Characterizing the Deep Chlorophyll Maxima in the NE Pacific using Ocean Gliders

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PRODIGY
PACIFIC RIM OCEAN DATA MOBILIZATION AND TECHNOLOGY

PHYTOPLANKTON ECOPHYSIOLOGY
UVic

UVIC
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UVic
Ocean
Gases
Lab

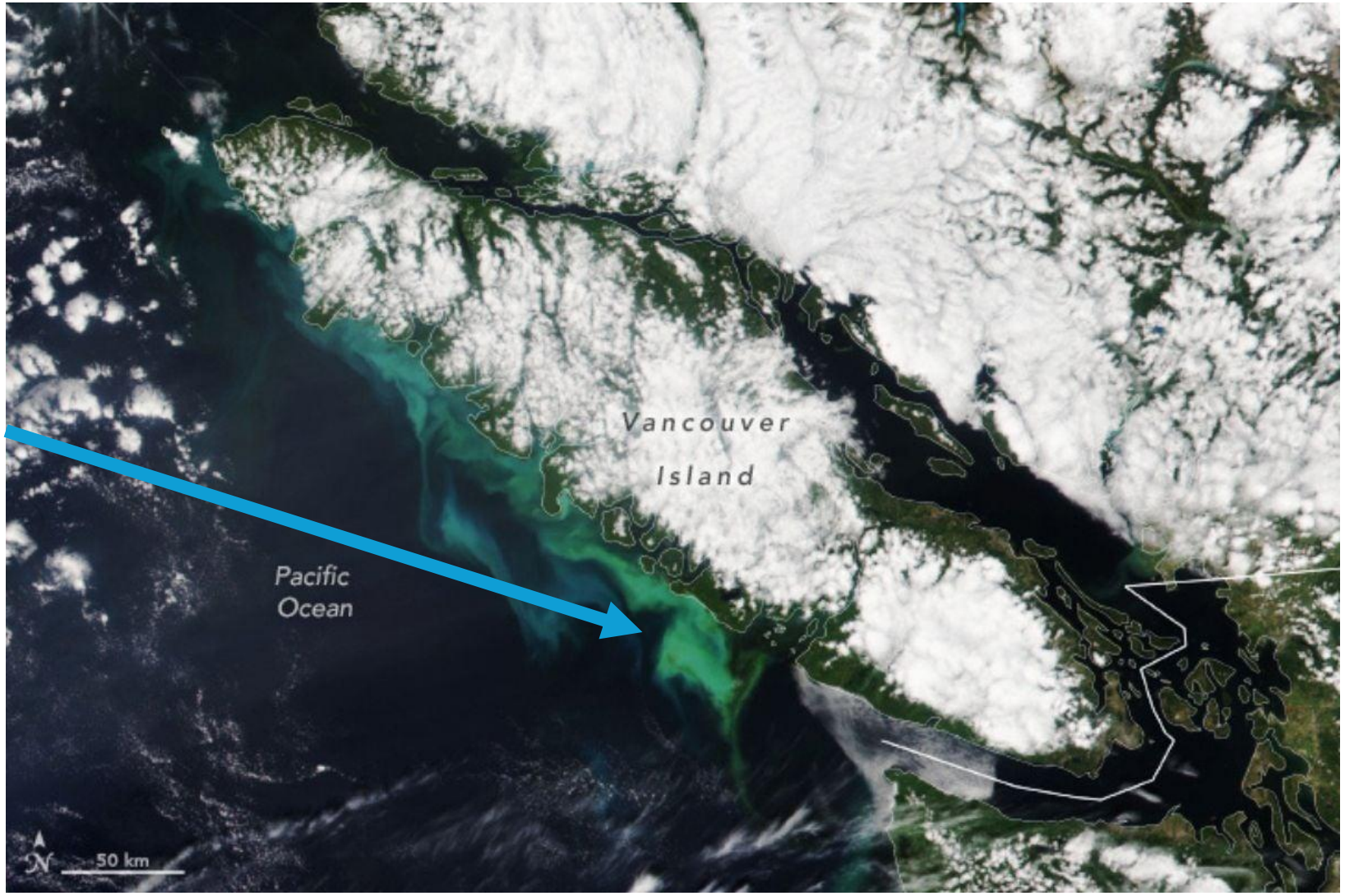
NSERC
CRSNG

C-PROOF

[Chlorophyll-a] is a proxy for phytoplankton biomass.

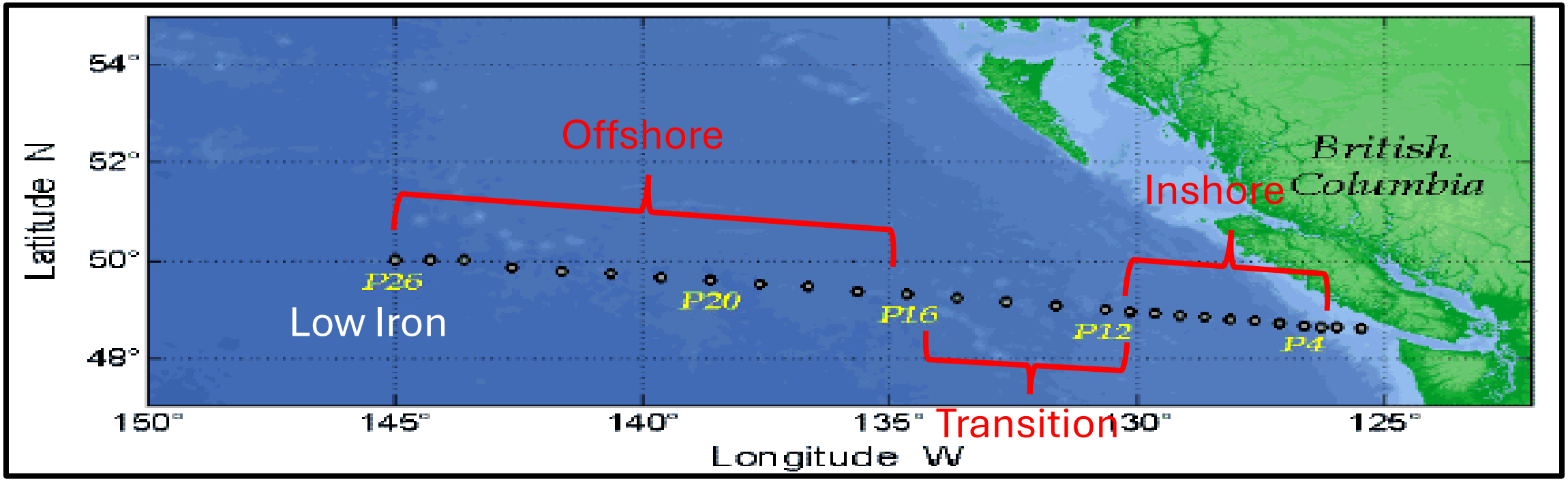


Curious Nature, 2026



Phytoplankton blooms south of Vancouver Island. Satellite image: NOAA-20, July 26, 2023

