

Phytoplankton community size structure in the global ocean: optical determination and ecological implications

Colleen Mouw

Phytoplankton cell size is important to biogeochemical and food web processes. Satellite remote sensing reflectance spectra ($R_{rs}(\lambda)$) of the ocean contains considerable information about in water constituents. Traditionally, chlorophyll concentration ([Chl]) was the sole ecological piece of information about phytoplankton derived from satellite observations. Phytoplankton cell size is also an important ecological parameter that can be optically differentiated. The feasibility of retrieving phytoplankton community structure (S_f) is investigated by isolating the effect phytoplankton cell size has on varying $R_{rs}(\lambda)$ in the presence of other optically active constituents through the use of optical and radiative transfer models that are linked in an off-line diagnostic calculation to monthly output of a global biogeochemical/ecosystem/circulation model. This reveals important implications on when and where the satellite standard algorithms will overestimate/underestimate [Chl] due to $R_{rs}(443)$ being significantly affected by phytoplankton size. Global monthly maps of phytoplankton cell size (S_f) for the first ten years of the SeaWiFS mission (September 1997 - August 2007) are retrieved from satellite imagery of ($R_{rs}(\lambda)$). The spatial and temporal patterns of S_f that emerge agree well with *in situ* observations. Spatial and temporal patterns of S_f in relation [Chl] are investigated. The interannual variability observed in the dataset is strongly correlated with the multivariate El Niño/Southern Oscillation Index (MEI). It is often assumed that [Chl] and S_f vary together. The analysis reveals there are temporal and spatial scales in which [Chl] and S_f are unrelated. These results point to the importance of considering phytoplankton cell size in investigations of primary production, biogeochemistry and carbon cycling.