Variable Bloom Dynamics in the Mid-Atlantic Bight Fall-Winter Transition

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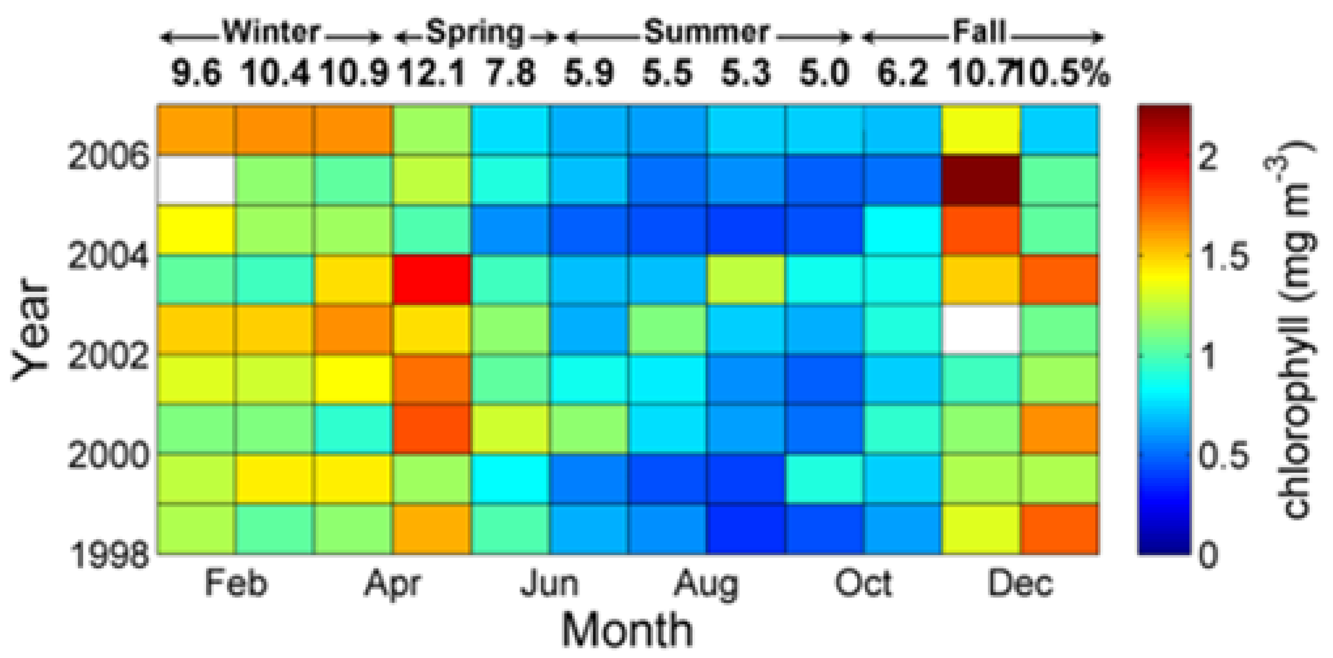
Background

- The Mid-Atlantic Bight (MAB) is a highly productive shelf ecosystem exhibiting strong seasonality
- Examining annual trends in primary productivity patterns have relied on ocean satellite imagery, but these data are sparse in Fall-Winter months when chlorophyll concentrations are relatively high
- There is a need to better characterize the dynamics of the winter bloom in the MAB

