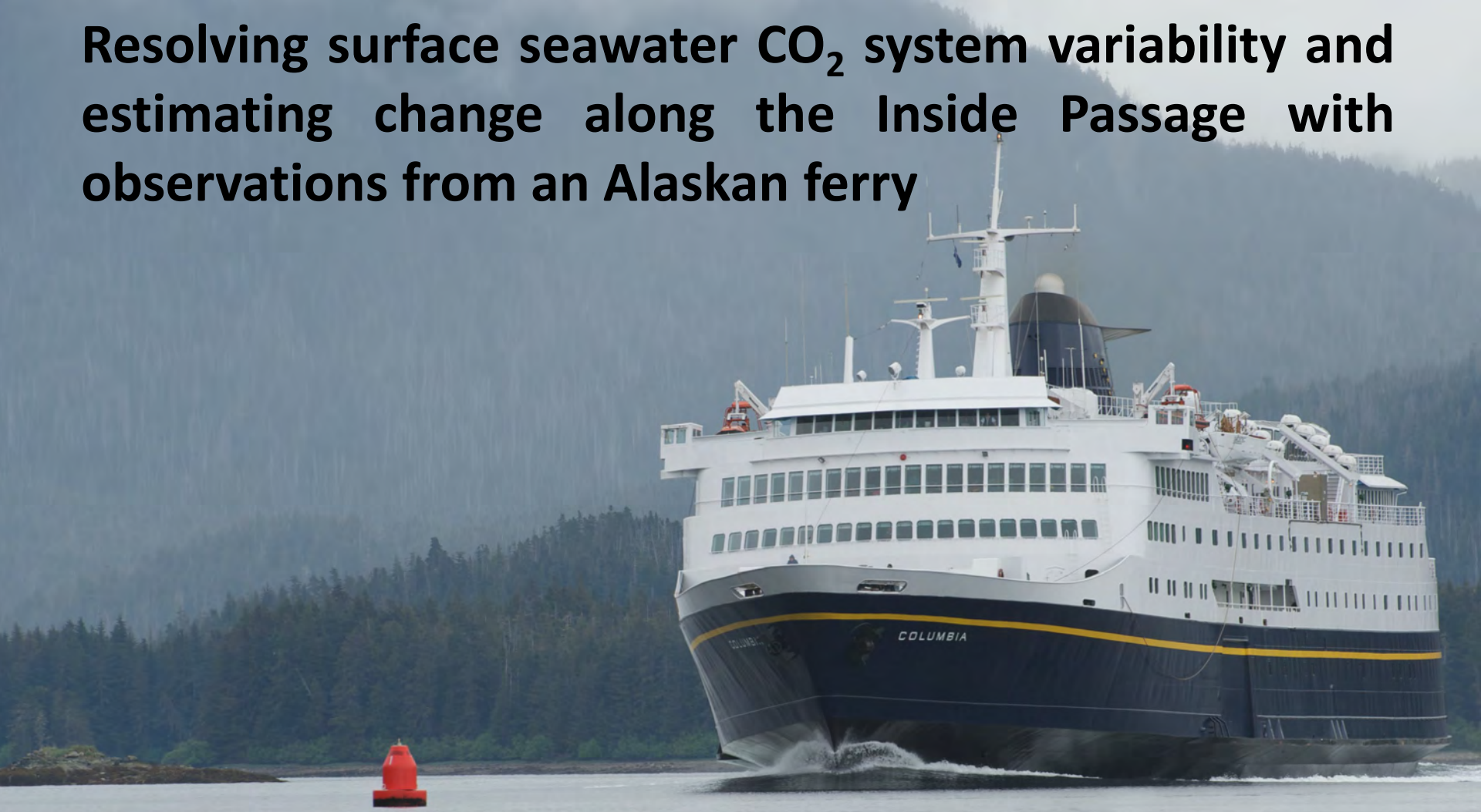
# Resolving surface seawater $CO_2$ system variability and estimating change along the Inside Passage with observations from an Alaskan ferry




**Wiley Evans[1,*], Geoffrey T. Lebon[2,3], Christen D. Harrington[4], Yui Takashita[5], Allison Bidlack[6]**

[1]Hakai Institute, Heriot Bay, British Columbia, Canada; [*]wiley.evans@hakai.org

[2]Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, Seattle, Washington, USA

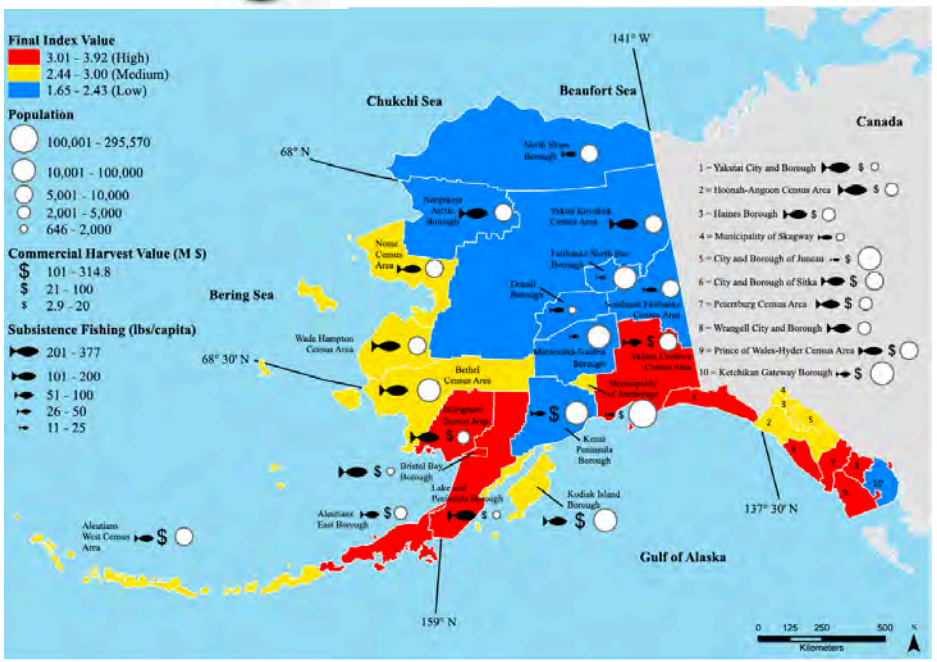
[3]Joint Institute for Study of the Ocean and Atmosphere, University of Washington, Seattle, Washington, USA

