Quantifying Phytoplankton Biomass and Productivity at Unprecedented Spatial Scales using Ship-Board Optics

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The Concept

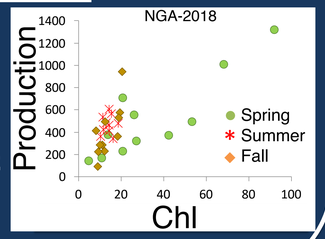
The Dilemma

Phytoplankton biomass & productivity in the Northern Gulf of Alaska **feeds the entire marine ecosystem** AND is **likely to change** due to increasing SST & freshwater input

However, the **dominant patterns & controls** on productivity **remain poorly understood**

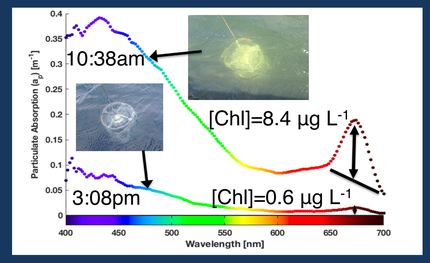
Why?

- A **reliance on chlorophyll as the principle proxy**
- An inability to make **measurements on time/space scales** that capture the intense variability of the region



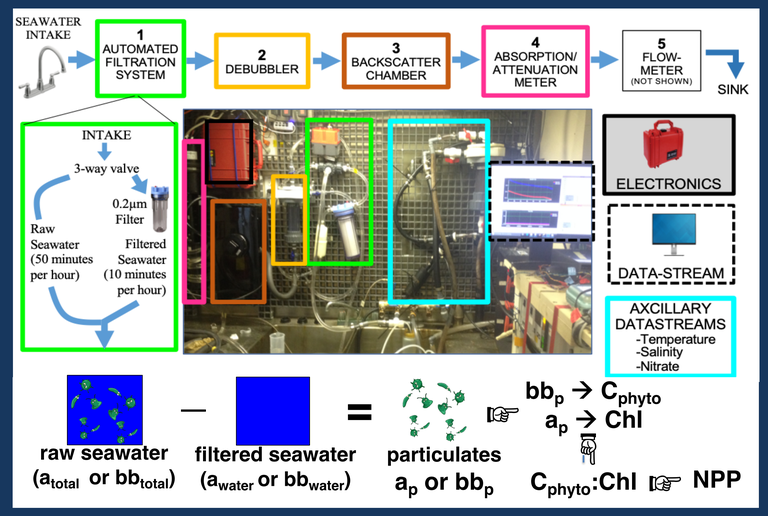
Seeing the light!

The size, shape & concentration of **particles** can be estimated by measuring **inherent optical properties of water**