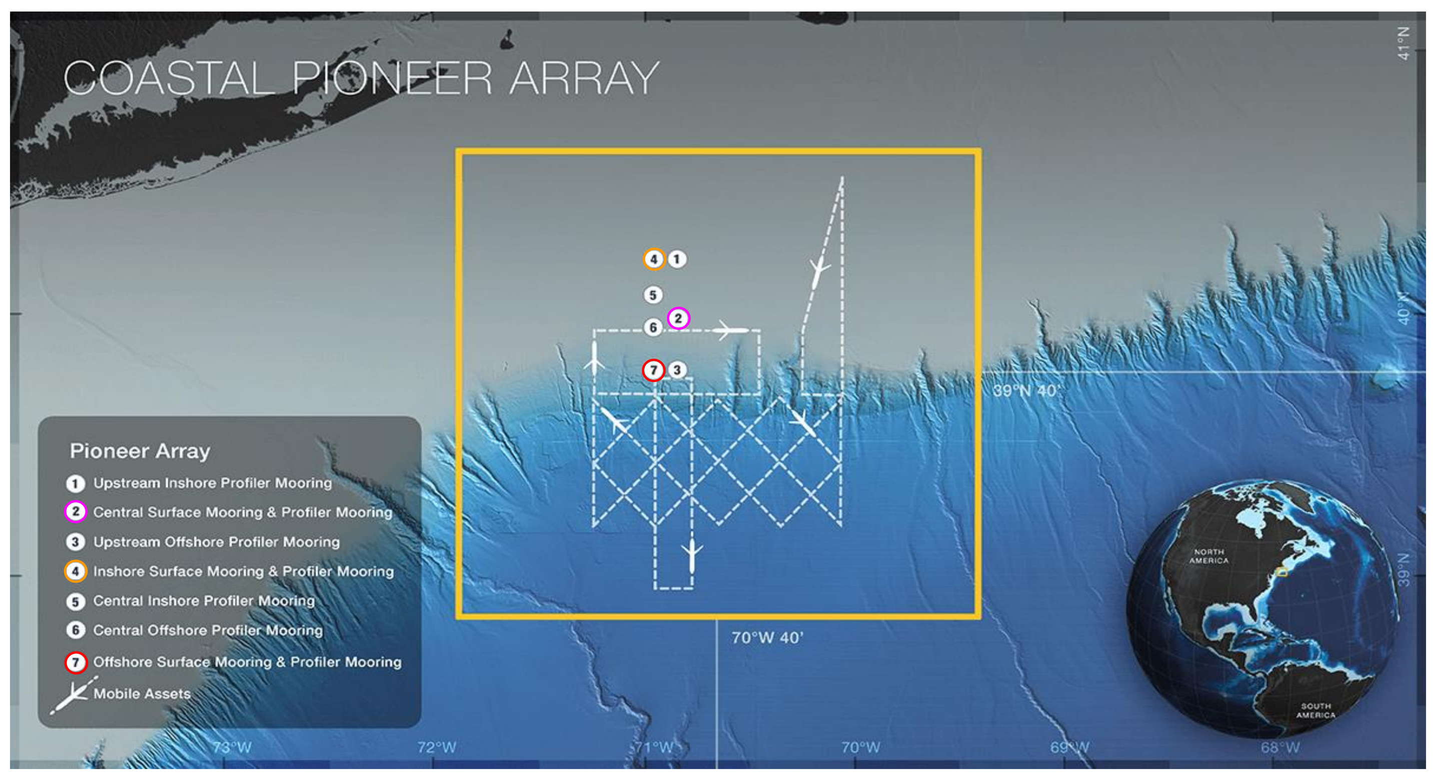


Monthly-averaged chlorophyll a within the Mid-Atlantic Bight from Xu et al. (2011).

Using *in situ* data collected through the Ocean Observatories Initiative (OOI), we are investigating the seasonality of the Fall-Winter transition and corresponding winter bloom