Primary Study Area

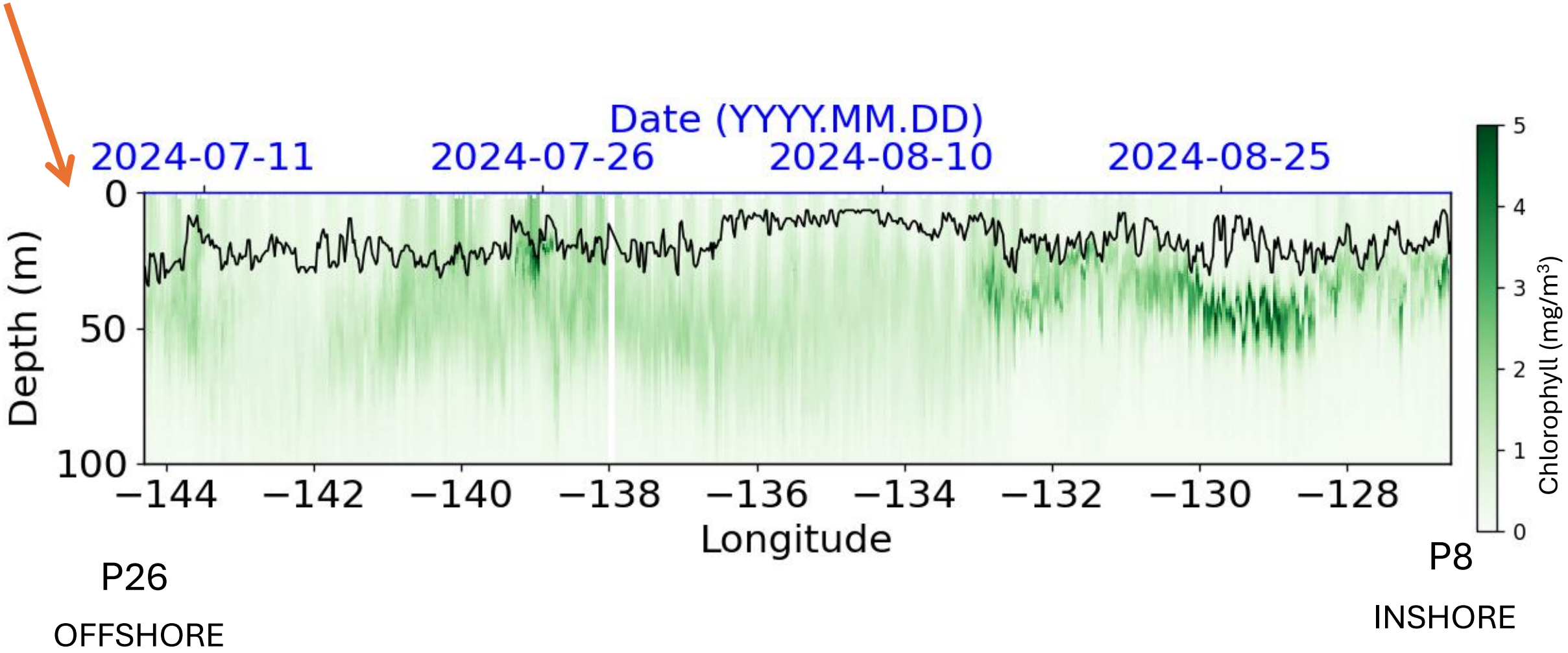


(DFO, 2017)

Deep Chlorophyll Maxima

Line P Glider Transect July-August, 2024

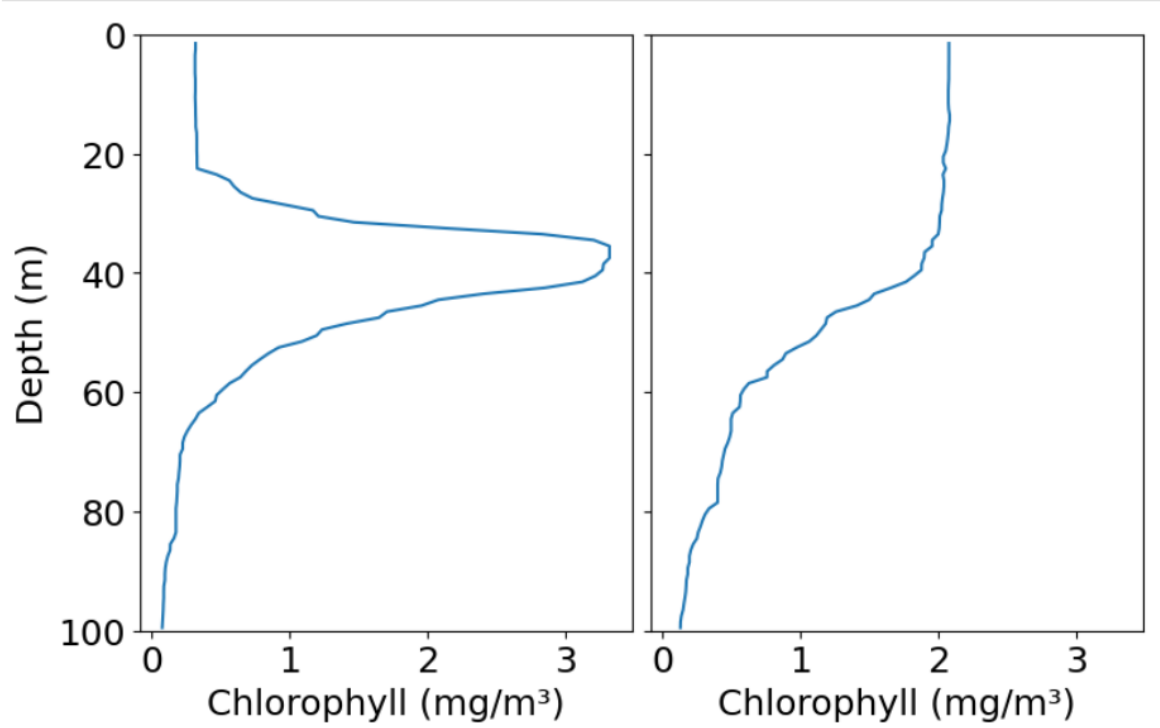
Base of Mixed Layer



Why study the deep maxima?

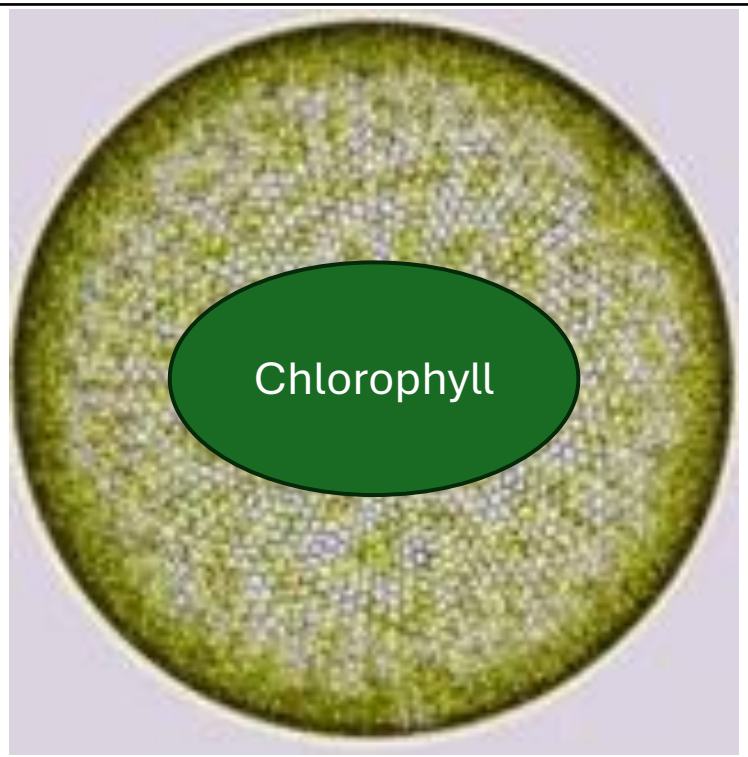
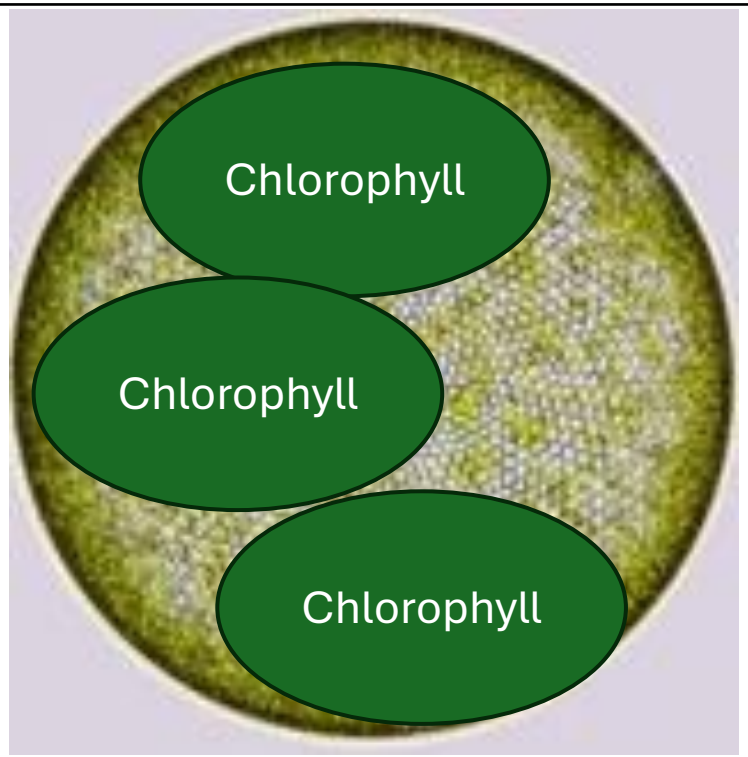
- Supplement surface limited satellite data
- Significant contribution to water column oxygen and organic matter production
- Study phytoplankton respond to low light environment