[4]Alaska Department of Transportation, Ketchikan, Alaska, USA

[5]Montery Bay Aquarium Research Institute, Moss Landing, California, USA

[6]Alaska Coastal Rainforest Center, University of Alaska Southeast, Juneau, Alaska, USA

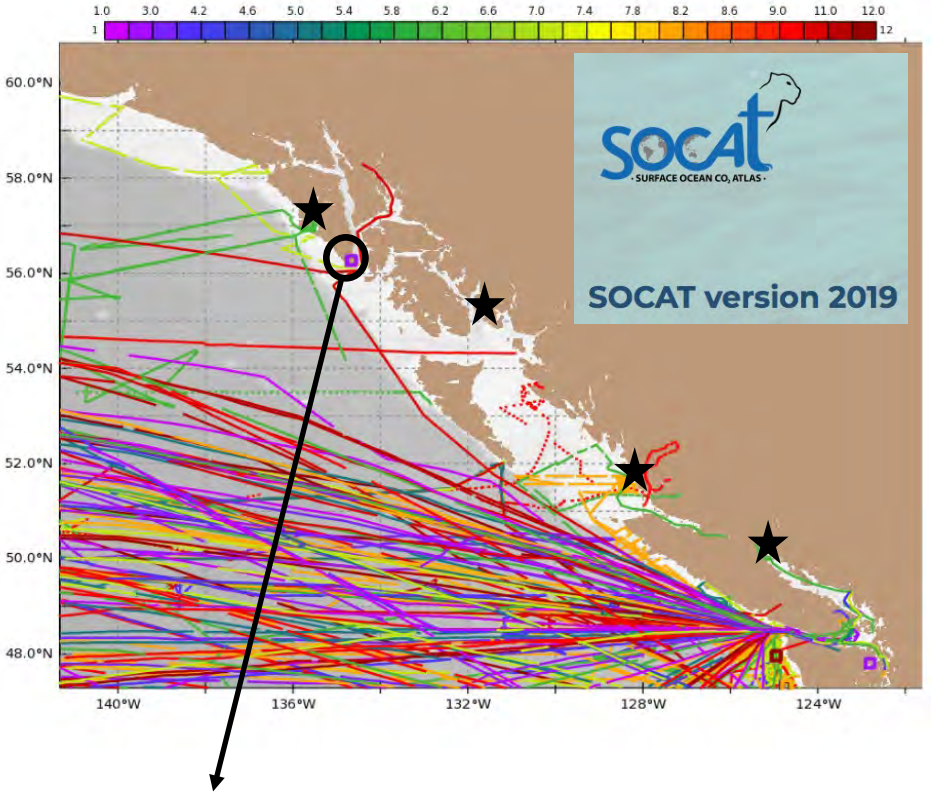

# The Inside Passage: part of a vulnerable region with low data coverage




Ocean acidification risk assessment for Alaska's fishery sector

J.T. Mathis [a,b,*,1], S.R. Cooley [c,1,2], N. Lucey [d], S. Colt [e], J. Ekstrom [f], T. Hurst [g,h], C. Hauri [i], W. Evans [a,b], J.N. Cross [a,b], R.A. Feely [a]

