




Session 4: P121

Presentation time:

Thursday, 17/Feb

Global
Biogeochemical Cycles*

Research Article |  Open Access |  

Partitioning the Export of Distinct Biogenic Carbon Pools in the
Northeast Pacific Ocean Using a Biogeochemical Profiling Float

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Partitioning the Export of Distinct Biogenic Carbon Pools Using a Biogeochemical Float in the Northeast Pacific

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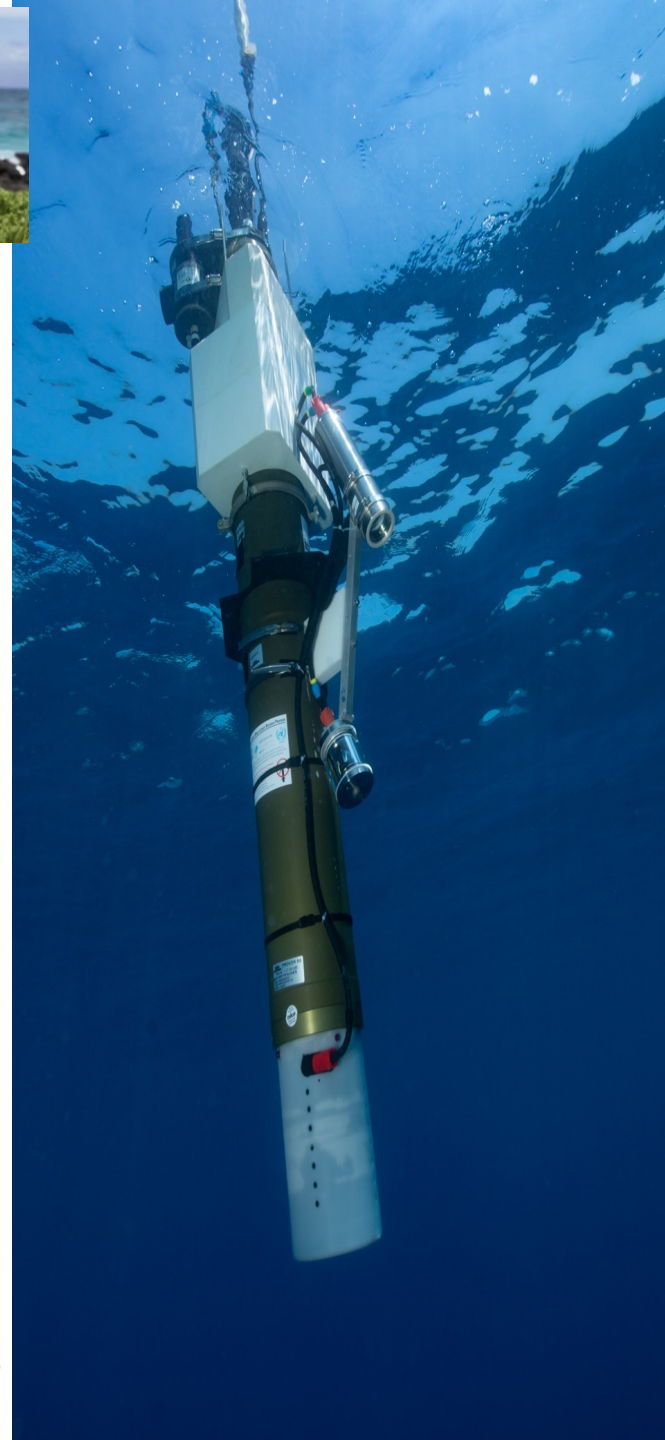
Collaborators: Andrea Fassbender, Jacki Long, Sophia
Johannessen, Mariana Bif