Deep Chlorophyll Maxima

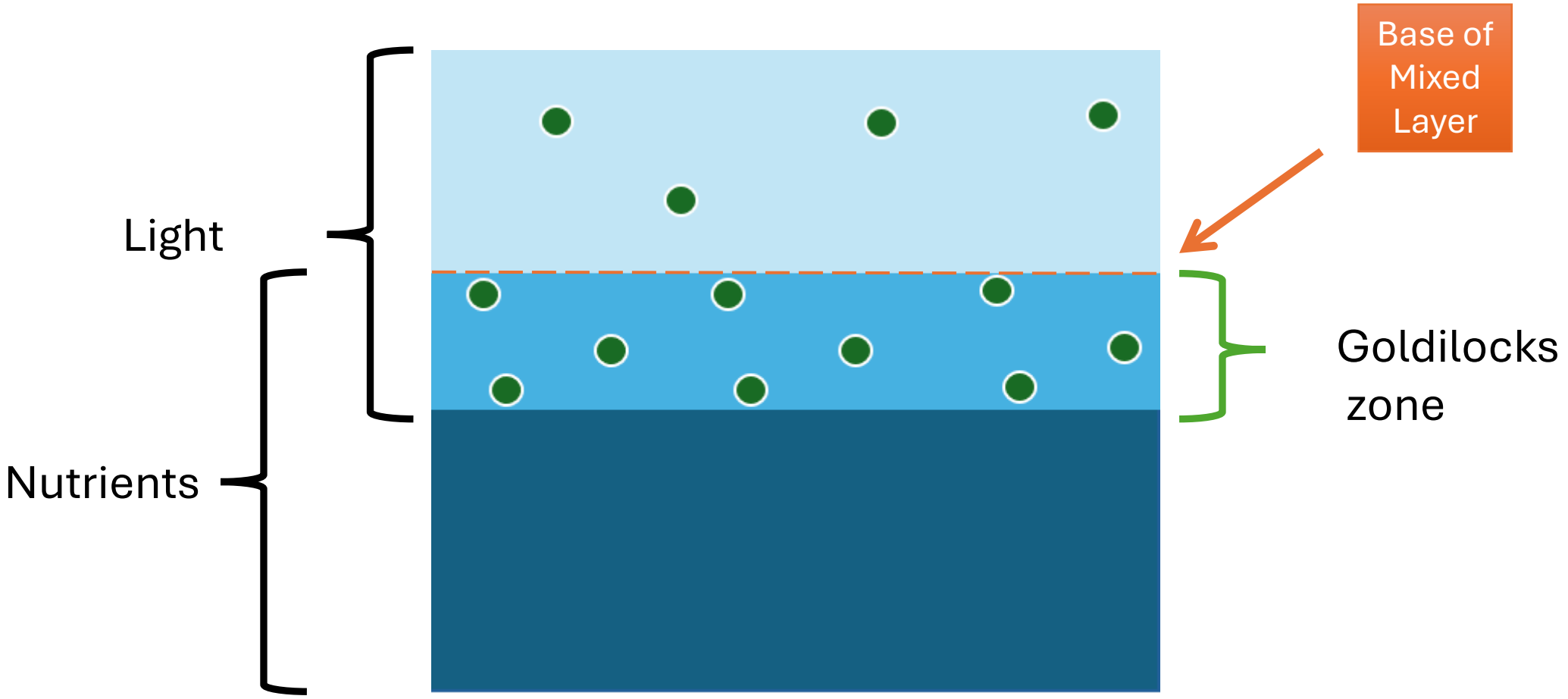


- Deep peak is at least 1.5x >mixed layer [chl]
- Deep peak is at least 0.5 mg/m^3 >mixed layer [chl]