Month of the year

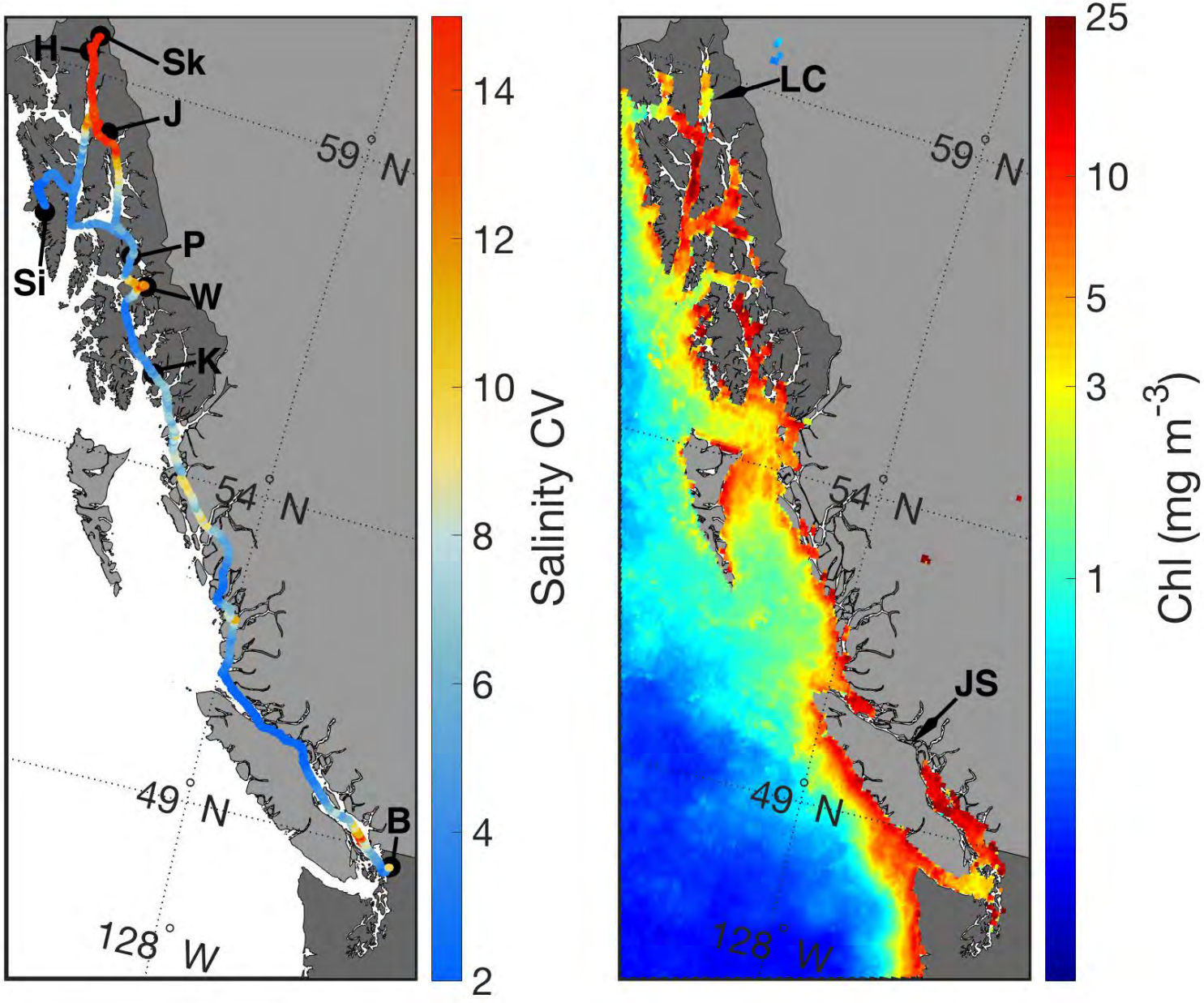



# Alaska Marine Highway Ferry *Columbia* $CO_2$ system in 2017

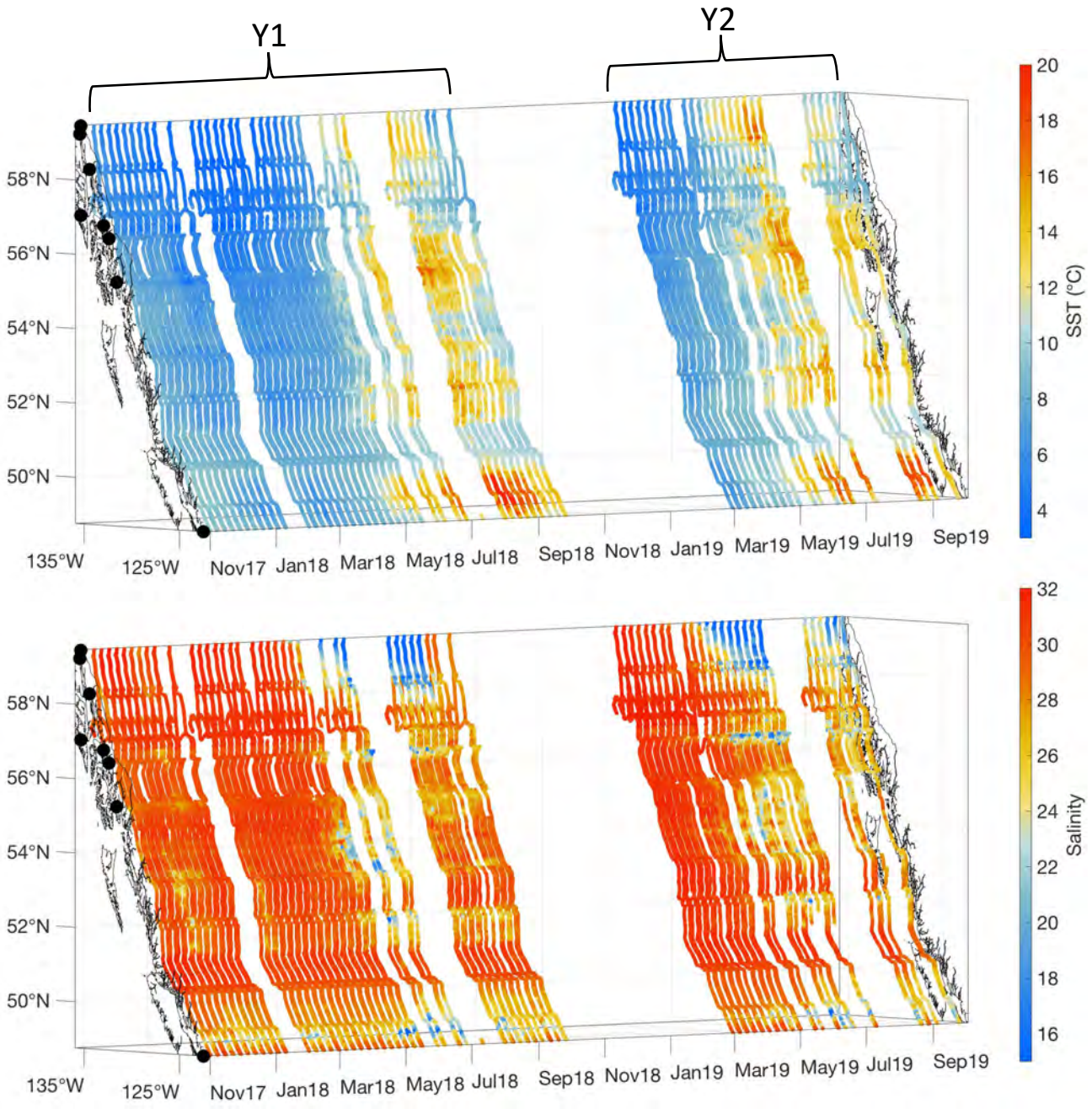


