Geophysical Research Abstracts
Vol. 19, EGU2017-5316, 2017
EGU General Assembly 2017

Modeled Chl:C ratio and derived estimates of phytoplankton carbon biomass and its contribution to total particulate organic carbon in the global surface ocean

Lionel Arteaga (1), Markus Pahlow (2), and Andreas Oschlies (2)

(1) AOS, Princeton University, Princeton, USA (laaq@princeton.edu), (2) Biogeochemical Modeling, GEOMAR - Helmholtz Centre for Ocean Research, Kiel, Germany

Chlorophyll (Chl) is a distinctive component of autotrophic organisms, often used as an indicator of phytoplankton biomass in the ocean. However, assessment of phytoplankton biomass from Chl relies on the accurate estimation of the Chl:carbon(C) ratio. Here we present global patterns of Chl:C ratios in the surface ocean obtained from a phytoplankton growth model that accounts for the optimal acclimation of phytoplankton to ambient nutrient, light, and temperature conditions. The model agrees largely with observed/expected global patterns of Chl:C. Combining our Chl:C estimates with satellite Chl and particulate organic carbon (POC), we infer phytoplankton C concentration in the surface ocean and its contribution to the total POC pool. Our results suggest that the portion of POC corresponding to living phytoplankton is higher in subtropical latitudes and less productive regions (∼30–70%) and decreases to ∼10–30% toward high latitudes and productive regions. An important caveat of our model is the lack of iron limiting effects on phytoplankton physiology. Comparison of our predicted phytoplankton biomass with an independent estimate of total POC reveals a positive correlation between nitrate concentrations and nonphotosynthetic POC in the surface ocean. This correlation disappears when a constant Chl:C is applied. Our analysis is not constrained by assumptions of constant Chl:C or phytoplankton:POC ratio, providing a novel independent analysis of phytoplankton biomass in the surface ocean. These results highlight the importance of accounting for the variability in Chl:C and its application in distinguishing the autotrophic and heterotrophic components in the assemblage of the marine plankton ecosystem.