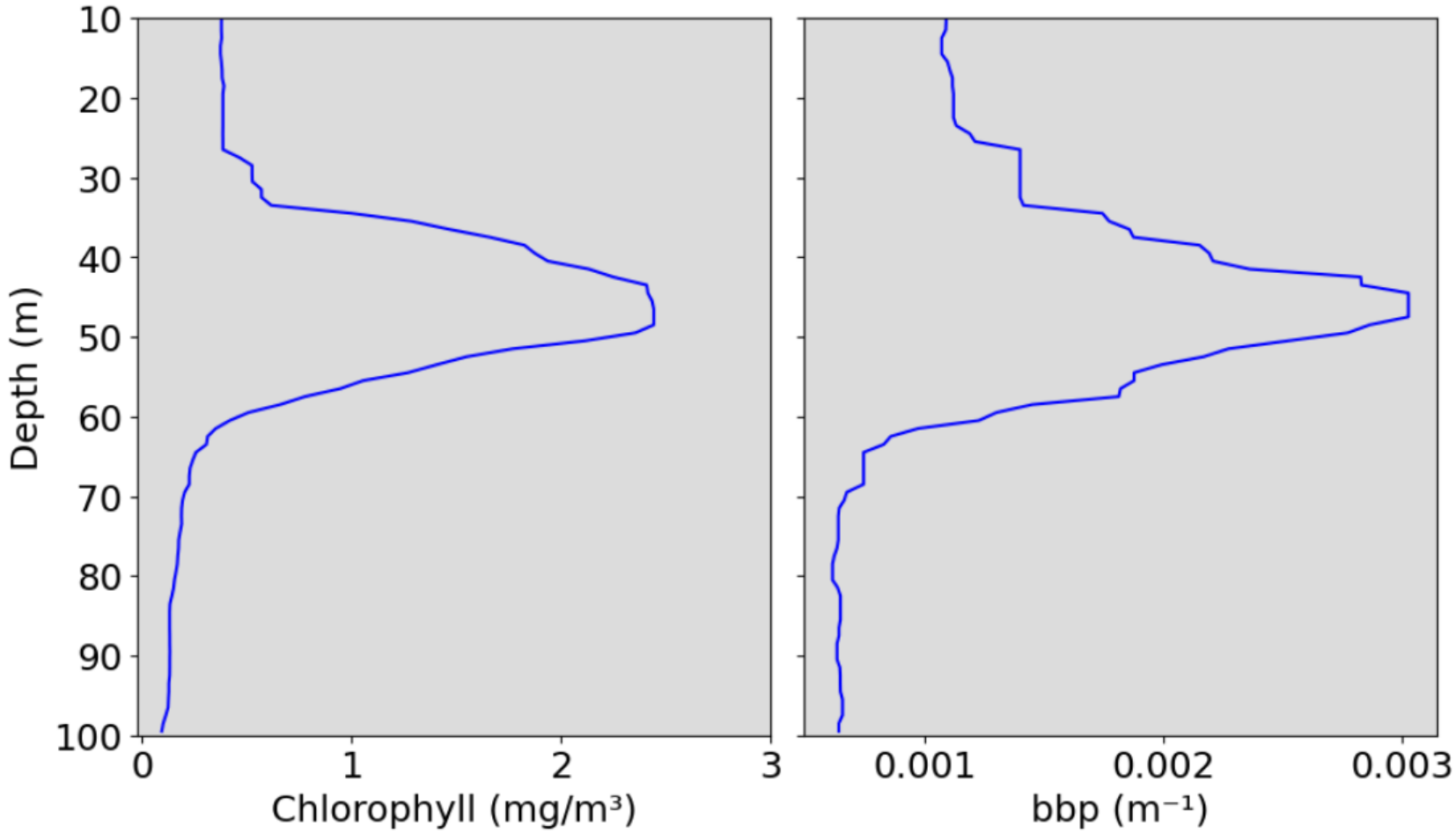
Light Acclimation Maxima

High Light at Surface (5m)	Low Light at Depth (40-60m)
	

Carbon Biomass Maxima



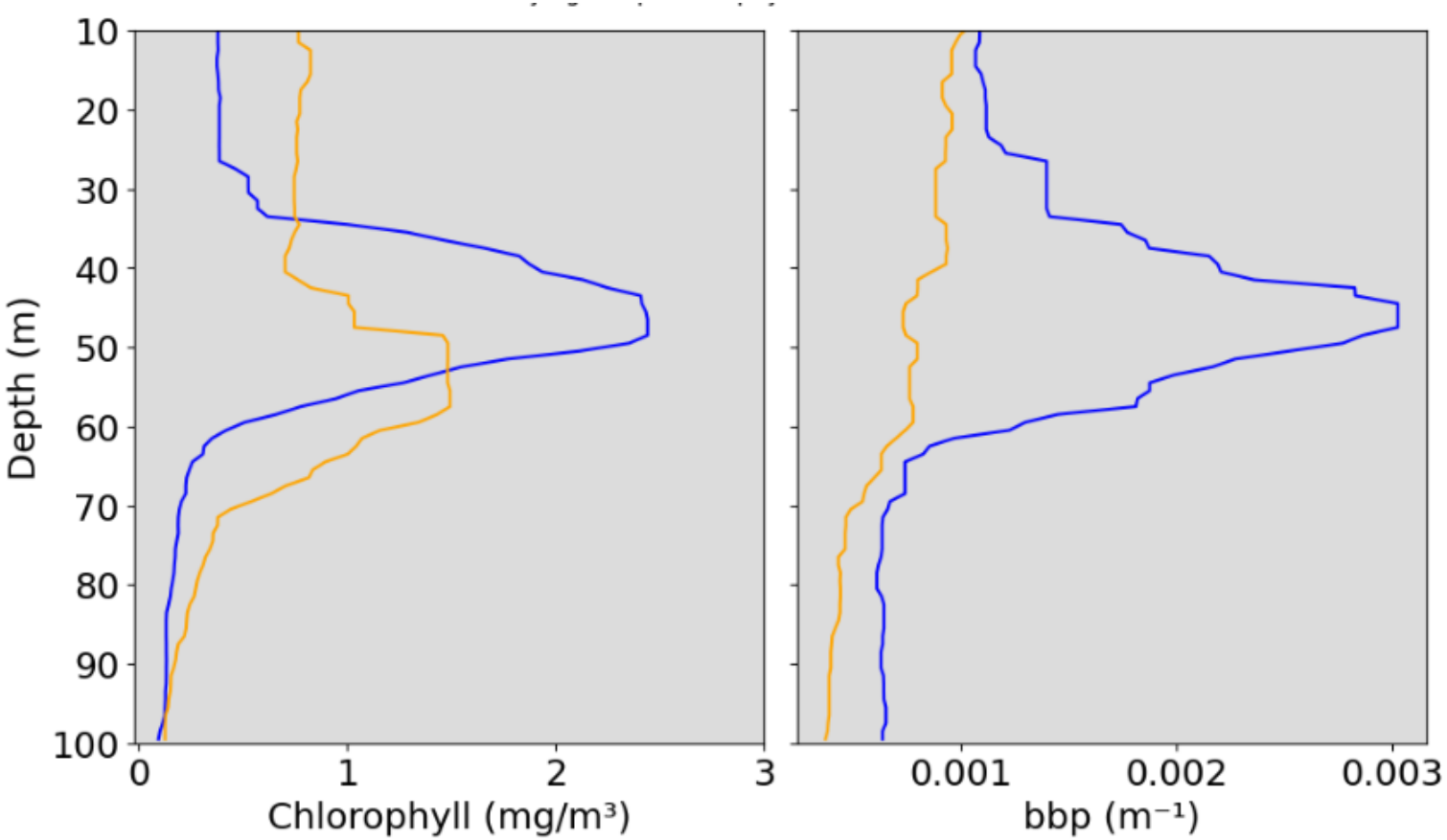
Classifying chlorophyll maxima



(proxy for POC)