# Addition of MBARI BioGeoChemical SUrface MOnitoring (BGC-SUMO) system in 2019

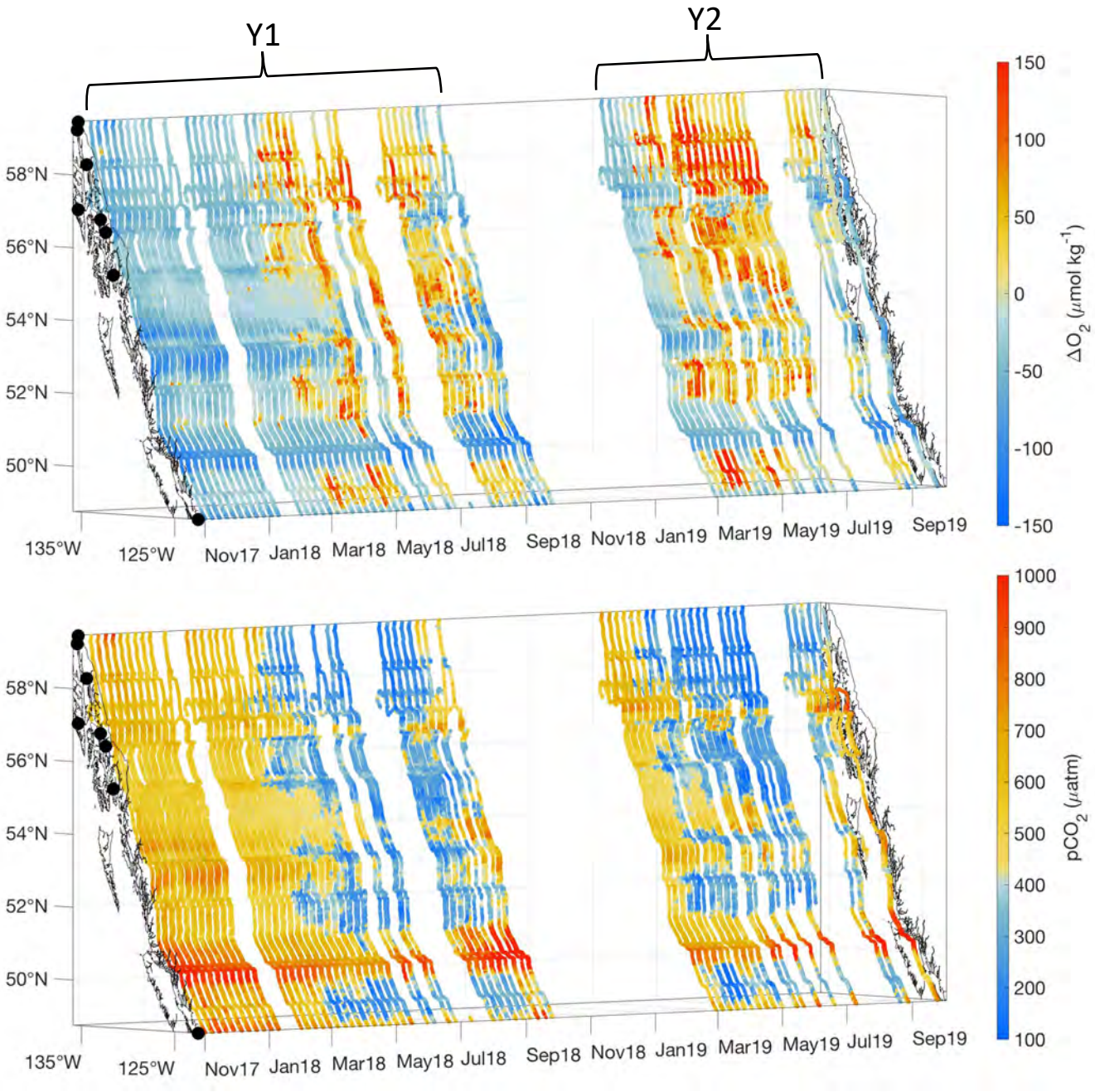