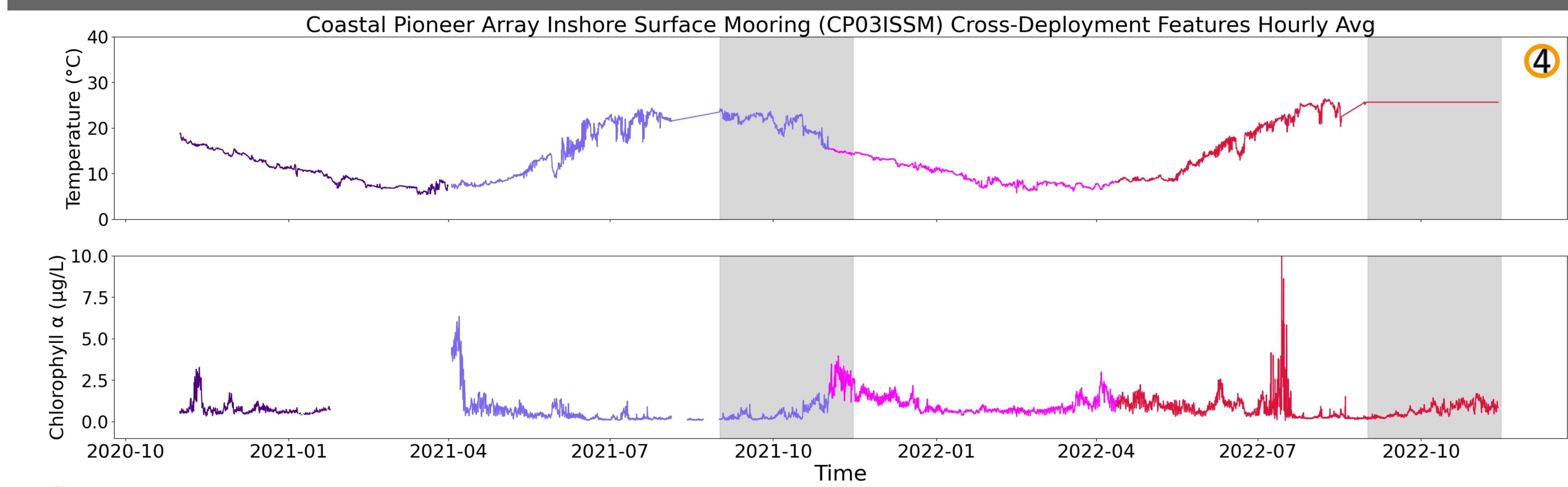
Methods

- The OOI Coastal Pioneer Array consisted of moorings located off the coast of New Jersey & New York that collected seawater surface and profile data from 2015-2022.
- Using data from sensors integrated into the moorings, we assessed the timing of fall-winter transition and magnitude of the winter bloom using temperature, salinity, fluorescence and optical backscatter data