Carbon Biomass Maxima

Classifying chlorophyll maxima

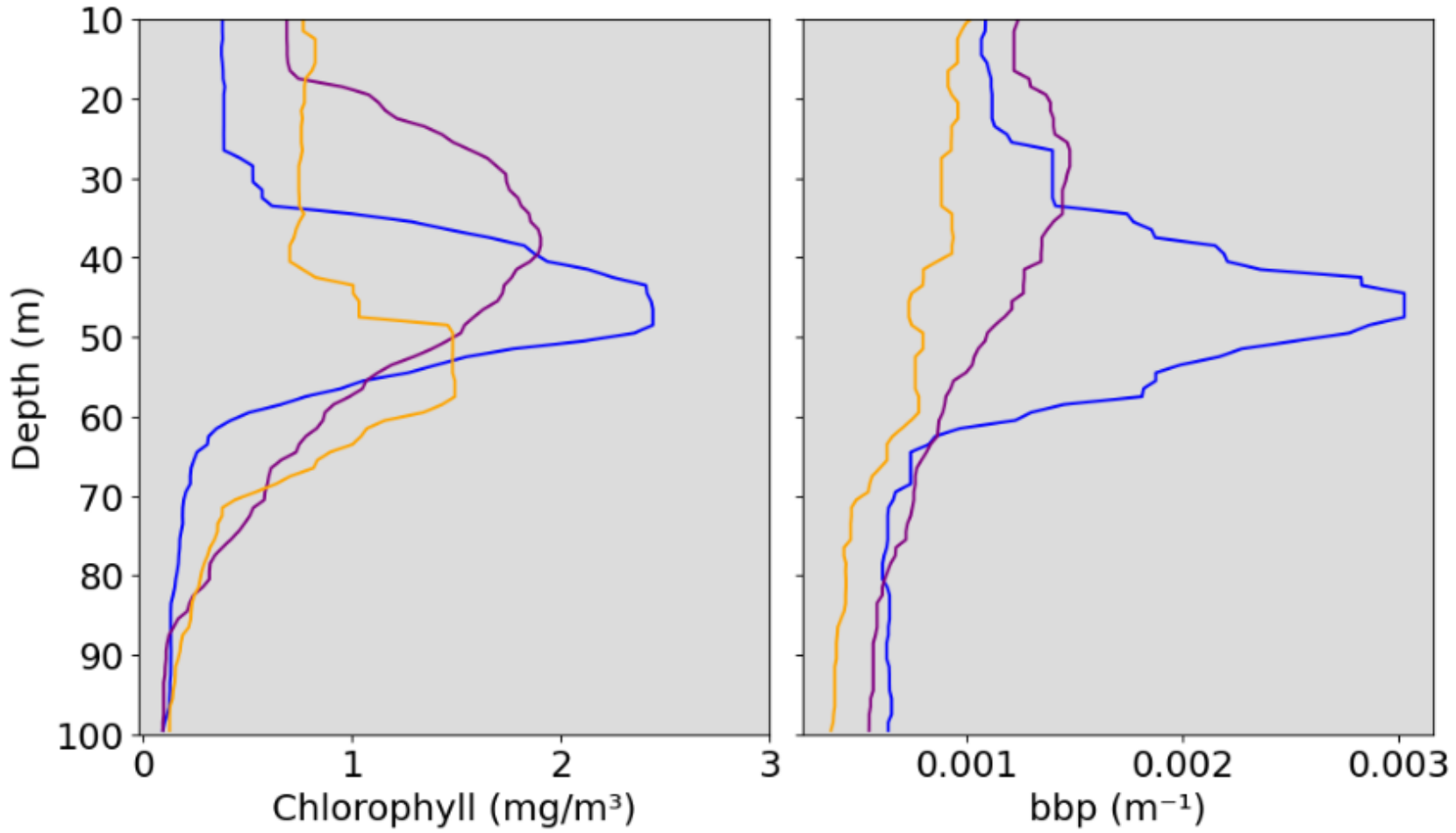


Carbon Biomass Maxima

Acclimation Maxima

(proxy for POC)

Classifying chlorophyll maxima



(proxy for POC)

Carbon Biomass Maxima

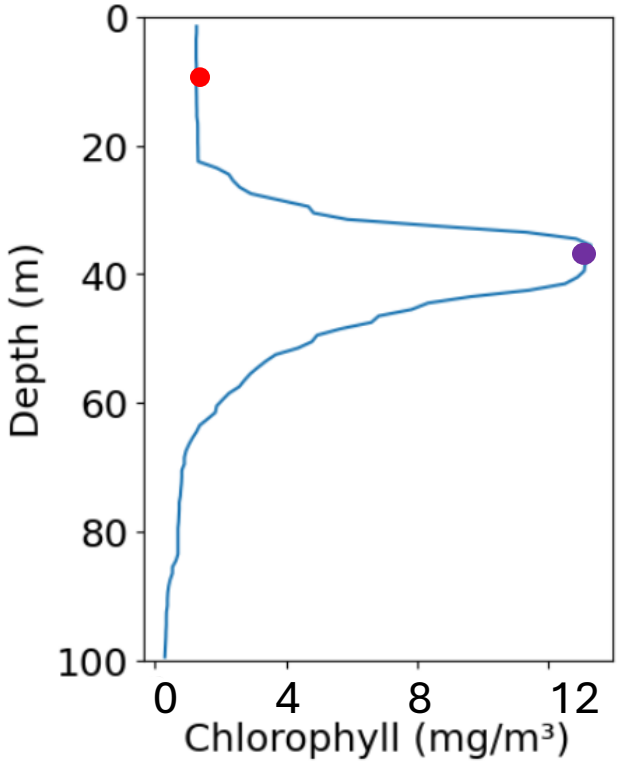
Acclimation Maxima

Dual Maxima

Quantifying Deep Maxima

- Chlorophyll metric and carbon metric

$$\text{Metric} = \frac{\text{Peak value at depth}}{\text{Mixed layer median}}$$



Quantifying Deep Maxima

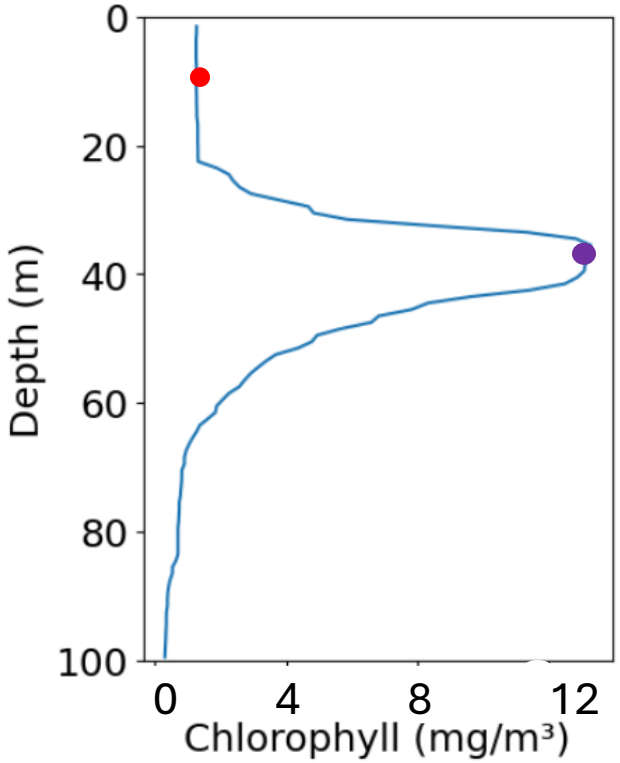
- Chlorophyll metric and carbon metric

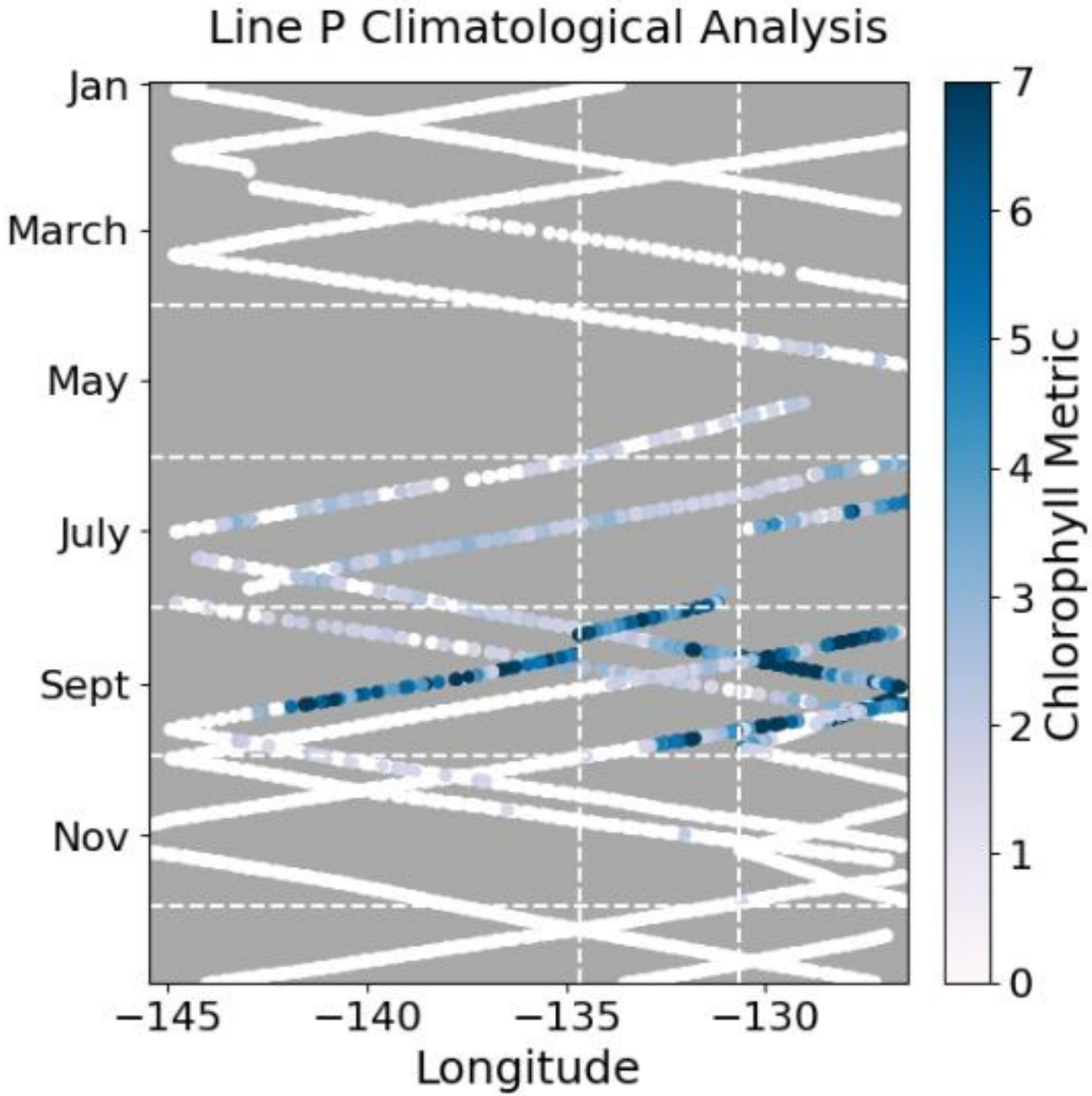
$$\text{Metric} = \frac{\text{Peak value at depth}}{\text{Mixed layer median}}$$