# The longest instrumented ferry run in North America
## ~1300 km 1-way



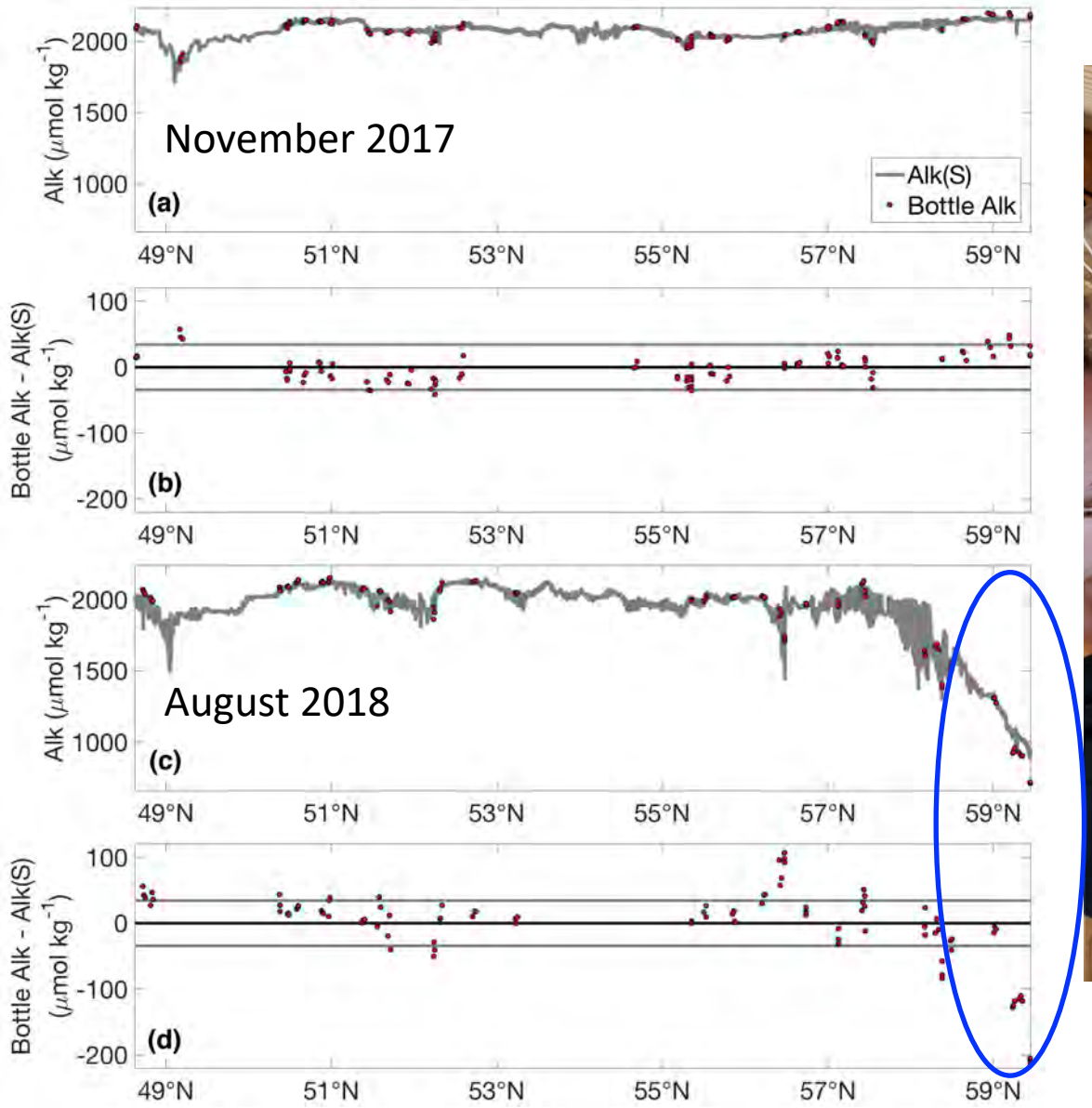
# Seasonal/Inter-annual patterns in SST & Salinity

