University of East Anglia

Glider based analyses of Ross Sea bloom net community production: biological vs. physical controls

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Background

Image courtesy of The Last Ocean

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- Bloom succession usually moves from *Phaeocystis antarctica* to diatoms around the daily biomass peak (Jones and Smith, 2017; Meyer et al., 2022)

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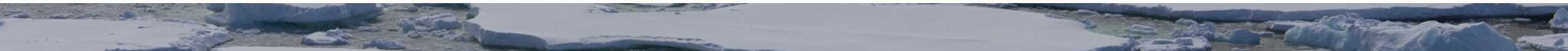

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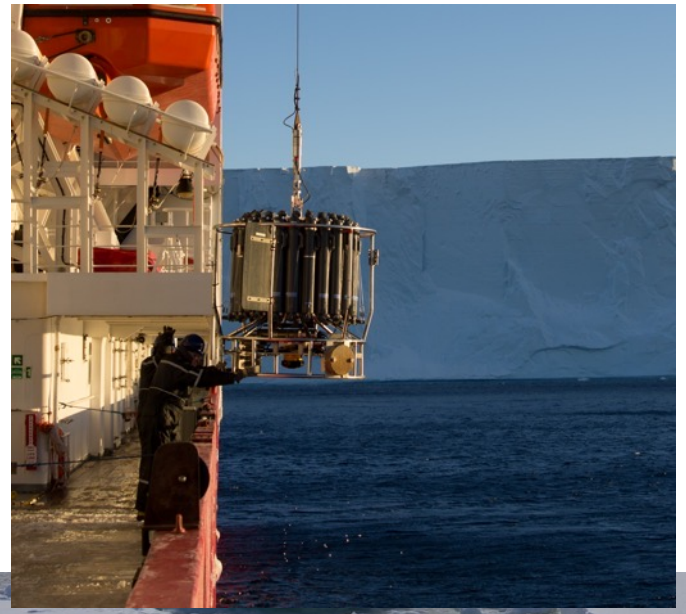
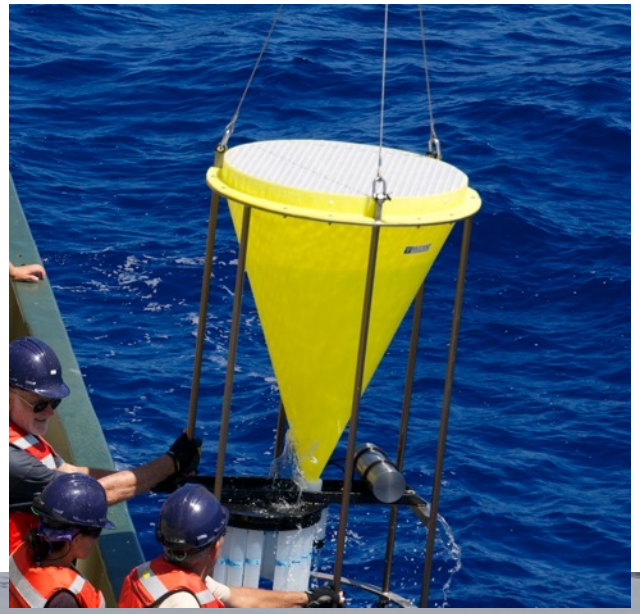
- Carbon export previously measured in the Ross from traditional methods (values ranging from <0.01 – 0.1 g C m^{-2} d^{-1}; Dunbar et al., 1998; Langone et al., 1997; Asper and Smith, 1999; Smith et al., 2011)