$$\text{Metric} = \frac{12}{2}$$

Metric= 6

The peak at depth is 6x greater than the mixed layer median

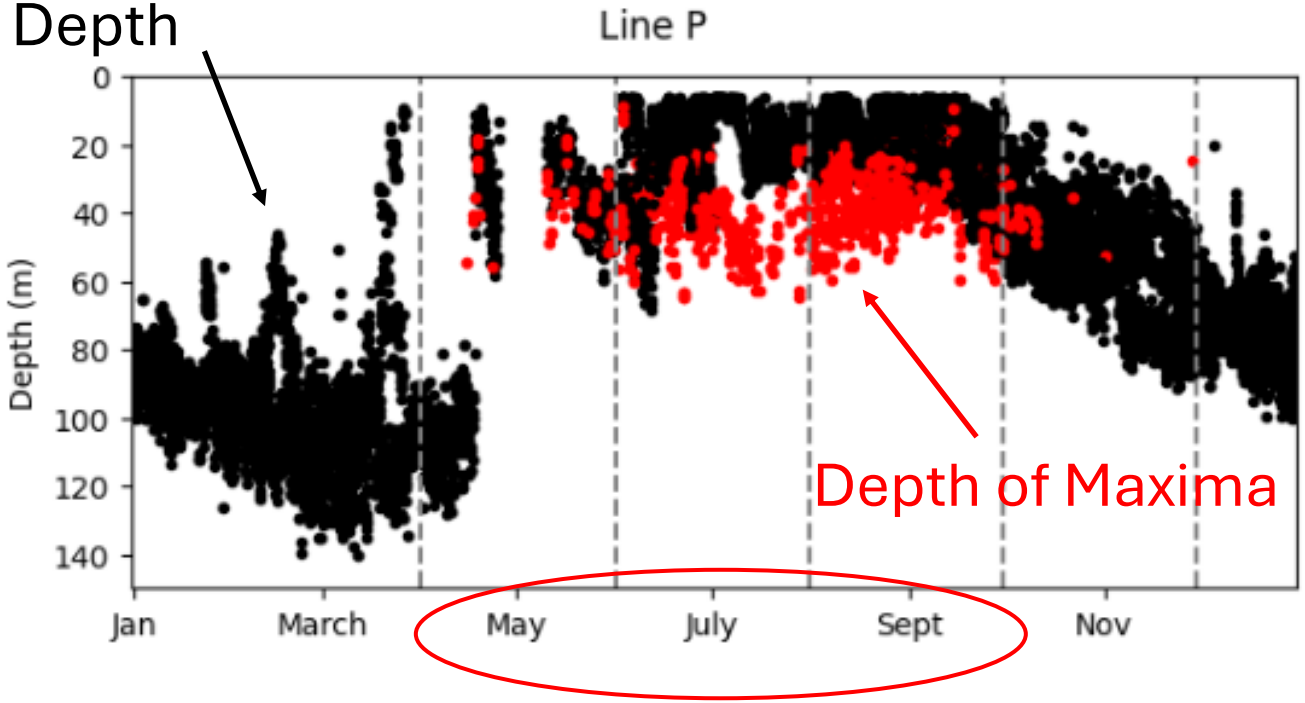


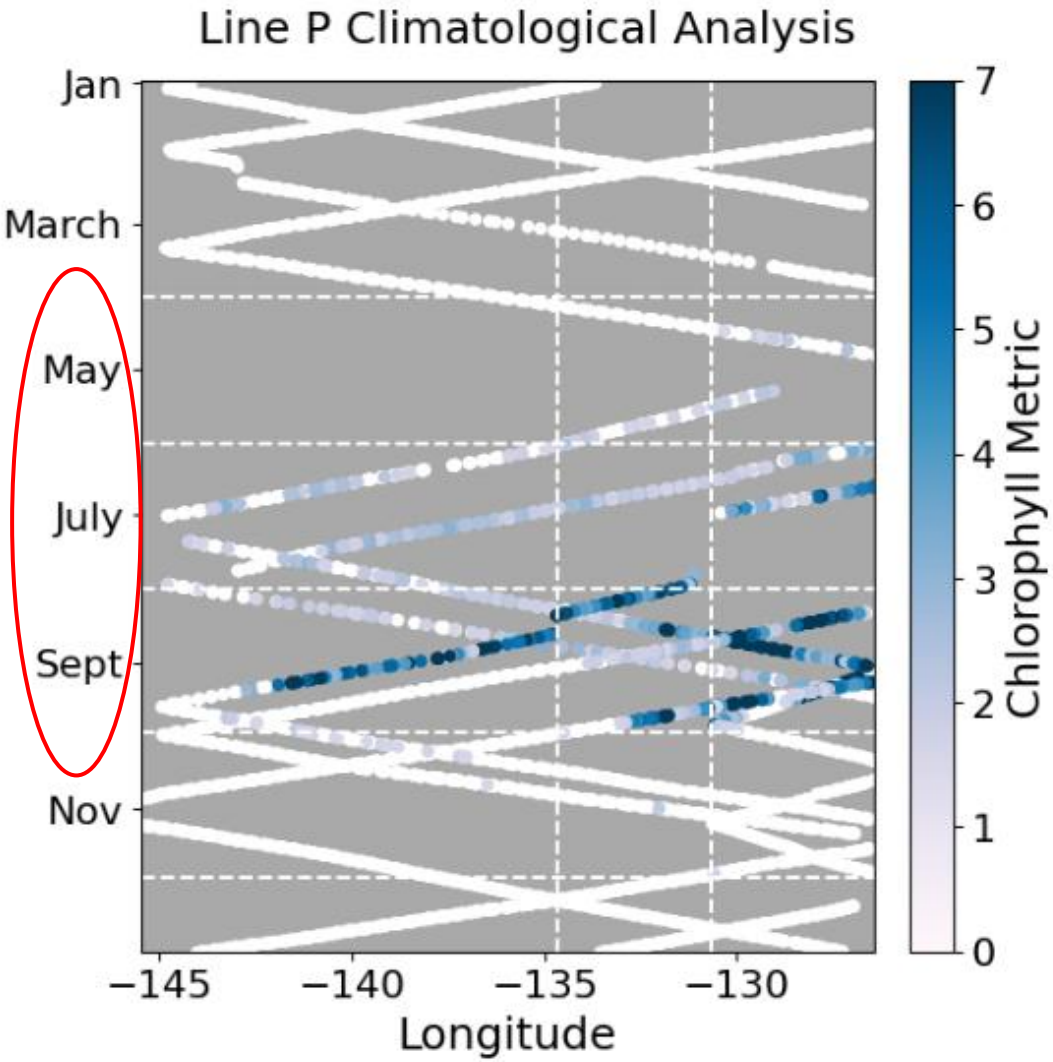


- Forms in the Spring
- Most pronounced in late summer
- Disappear in the Fall

$$\text{Metric} = \frac{\text{Peak value at depth}}{\text{Mixed layer median}}$$

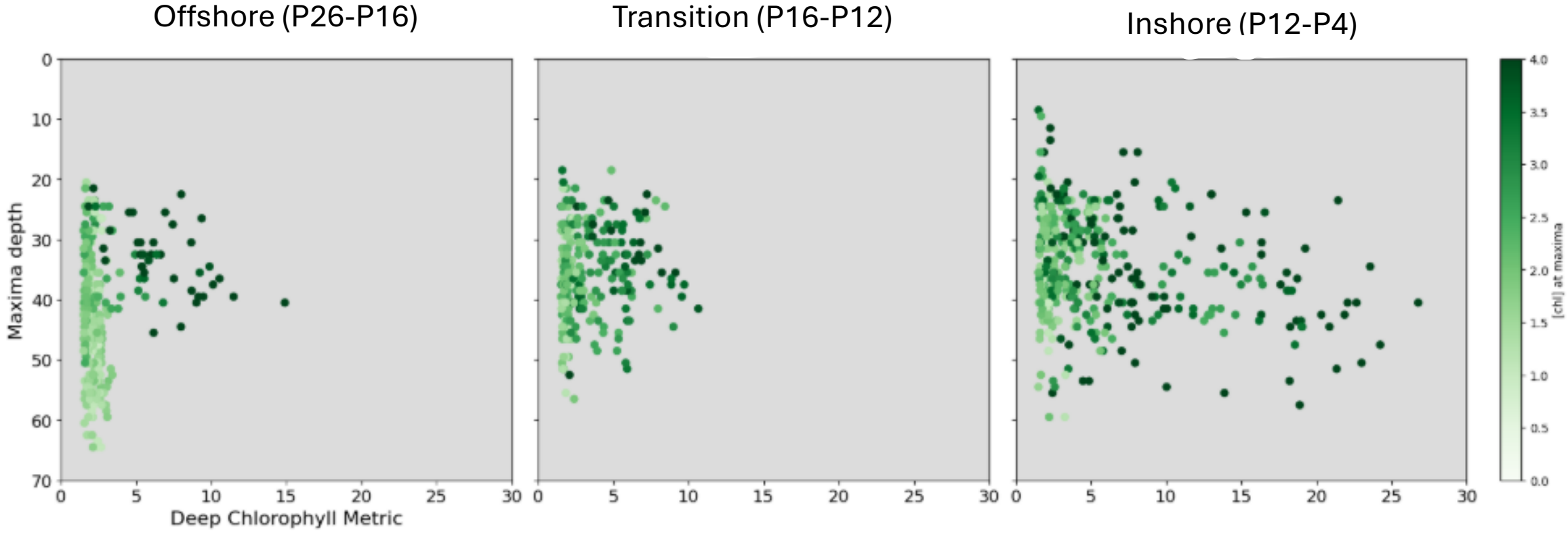
Mixed Layer Depth

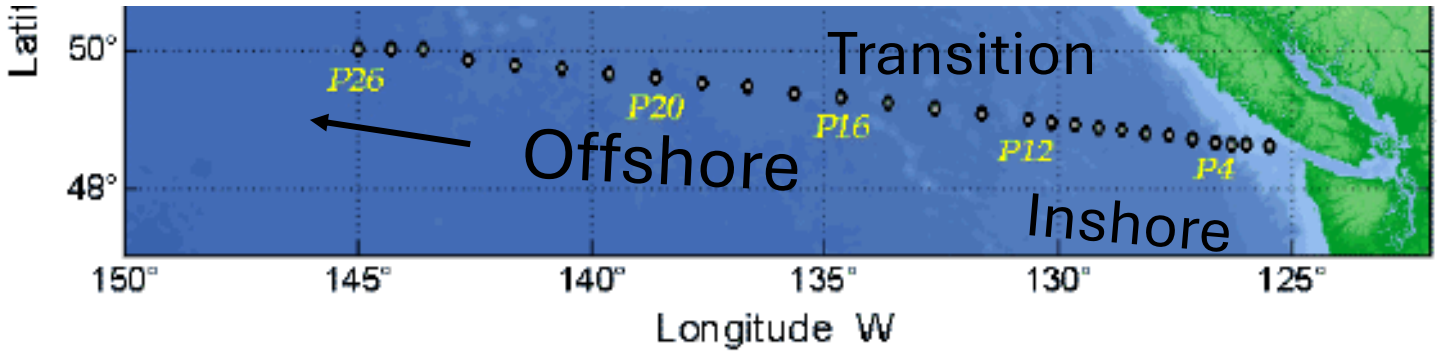




Deep chlorophyll maxima are present when mixed layer has shoaled

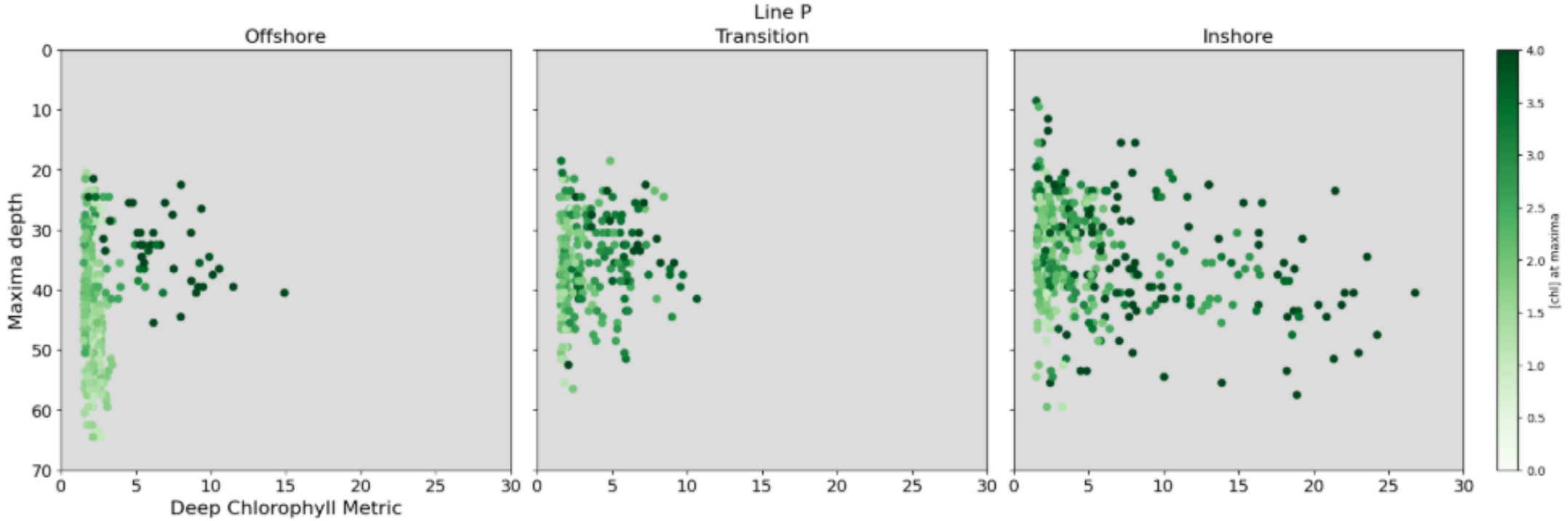
Line P Spatial Variability





$$\text{Metric} = \frac{\text{Peak value at depth}}{\text{Mixed layer median}}$$