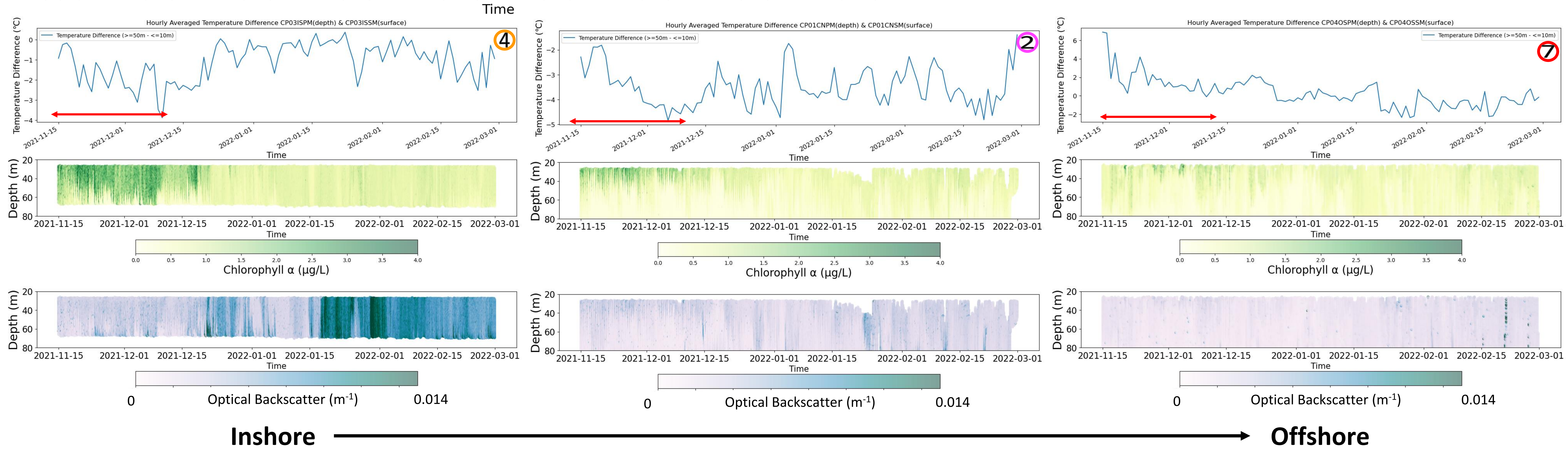


Map displaying the 7 moored locations constituting the Coastal Pioneer Array. Smaller shapes drawn by white marks display coverage area of gliders and Autonomous Underwater Vehicles providing complementary data. This poster focuses on mooring data however the future efforts will use the Slocum glider data. Figure from the Ocean Observatories Initiative.

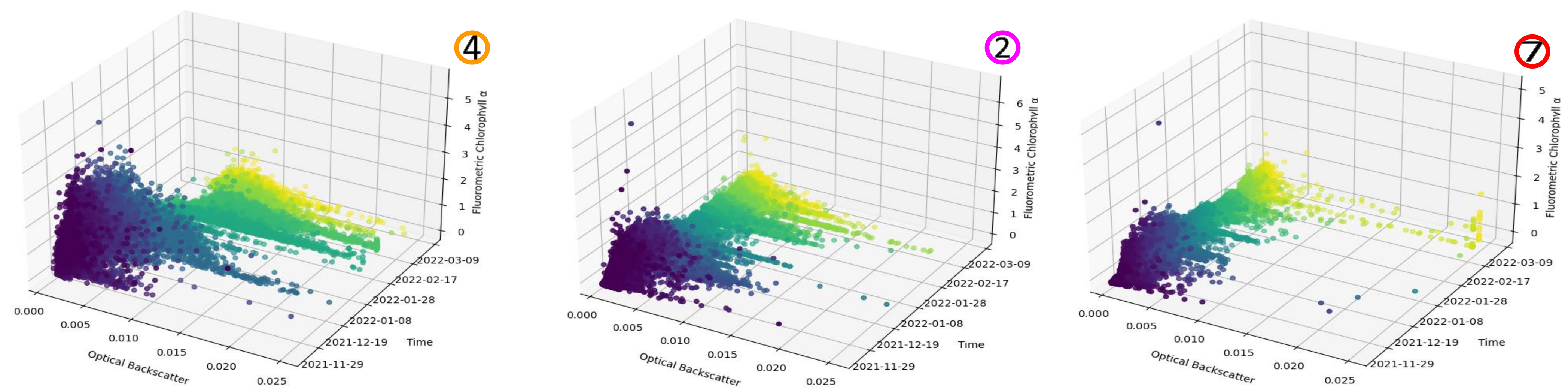
Preliminary Results



- A 2-year set of observations from three separate mooring deployments shows the decline in surface temperature and simultaneous increases in chlorophyll during the fall-winter transition (highlighted in gray)
- Chlorophyll increases into the Fall-Winter may have basis in reintroduction of dark-acclimated phytoplankton to surface waters or turbulence-based nutrient injection due to the many storms during this time



- To assess the timing of destratification, we used the temperature difference between the surface and bottom waters as an index.
- A bloom is observed across moorings at the beginning of the destratification, and signals are observed in both the chlorophyll fluorescence and optical backscatter. Later in the winter season there is a decorrelation between the fluorescence and backscatter. The magnitudes of the response are largest for the inshore moorings.



- 3D charts of chlorophyll and optical backscatter throughout the Fall-Winter transition reveal:
  - Backscatter values highest for short (~24-hour) periods, which we hypothesize reflects storm-based resuspension
  - High backscatter events most frequent during the winter months and were not correlated with the chlorophyll fluorescence

Future Directions

Further characterize Fall-Winter transition:

- Introduce data gathered from bulk meteorology sensors to verify storm linkage to observed resuspension events
- Discern whether storm frequency impacts microalgae bloom intensity or timeline

Investigate Biological Dynamics:

- Utilize imaging flow cytometry to track changes in phytoplankton community compositions over time
- Attempt to align microalgae community dynamics with upper trophic level changes

References

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Acknowledgements

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