Images courtesy of BAS, MBARI, UW

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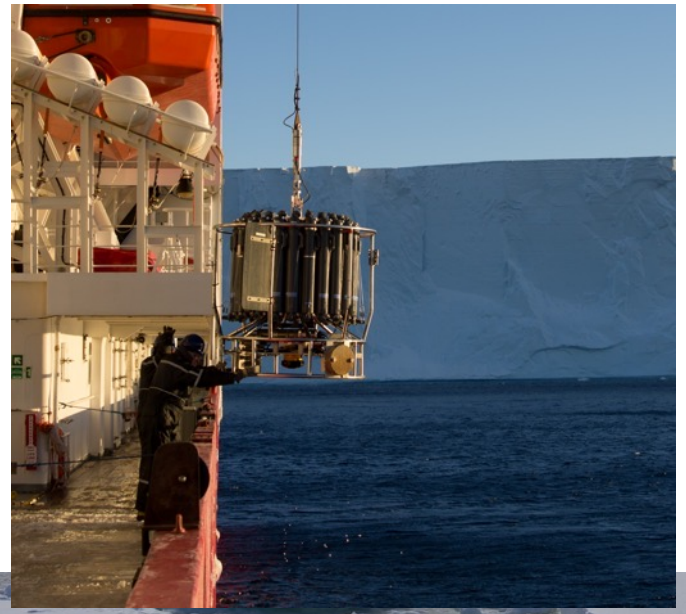
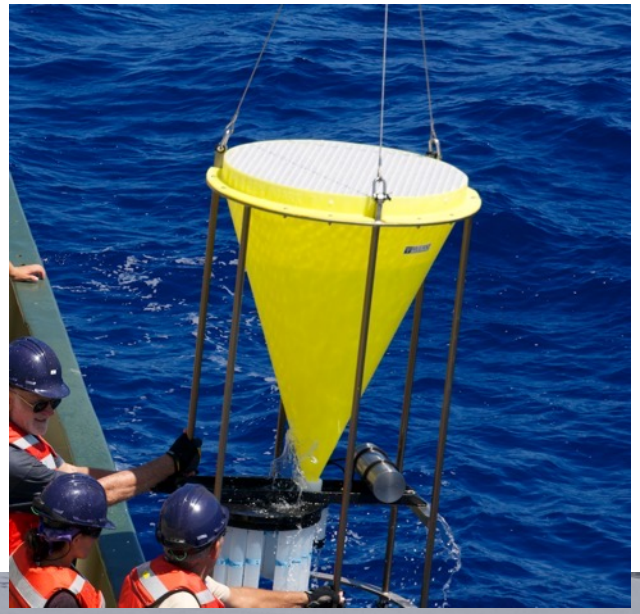
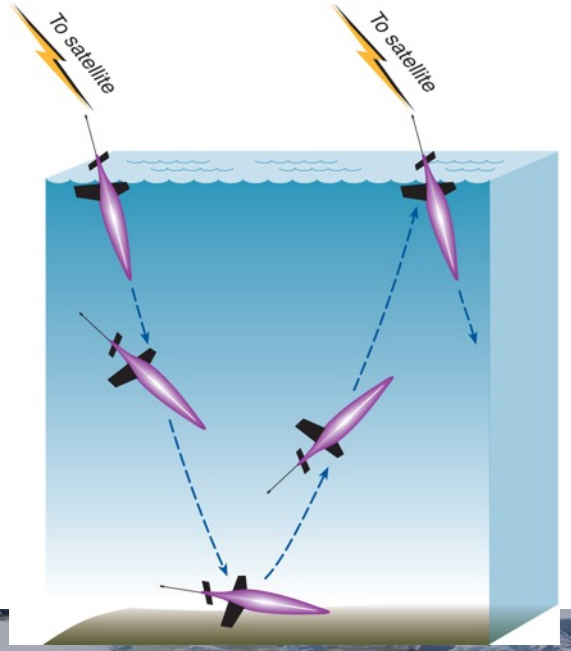
- Gliders present opportunity for enhanced spatiotemporal resolution







