Underway observations of inherent optical properties for the estimation of near-surface chlorophyll-a in the Fram Strait

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Introduction

The inherent optical properties (IOPs) of seawater are proved to have good linkage to biogeochemical variables. With the emergency of in situ optical sensors, high spatial and temporal resolution measurements of bio-optical properties are achievable, making it possible to understand ocean biogeochemical processes on a broader scale. However, data quality control of the optical sensors remains challenging because of biofouling and the instrumental instability. In this study, we established a ship-based flow-through system of Absorption Attenuation Spectra Meter (AC-s).

Objectives:
1. Develop a method to correct light absorption and attenuation of seawater from flow-through AC-s system;
2. Retrieve surface phytoplankton Chl-a concentration from quality controlled hyperspectral particulate absorption (α).

Instrument Setup

- An AC-S was installed on R/V Polarstern’s flow-through seawater system, measuring both a and c.
- The flow-through seawater was supplied by a vacuum pump plumbed to the keel intake (~11 m below surface). This water was passed through a debubblizer and then through the AC-S.
- The AC-S sensor was operated constantly except when in port or once per day or every 2 days for instrument cleaning and filter cartridge replacement.
- Periodic switching of a custom valve passed 0.2 µm filtered seawater through the sensor for 30 min of every hour, allowing for the calculation of a and c for particulate.

Method flow and Results

- Before (blue) and after (red) spikes removal of raw AC-S data collected from 23/07/2015 18:50 to 24/07/2015 6:47.
- Time series of the corrected particulate absorption at 443 nm.
- Comparison of particulate absorption from AC-S versus filter-pad.
- Contribution of phytoplankton taxonomic composition to surface water.
- Before and after correction with data from AC-S & filter-pad versus Chl-a.
- Comparison of particulate absorption from AC-S & filter-pad versus Chl-a.

Study Area

We conducted continuous underway measurements of hyperspectral IOPs during the PS93.2 expedition to the Fram Strait.

Conclusion

- The AC-S data are reliable after applying our correction scheme.
- AC-S αp has a good agreement with filter-pad data.
- AC-S αc has a robust relationship with Chl-a.

Outlook

- Adjust beta factor of filter-pad data, and further correct AC-S αp.
- Apply scattering correction method from Rötgers et al., 2013, and see if better relationships can be found between AC-S αp and filter-pad data.
- Clustering analysis of how better relationships can be found by Chemtax determines the 100 factors αc within the cruise.
- Validate satellite data with Chl retrieved from AC-S.

References


Acknowledgement

This project would have been impossible without the the support of the HGF FRAM Infrastructure project and the China Scholarship Council.