REMOTE-SENSING-BASED MEASUREMENT OF PHYTOPLANKTON SIZE SPECTRUM AND CELL DIAMETER IN THE GLOBAL OCEAN

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INTRODUCTION

- Cell size and size classes of phytoplankton are related to ecosystem function, ocean carbon cycle, and climate change.
- The changes in phytoplankton size not only the biological properties of the water column, but also the trophic interactions within the ecosystem.
- Absorption spectra of phytoplankton in the visible wavelengths hold implicit information about cell size, but advanced models or algorithms are required to decode them.

We present a novel method to use the absorption coefficient of phytoplankton to retrieve quantitative information of phytoplankton size structure from remotely-sensed ocean colour data.

THE MODEL

Exponent of phytoplankton size spectrum as a function of the specific-absorption coefficient of phytoplankton at 676 nm

Chlorophyll fractions of three size classes of phytoplankton as a function of the specific-absorption coefficient at 676 nm

The method was implemented on a large in situ phytoplankton data collected from North-West Atlantic, the Arabian Sea, off Vancouver Island, in the Gulf of Mexico, and off the coast of Chile mainly by the scientists of the Bedford Institute of Oceanography.

APPLICATION

Global distribution of chlorophyll concentration in [mg m⁻³] based on MODIS-AQUA composite image for Winter 2011, i.e., day 355, 2010 - to day 79, 2011

REMARKS

- We present a new method to compute the equivalent spherical diameter of phytoplankton cells and the exponent of phytoplankton-size spectrum, and thereby estimate the chlorophyll fractions in different phytoplankton size classes on a global scale.
- The spatial distribution of the exponent of size-spectrum and the chlorophyll fractions of pico-, nano- and micro-phytoplankton estimated are consistent with our current understanding of phytoplankton size in the global oceans.
- This approach can enhance our understanding of the distribution and time evolution of phytoplankton size structure in the oceans.
- This approach will also be useful for understanding and monitoring phytoplankton functional types in the global ocean.

REFERENCES