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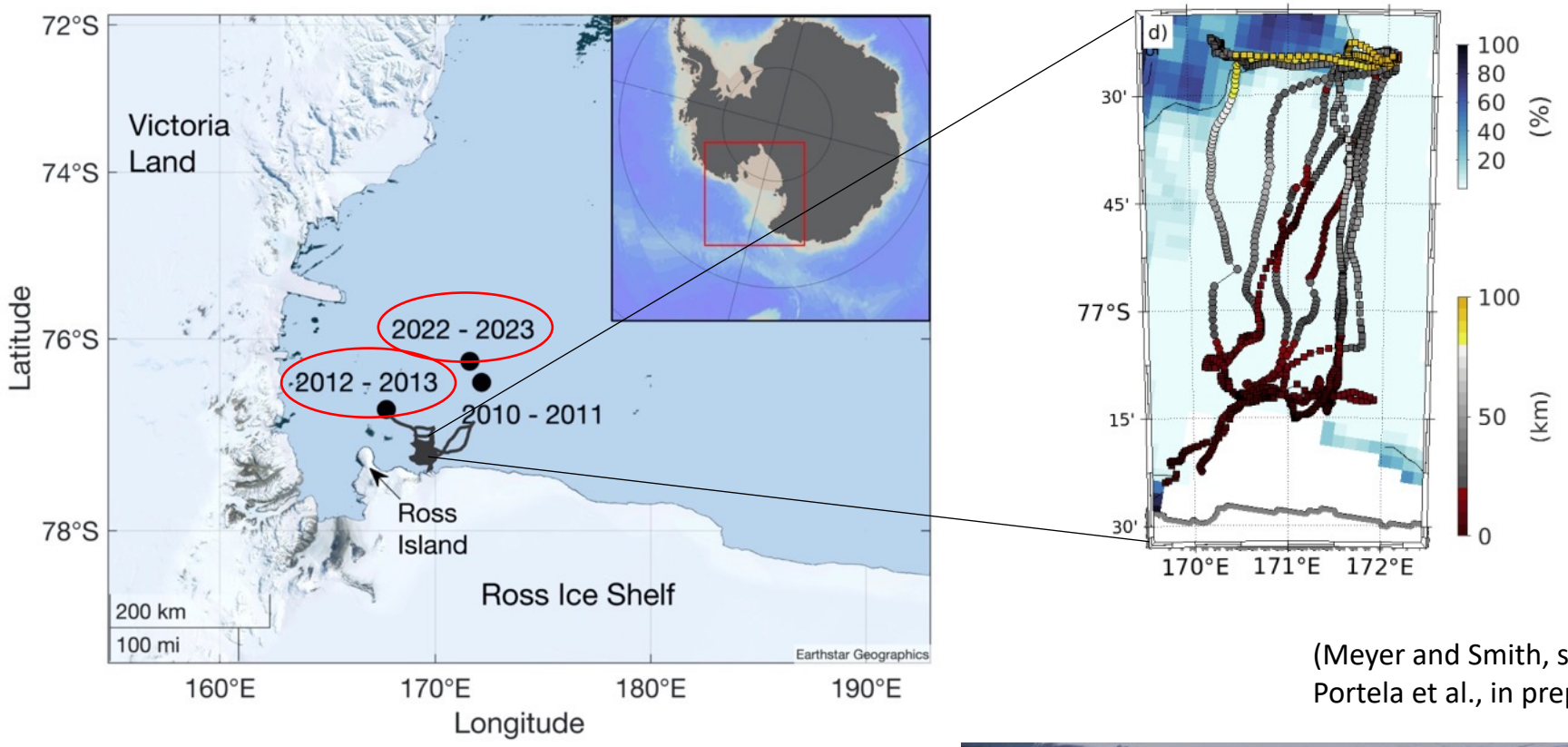

(Meyer and Smith, submitted; Portela et al., in prep)

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$$Export^*_{POC} = NCP - \frac{\partial \mathrm{POC}}{\partial \mathrm{t}}$$ (Meyer et al., 2022)

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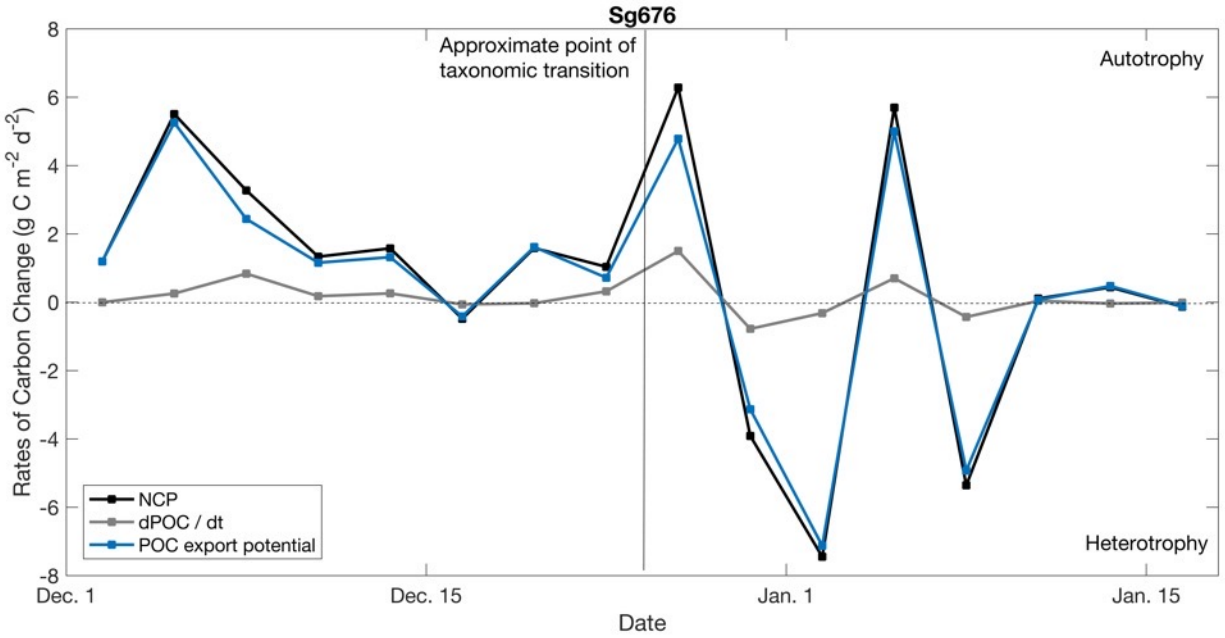