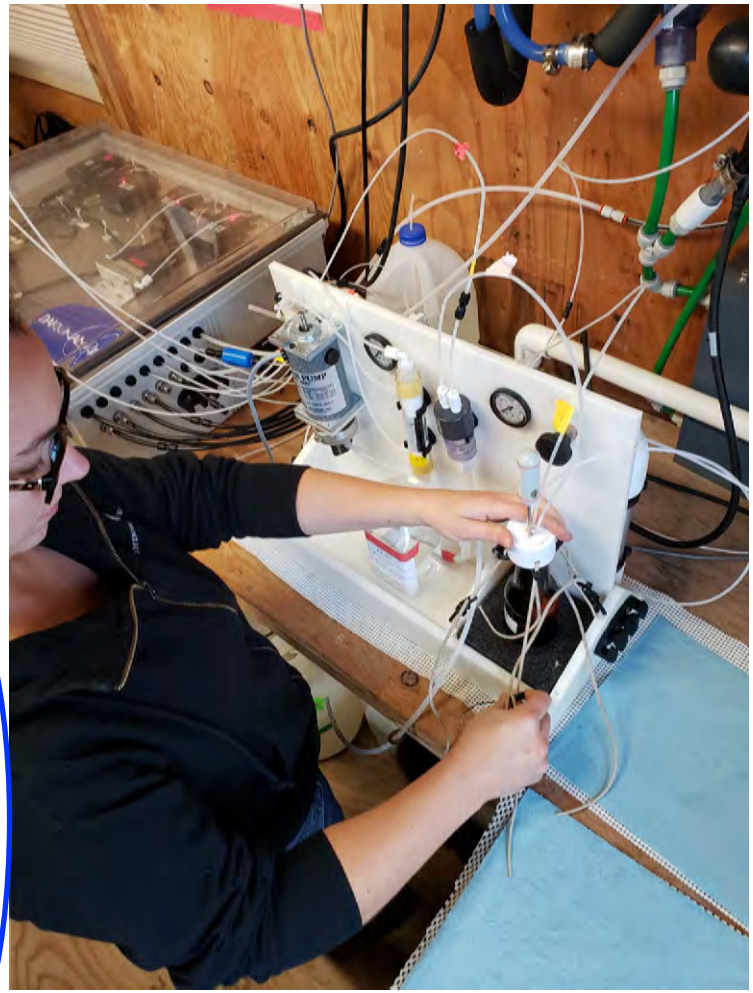


# Seasonal/Inter-annual patterns in $O_2$ & $pCO_2$



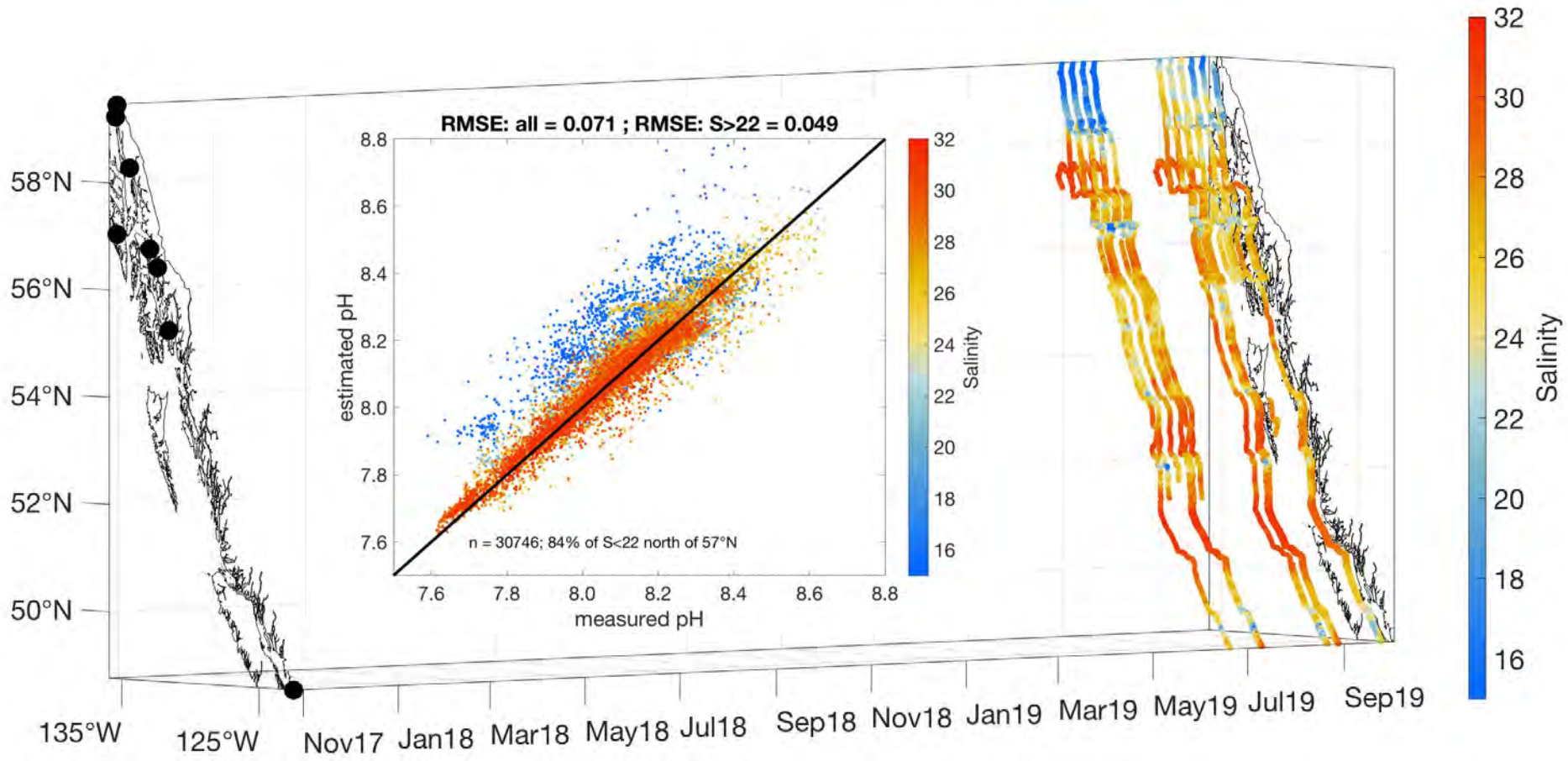
# Discrete $pCO_2$/$TCO_2$ sample validation