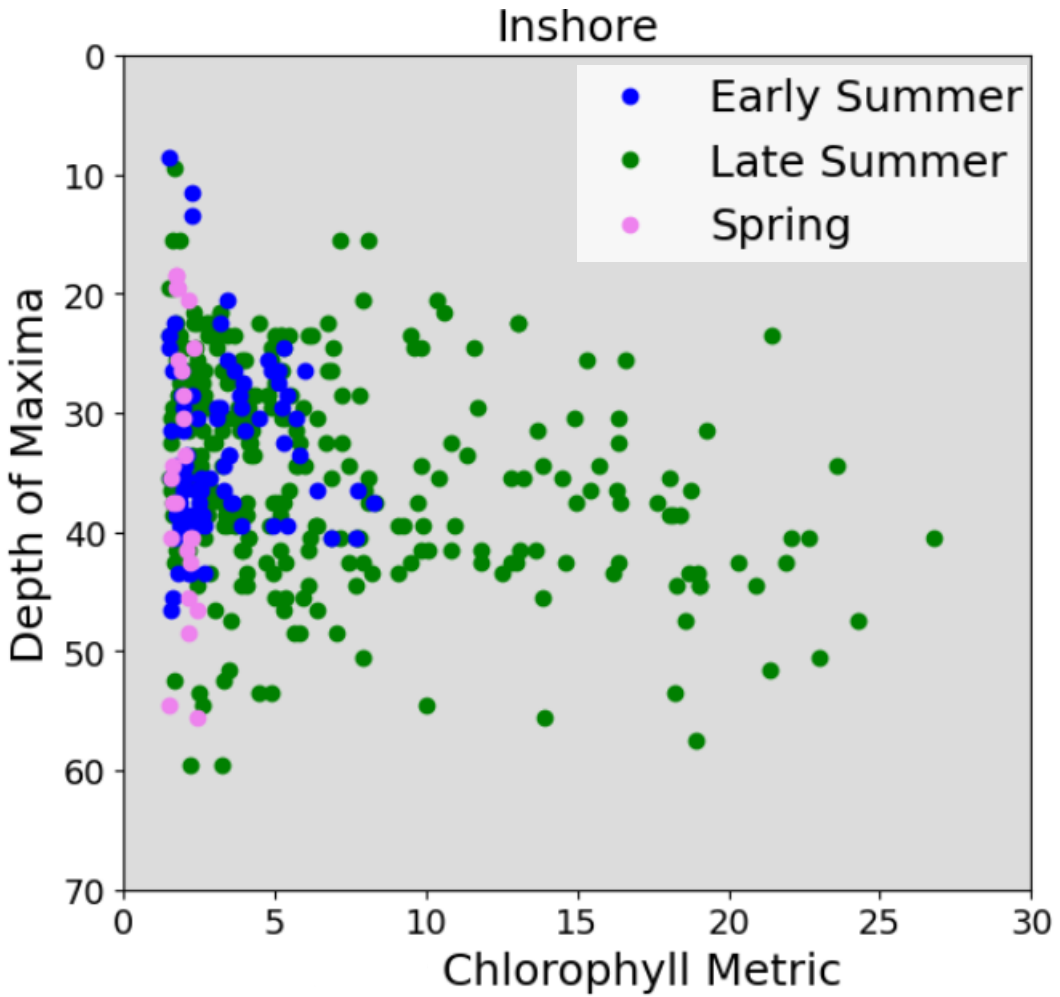
Spatial Variability



Relative to Inshore the Offshore:

- Metric limited to lower range
- Dominated by low [chl] datapoints

Line P Inshore Chlorophyll Metric

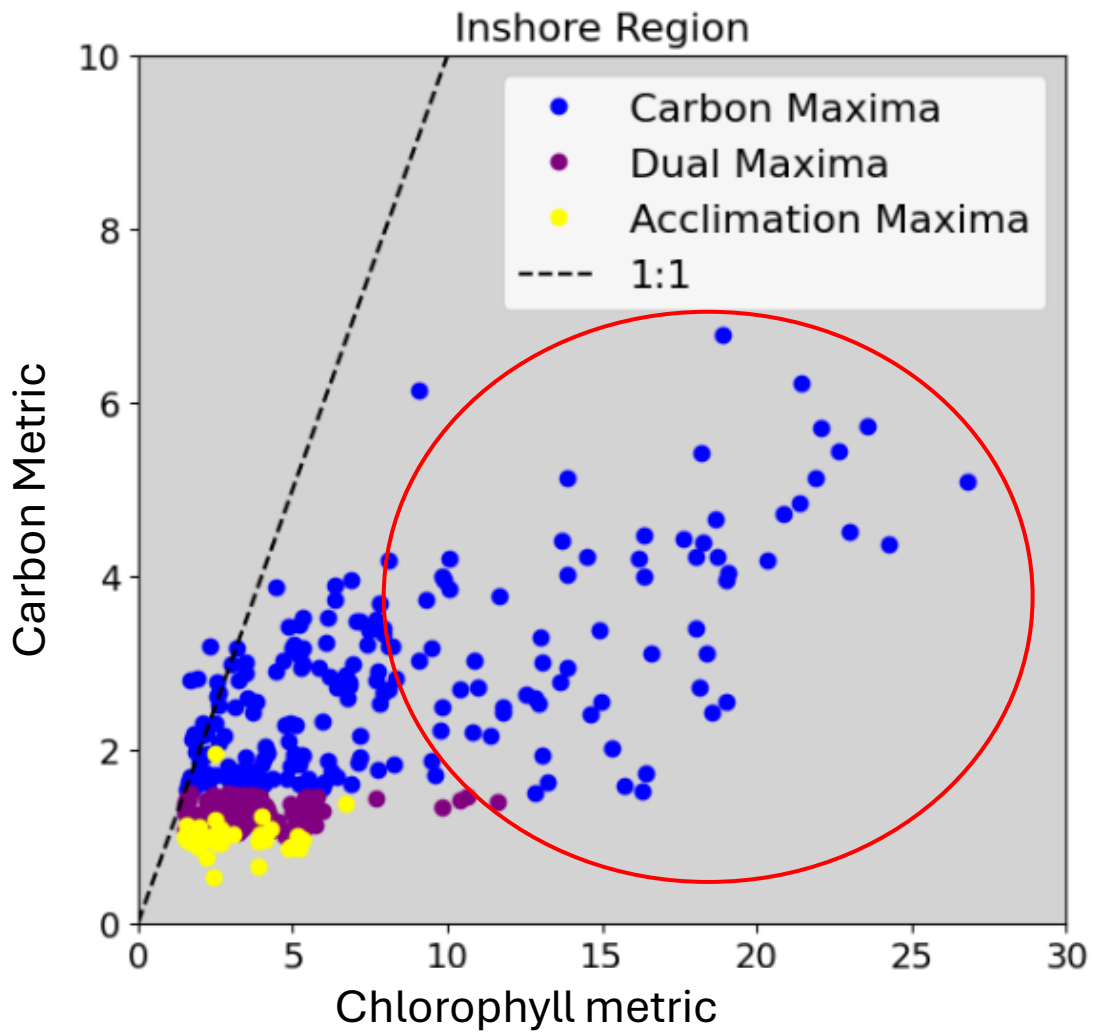


Low chlorophyll metrics present throughout entire depth range & seasons

High chlorophyll metric are concentrated in mid depth range in late summer

$$\text{Metric} = \frac{\text{Peak value at depth}}{\text{Mixed layer median}}$$

Comparing changes to [chl] and carbon



- Significant variability in less pronounced maxima
- Acclimation influences majority of maxima
- Very pronounced maxima classified as carbon maxima (late summer, mid depth)

$$\text{Metric} = \frac{\text{Peak value at depth}}{\text{Mixed layer median}}$$

In Closing….

- Deep maxima…..
  - are present when mixed layer has shoaled
  - most pronounced in inshore late summer within the mid depth range (Goldilocks zone)
  - always experience a degree of acclimation
- Combining fluorescence and backscatter data provides insight into physiology under low light conditions adding context into biomass measurements
- Glider spatial and temporal coverage supplements surface limited satellite data, providing a full picture of water column phytoplankton biomass