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Year-to-Year Averages			
all units = g C m^{-2} d^{-1}			
	NCP	dPOC/dt	POC export*
2012-2013	0.05	0.22	-0.17
2022-2023	0.67	0.15	0.52
Difference	0.62	-0.07	0.69

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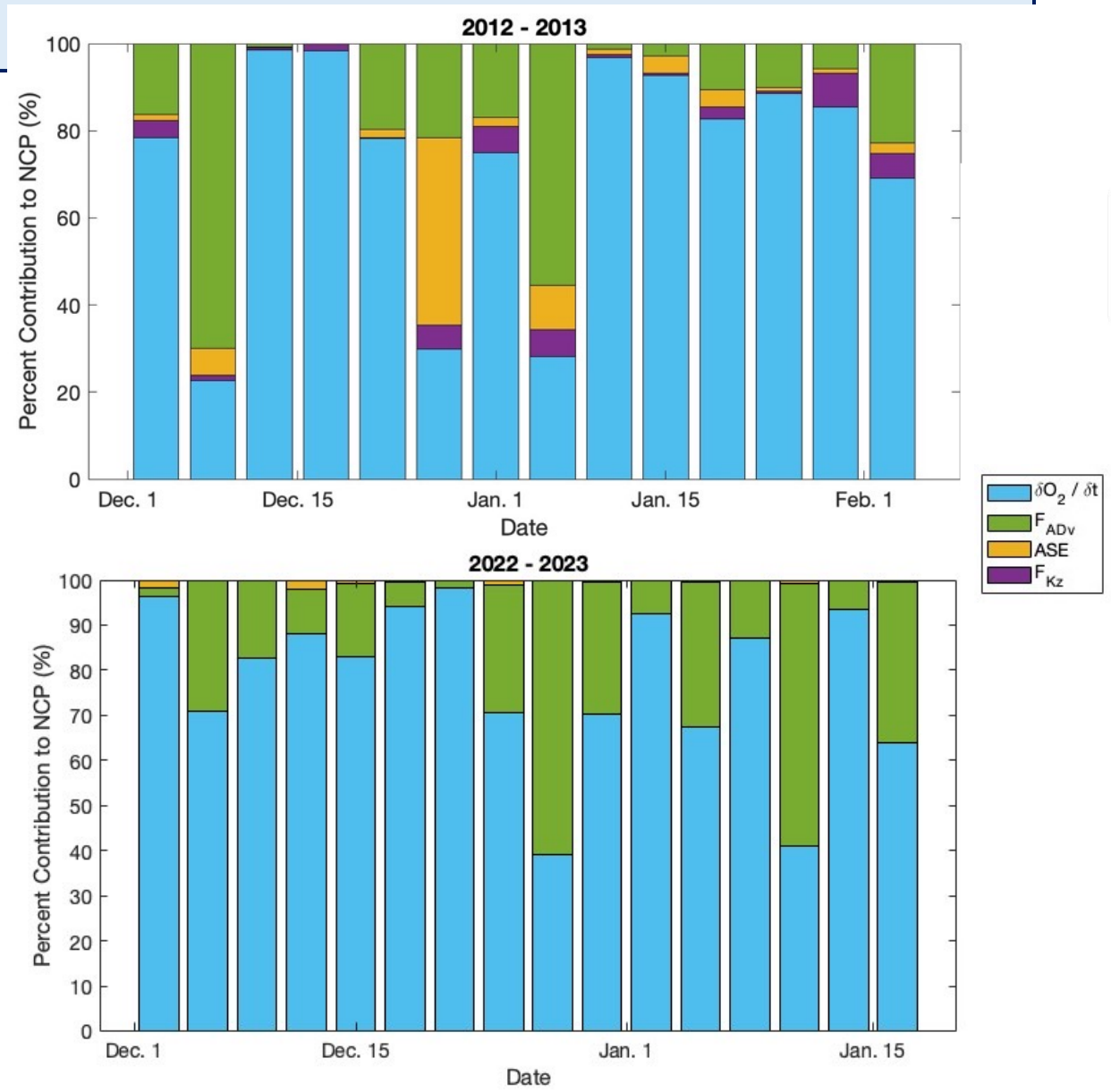