Alkalinity poorly estimated in low S water

# BGC-SUMO pH comparison

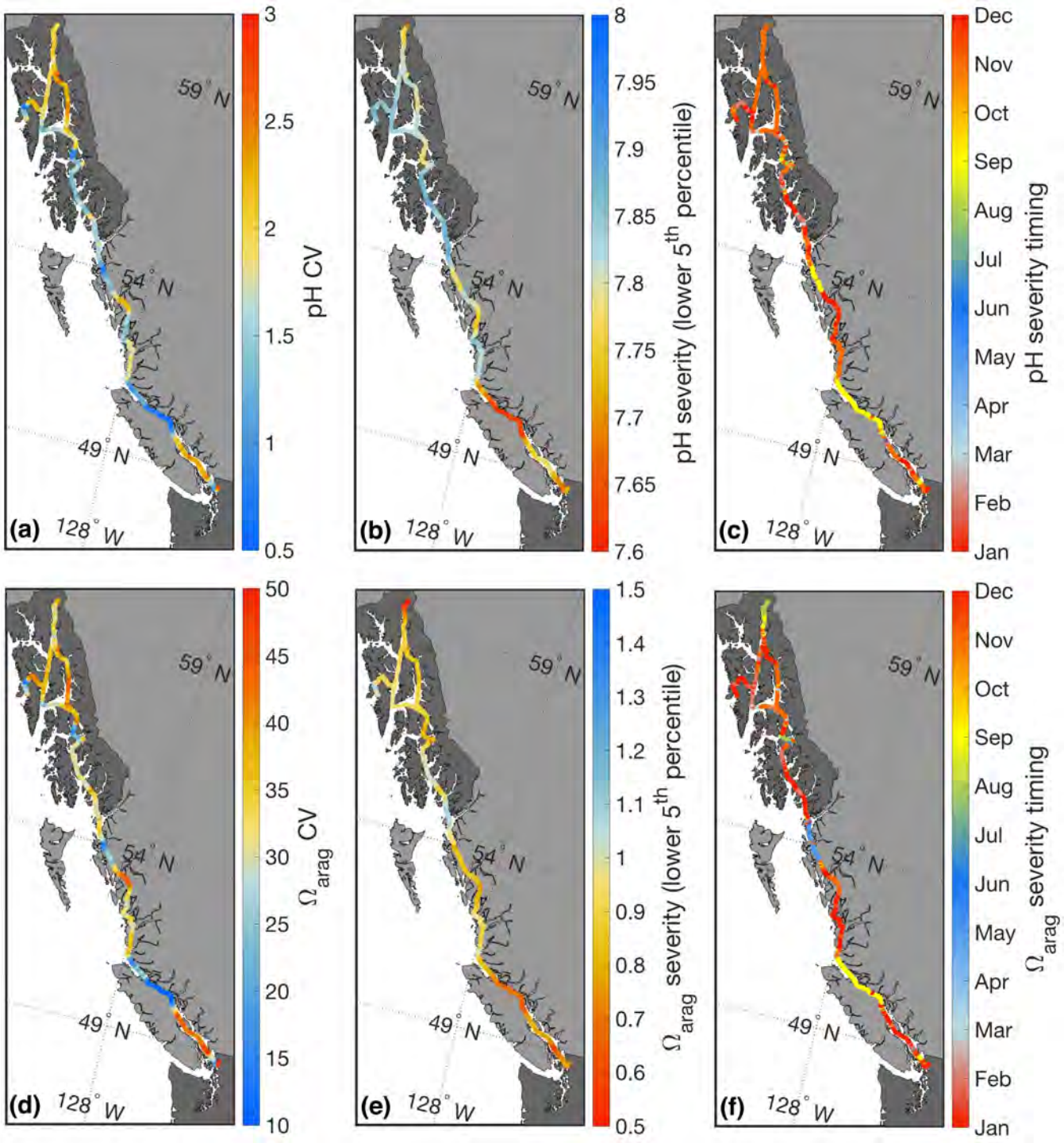



Points to over-estimate in alkalinity in low S water

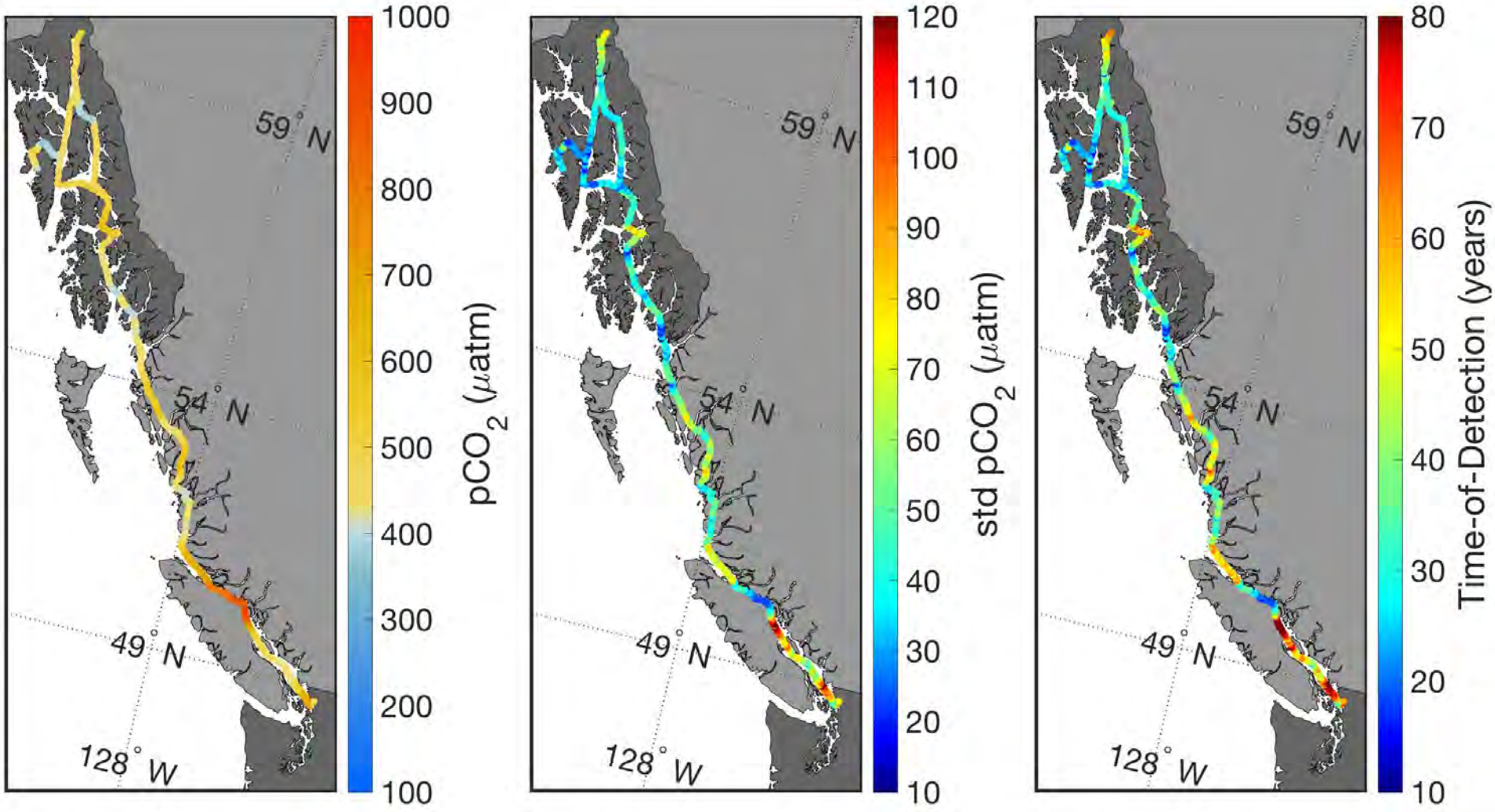
Measured pH lower than estimated

Most evident in summer in Lynn Canal

Variability in derived $CO_2$ parameters with differences in severity and timing

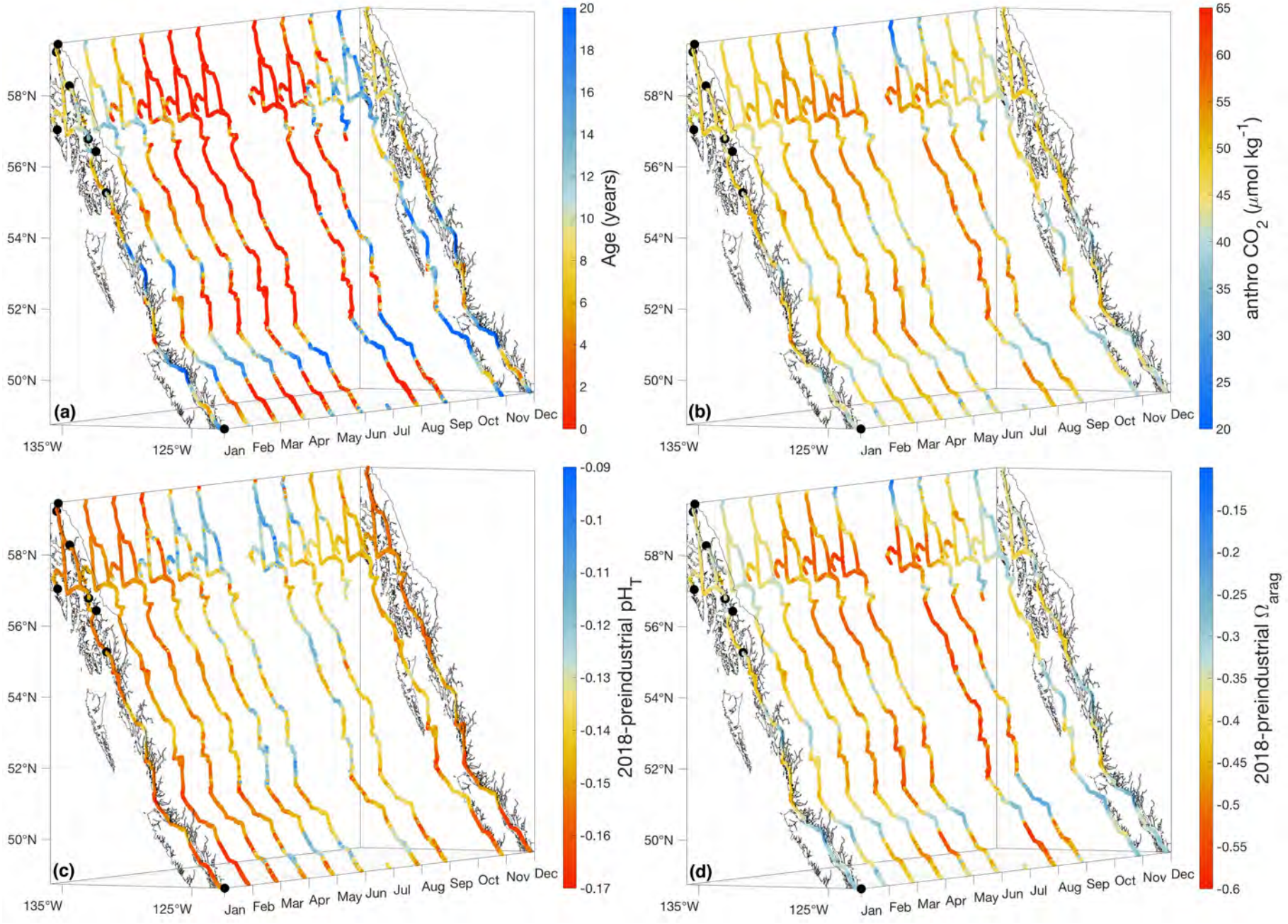


# Can we use this information to optimize our observing system?



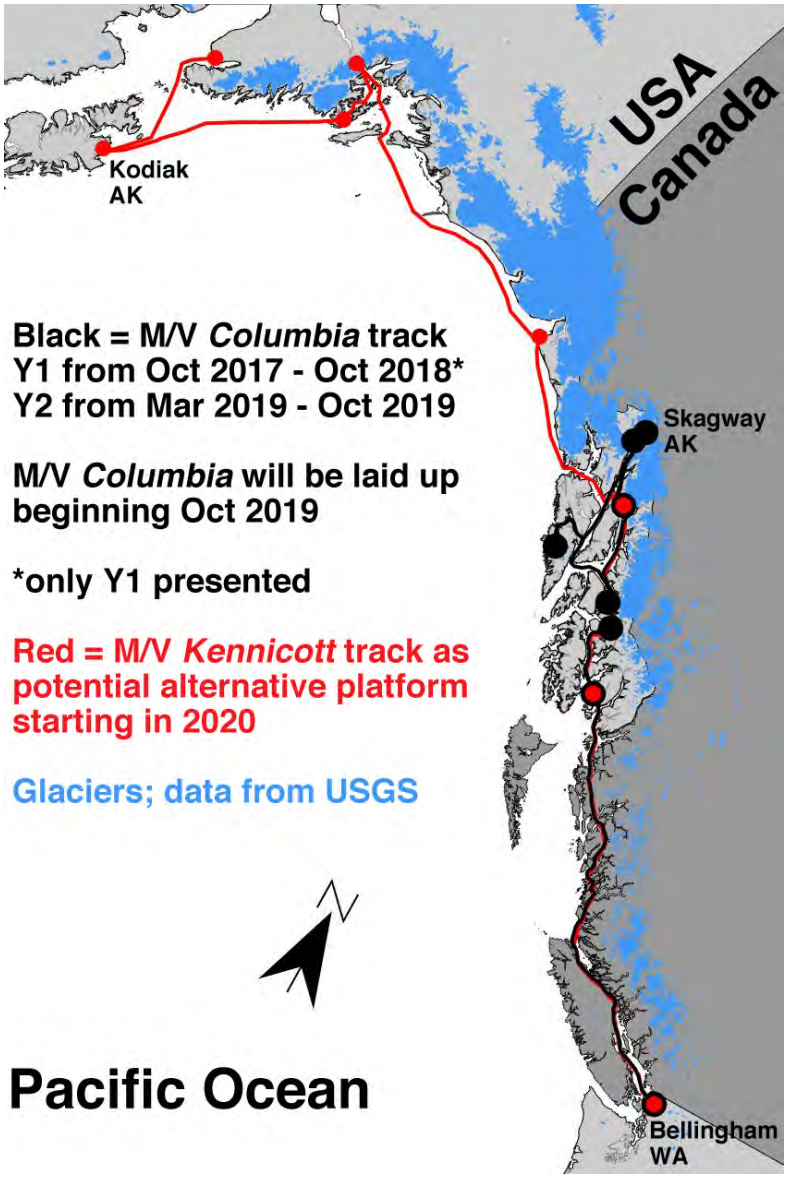

Without long datasets, must rely on estimating anthropogenic $CO_2$ to evaluate change

# Water mass age, anthro-$CO_2$, & impacts on pH / $\Omega_{arag}$



# Closing Remarks

- Resolved $O_2$/$pCO_2$ variability for Inside Passage
- Need to improve TA estimation in regions of glacial melt
- Most severe pH/$\Omega_{arag}$ do not necessarily occur at the same time / location
- Strategize OA observing based on observed $pCO_2$ variability
- Seasonally dynamic anthro-$CO_2$ with differential between change in pH and $\Omega_{arag}$




**Data available:**
https://dx.doi.org/10.21966/zxzr-e472