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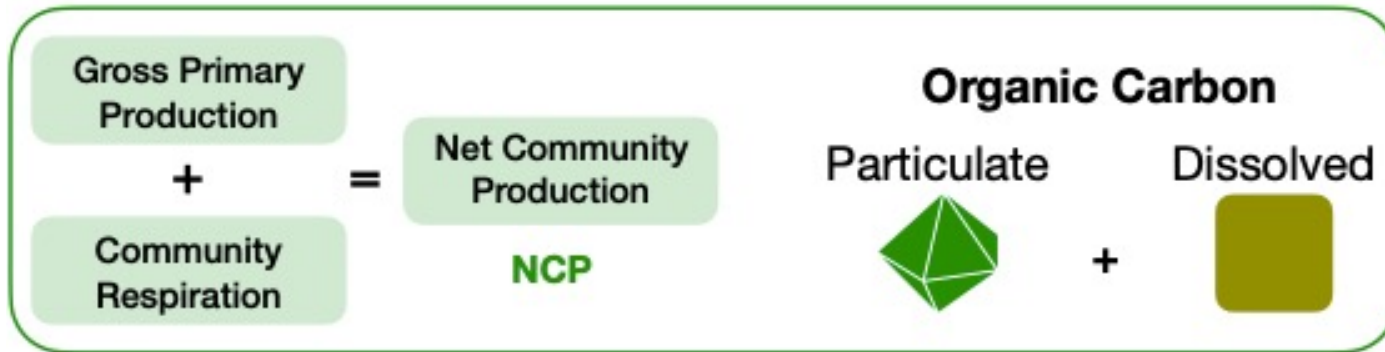


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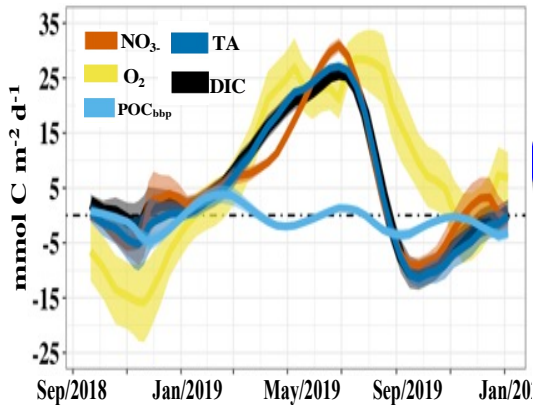


Summary

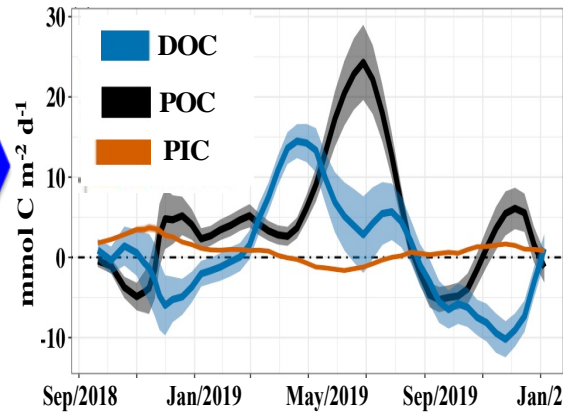
A **novel approach** to partition the export of **distinct biogenic pools** by the **autonomous platform**