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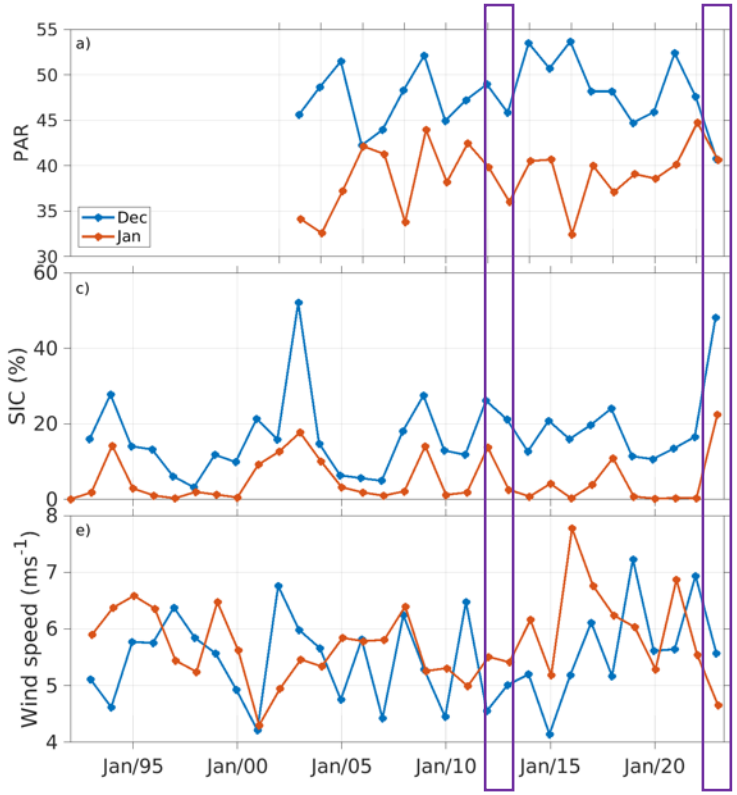