THE KEY: **Measurements of light can be made extremely rapidly**

The underway optical sampler



The Data

Multi-parameter high-resolution in-situ biogeochemistry

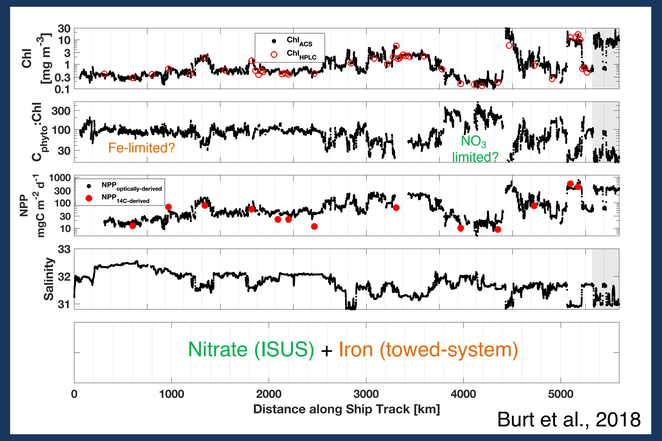
Chl &Biomass

Physiology

Productivity

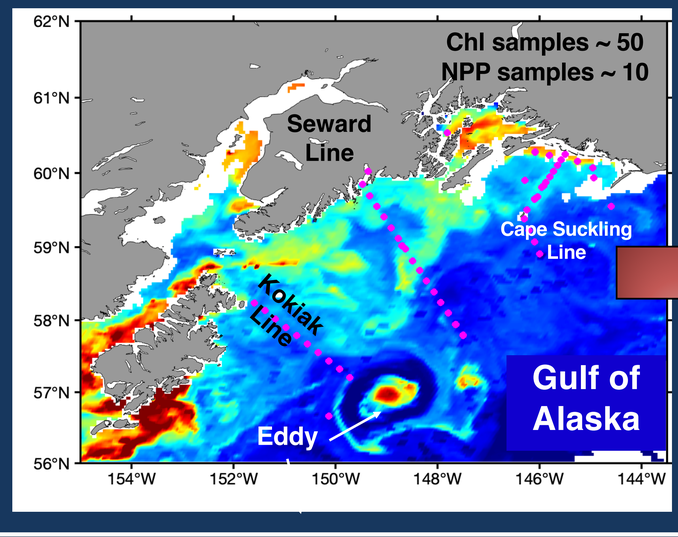
Physics (+T, PAR)

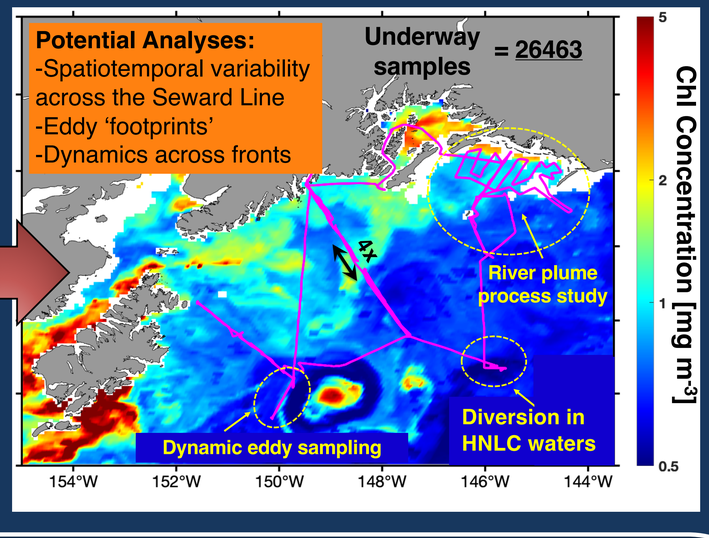
Chemistry



Burt et al., 2018

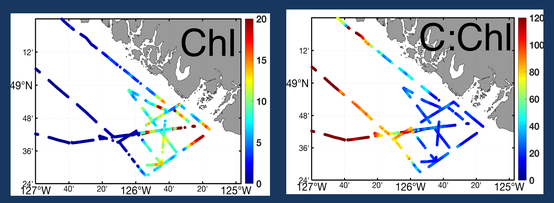
Moving from on-station to underway measurements





The Applications

Chl ≠ Production Understand how/where & by how much

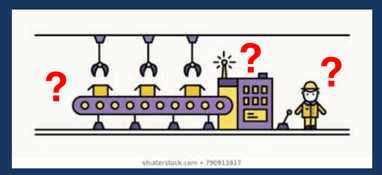


⇧ Chl = diatom-rich = ⇩ C:Chl

⇩ Chl = pico-rich = ⇧ C:Chl

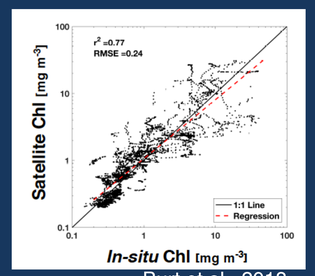
Quantify what drives production

Both regionally and at productive 'hot-spots'?



Satellite Validation

High-resolution data facilitates detailed match-up analysis



Burt et al., 2018

THE NEXT BIG QUESTION:

How can these data be applied to improve biogeochemical / ecosystem models?

FUTURE PLANS:

- **Add 'acidification module' to assess importance of calcifiers**
- **Develop methods for HAB detection**
- **Find great students!**