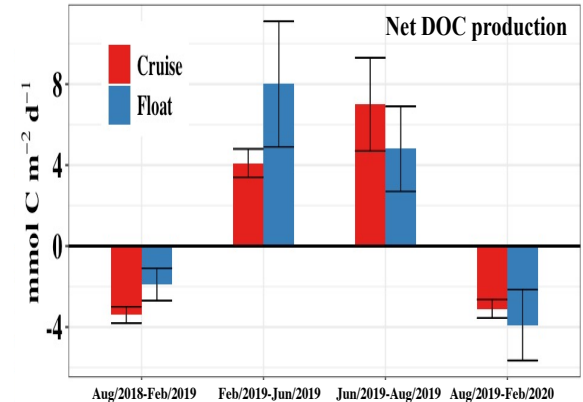
Integration of multiple sensors



Decomposition of carbon pools



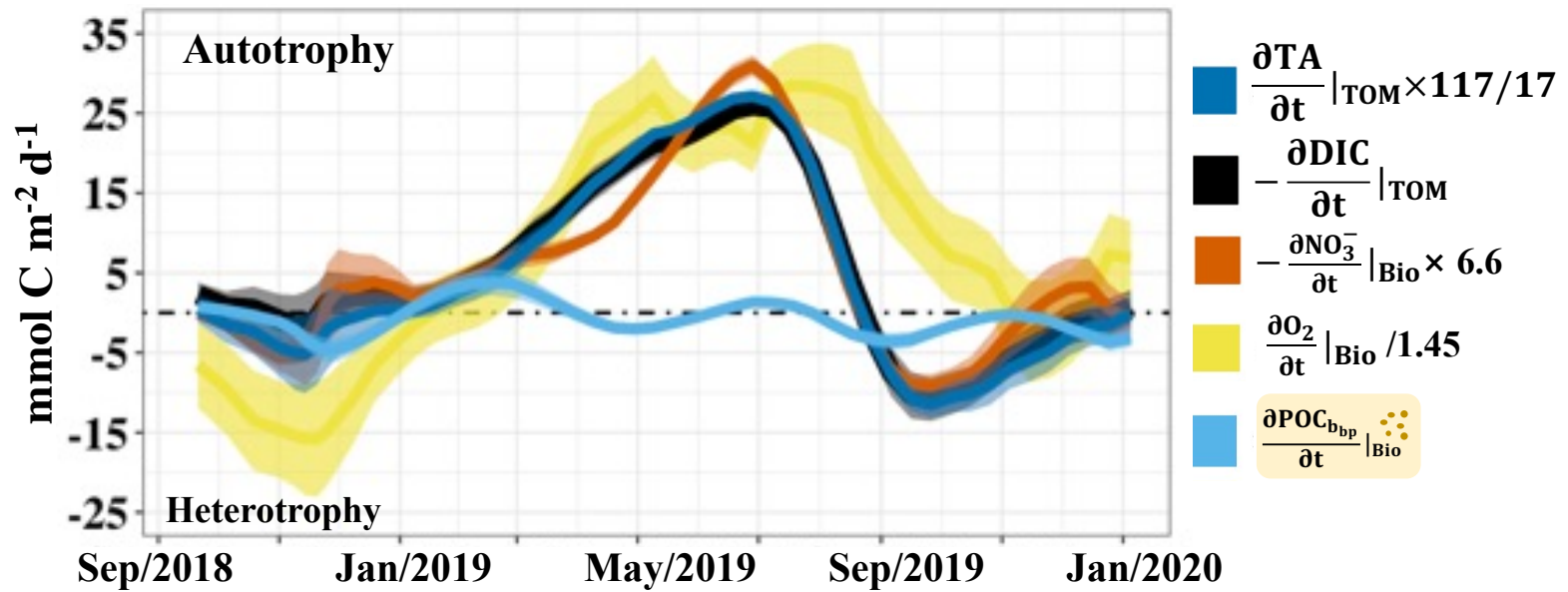
Validation of new approach



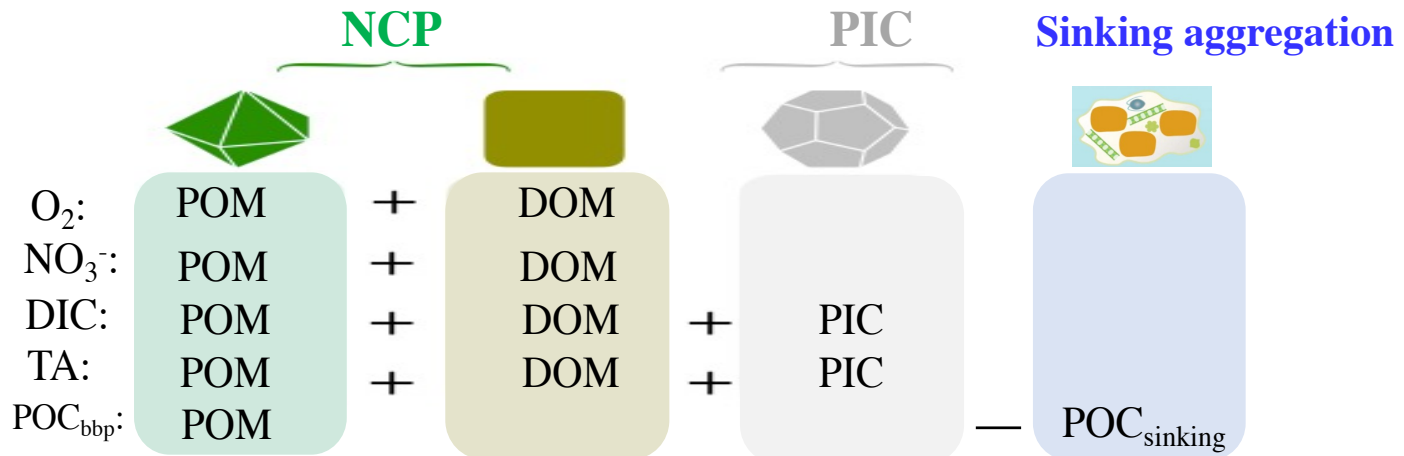
Huang *et al.*, 2022, Global Biogeochemical Cycles