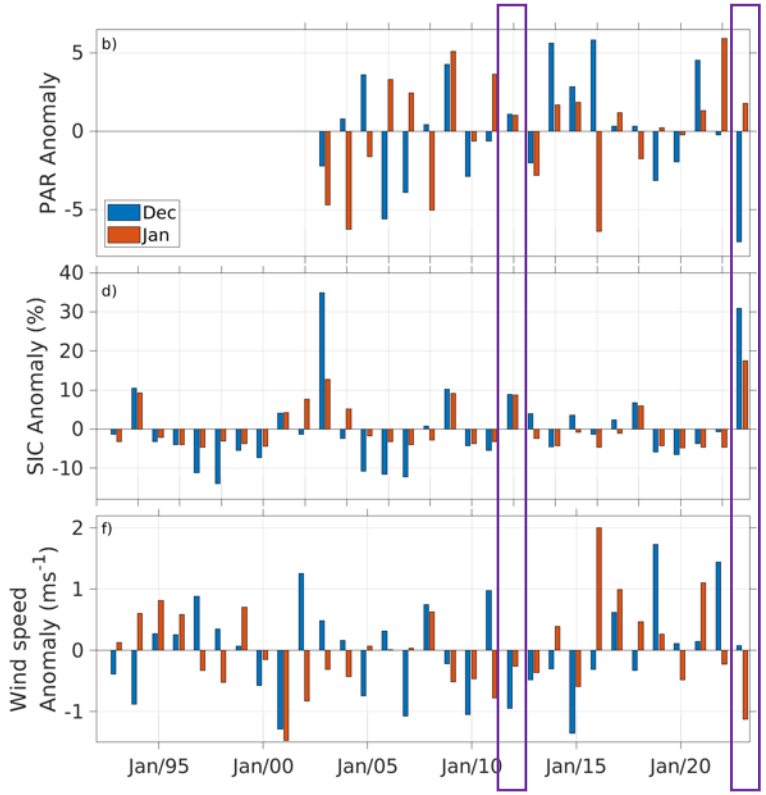

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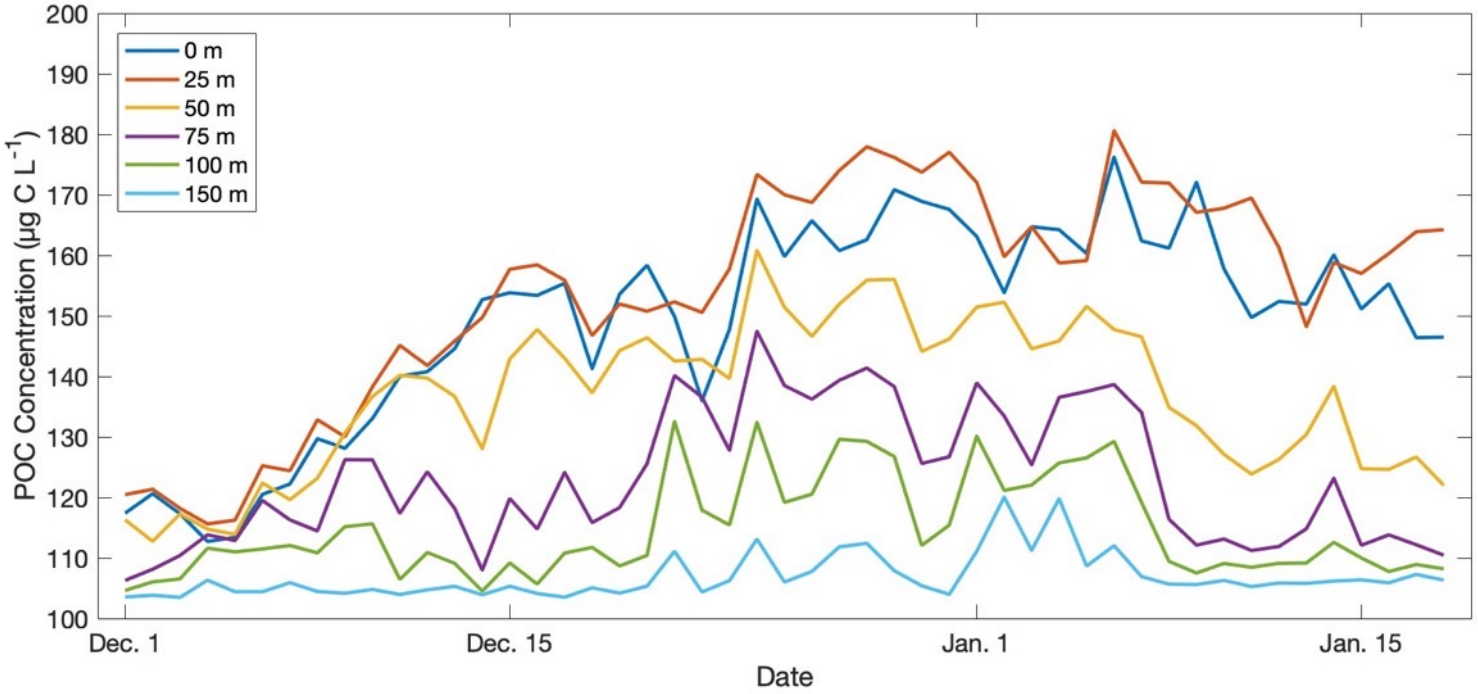