Live Presentation time: Thursday, 17/Feb

Net Biological Production Constrained by Multiple Tracers



Huang *et al.*, (2022, GBC)



Theoretical Formulations of Decomposition of Carbon Export

DIC & TA Budget

$$\frac{\partial DIC}{\partial t} |_{Bio} = \frac{\partial DIC}{\partial t} |_{TOM} + \frac{\partial DIC}{\partial t} |_{CaCO_3}$$

$$\frac{\partial TA}{\partial t} |_{Bio} = \frac{\partial TA}{\partial t} |_{TOM} + \frac{\partial TA}{\partial t} |_{CaCO_3}$$

+

Stoichiometric Ratio

$$\frac{\partial DIC}{\partial t} |_{CaCO_3} = 2 * \frac{\partial TA}{\partial t} |_{CaCO_3}$$

$$\frac{\partial DIC}{\partial t} |_{TOM} = \frac{17}{-117} * \frac{\partial TA}{\partial t} |_{TOM}$$

Anderson and Sarmiento (1994)

PIC and TOM Partitioning

$$\frac{\partial DIC}{\partial t} |_{TOM} = \frac{\frac{\partial TA}{\partial t} |_{Bio} - 2 * \frac{\partial DIC}{\partial t} |_{Bio}}{2 - 17}$$

$$\frac{\partial DIC}{\partial t} |_{PIC} = \frac{\partial DIC}{\partial t} |_{Bio} - \frac{\partial DIC}{\partial t} |_{TOM}$$

DIC & NO₃⁻ Budget

$$\frac{\partial DIC}{\partial t} |_{TOM} = \frac{\partial DIC}{\partial t} |_{POM} + \frac{\partial DIC}{\partial t} |_{DOM}$$

$$\frac{\partial NO_3}{\partial t} |_{TOM} = \frac{\partial NO_3}{\partial t} |_{POM} + \frac{\partial NO_3}{\partial t} |_{DOM}$$

+

Stoichiometric Ratio

$$\frac{\partial DIC}{\partial t} |_{POM} = 5.6 * \frac{\partial NO_3}{\partial t} |_{POM}$$

$$\frac{\partial DIC}{\partial t} |_{DOM} = 14 * \frac{\partial NO_3}{\partial t} |_{DOM}$$

Haskell *et al.*, (2020)

POM and DOM Partitioning

$$\frac{\partial DIC}{\partial t} |_{DOM} = \frac{\frac{\partial NO_3}{\partial t} |_{TOM} - \frac{1}{6.6} * \frac{\partial DIC}{\partial t} |_{NCP}}{\frac{1}{14} - \frac{1}{6.6}}$$

$$\frac{\partial DIC}{\partial t} |_{POC} = \frac{\partial DIC}{\partial t} |_{TOM} - \frac{\partial DIC}{\partial t} |_{DOM}$$