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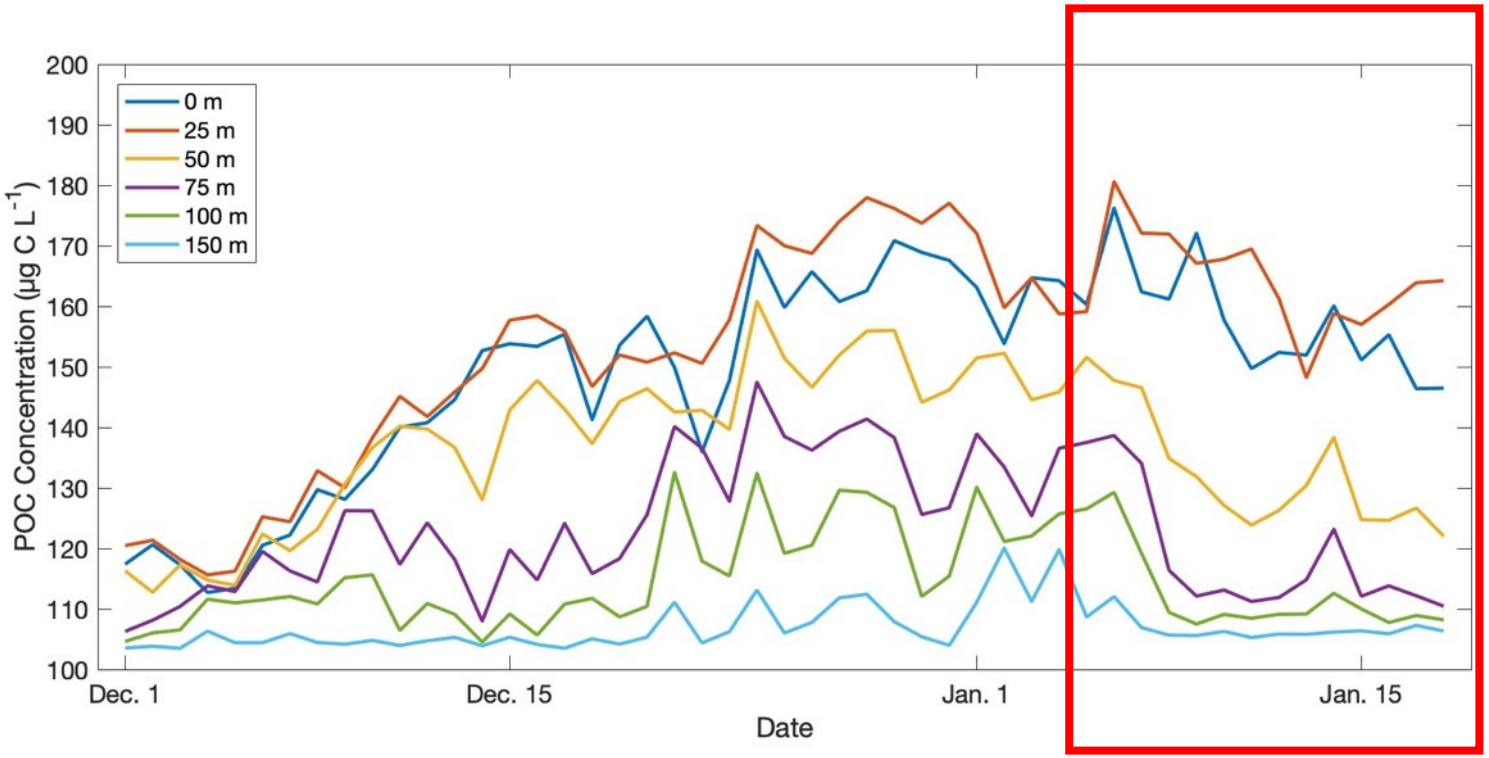
- Low POC concentrations and dPOC/dt
    - POC retention in the upper water column



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    - High NCP appears related to enhanced biological fluxes with lower than average physical fluxes
    - Uncertain how this balance would change in the late season
- 2022-2023 experienced higher F_{ADV} but lower air sea exchange (ASE_{ML}) potentially due to enhanced ice cover

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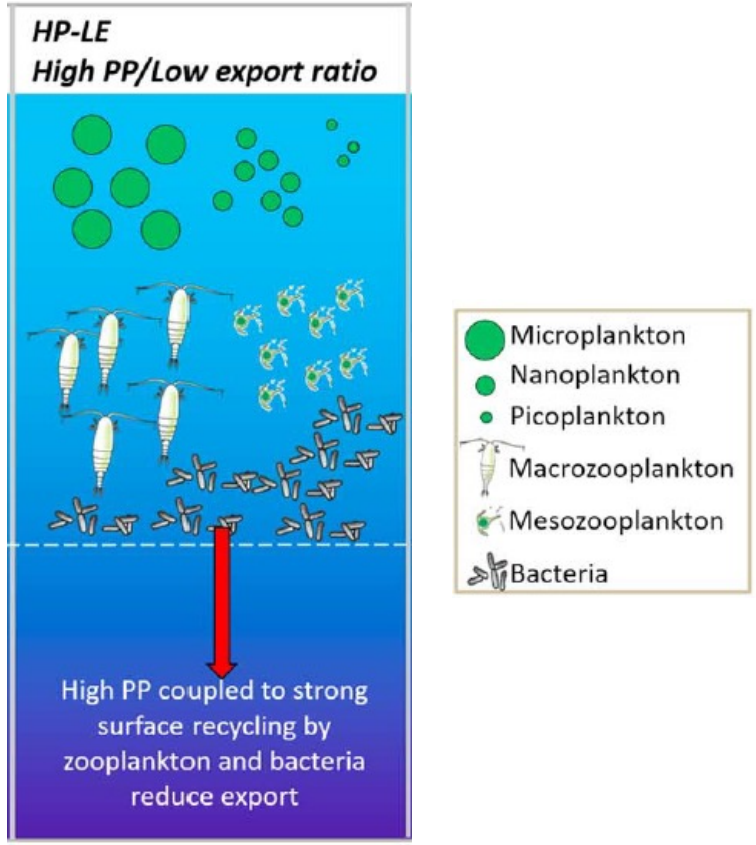