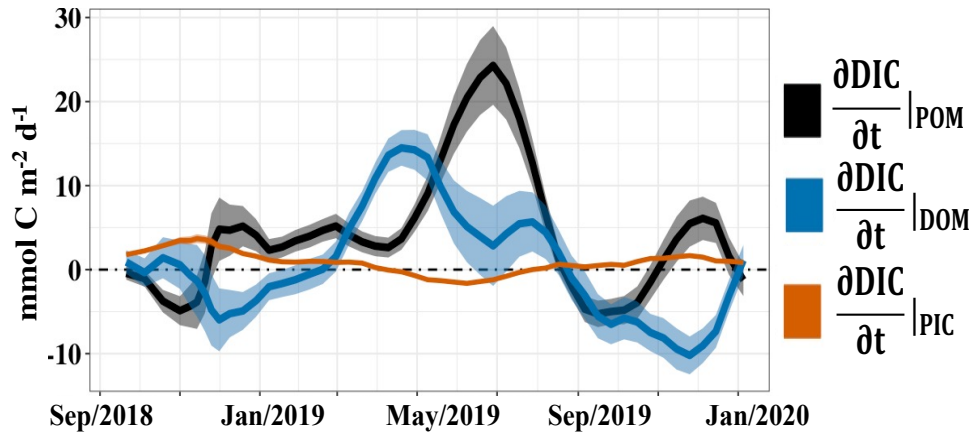
Alkire *et al.*, (2012)

Sinking POC

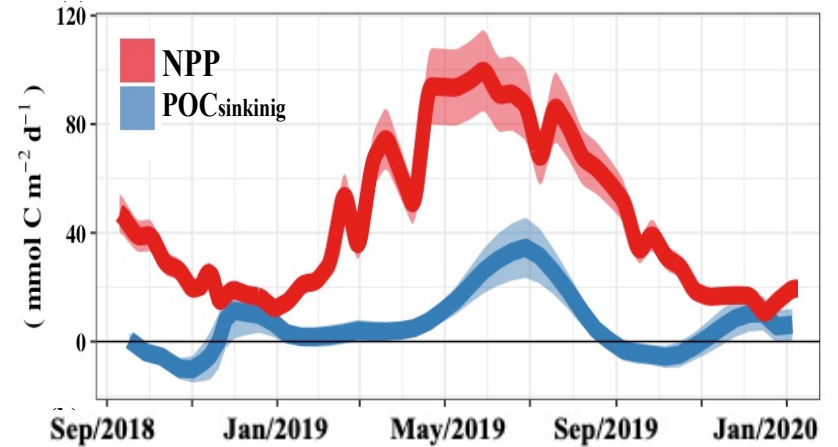
$$\frac{\partial POC}{\partial t} |_{sinking} = \frac{\partial DIC}{\partial t} |_{POM} - \frac{\partial POC}{\partial t} |_{bio}$$

Seasonal Dynamics of Export of Distinct Biogenic Pools

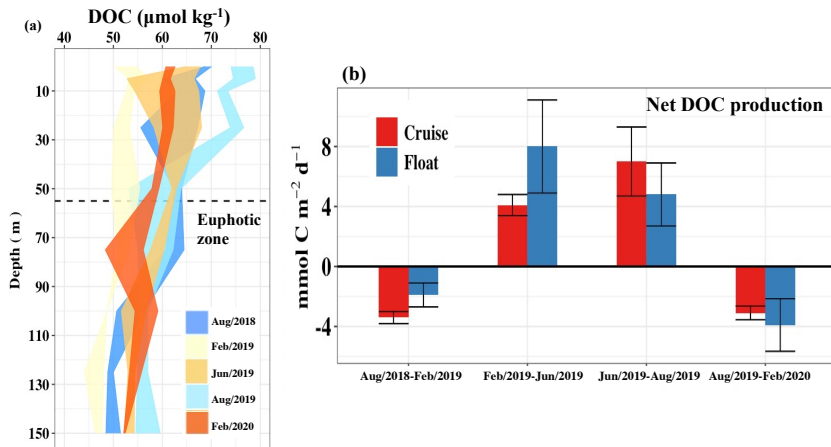
Distinct biogenic carbon pools



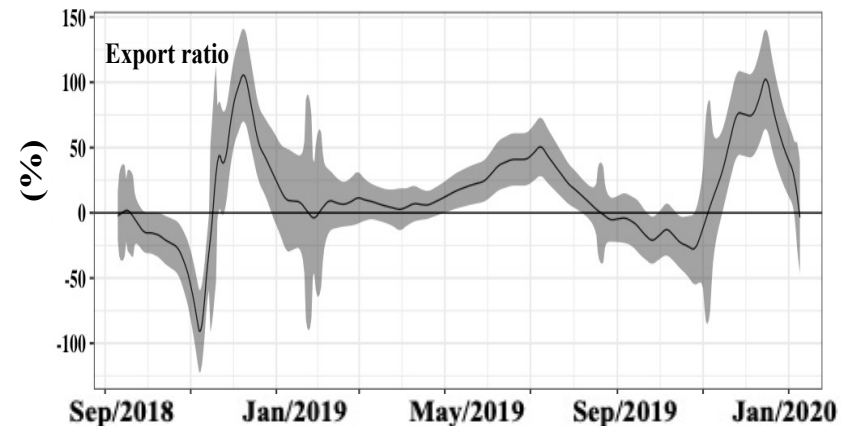
Float estimate of NPP and POC sinking flux



Validation of DOC production by Ship-based Measurement



Real-time Export Ratio

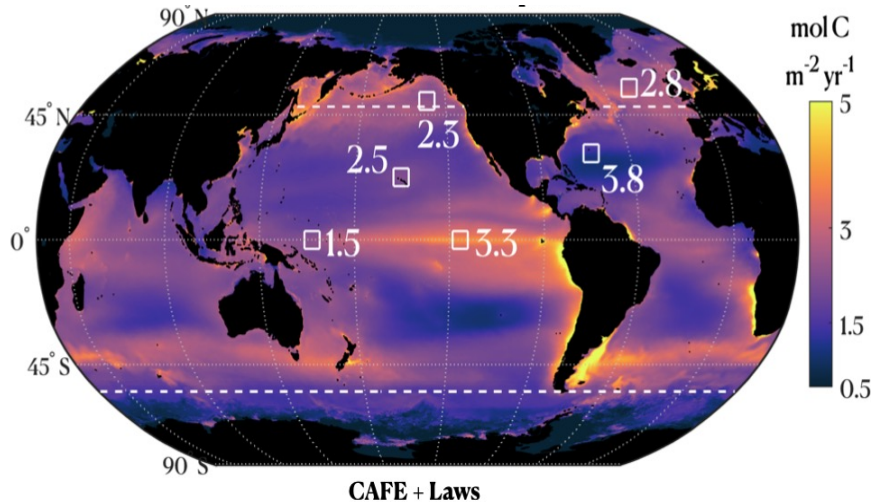


Future Perspective: Constraining Export from BGC-floats:

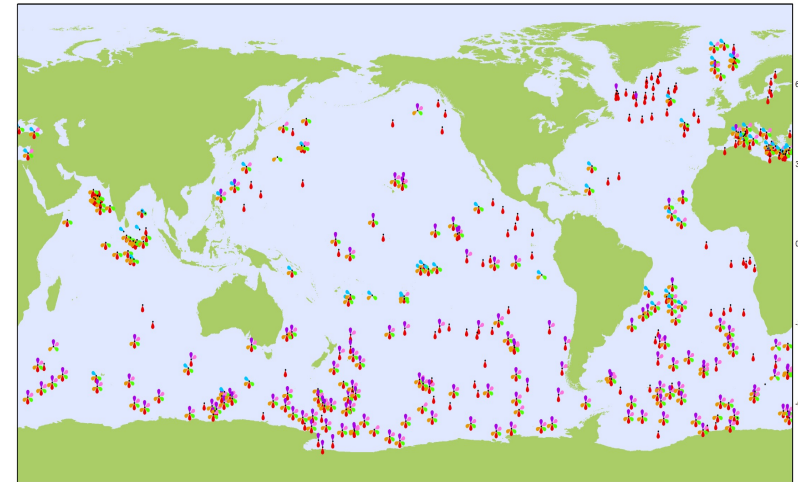
Drawback of extent Satellite models:

1. Larger meridional variability than field observation
2. Scarcity of training/validation dataset
3. Omit DOC and PIC export
4. Inappropriate depth integration (Euphotic zone vs deepest winter mixed layer)

Carbon Export from Satellite Estimate



Global distribution of BGC-floats



Long-term view:

[Toward Persistent Training and Validation of Satellite Carbon Export Algorithms](#)