Figure from Henson et al., 2019

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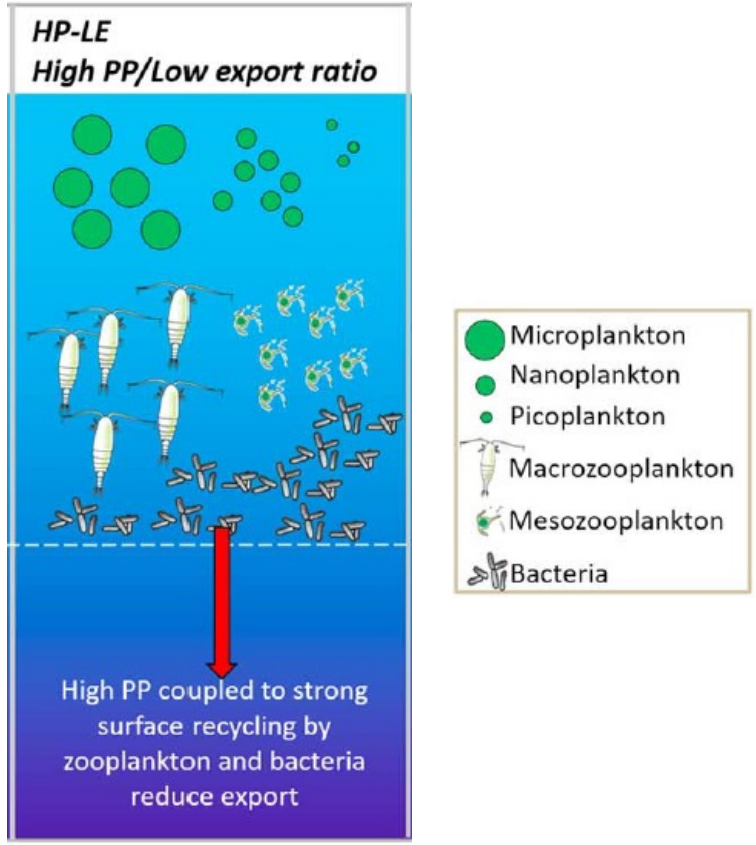

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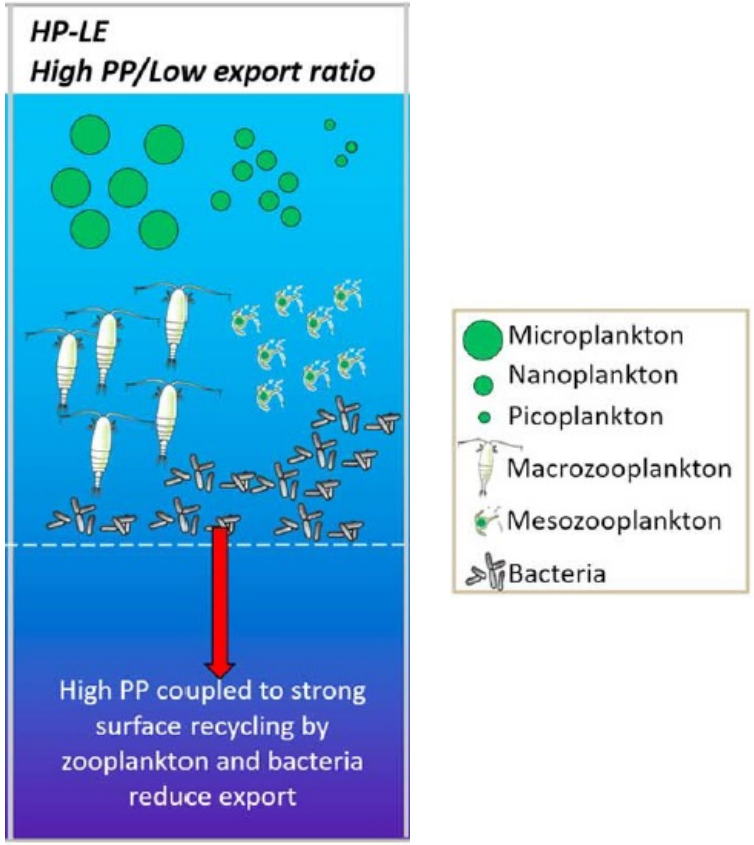
  → Differential responses of biological and physical fluxes in future climate projections



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Meyer, M. G., Jones, R. M., & Smith, W. O. Jr. (2022). Quantifying seasonal particulate organic carbon concentrations and export potential in the southwestern Ross Sea using autonomous gliders. Journal of Geophysical Research: Oceans, 127, e2022JC018798. https://doi.org/10.1029/2022JC018798

Thank you! Questions?

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