Development of new satellite ocean colour products: moving forward to an estimation of phytoplankton photo-physiology

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Since the launch of the Coastal Zone Color Scanner (CZCS) in the 1970s, ocean color remote sensors have been providing synoptic views of marine biological (and biogeochemical) activities via surface chlorophyll-a observation. The ocean colour algorithms, in addition to ocean colour sensors, also evolved since the CZCS, and the remote sensing data of various biogeochemical variables have become available (e.g. particulate organic carbon, calcite concentration, chromophoric dissolved organic matter etc.). While availability of the biogeochemical products from the ocean color remote sensing is continuously growing, it is only the fluorescence line height due to phytoplankton that became available as a biological product after chlorophyll-a. Here we challenge to develop a new satellite algorithm to retrieve more biological variables using the ocean colour remote sensing. We found in theory that some physiological quantities of various phytoplankton groups such as the chlorophyll-a specific-absorption coefficient and the quantum yield of photosynthesis can be retrieved by integrating a bio-optical theory and an image processing technique. When these biological products were actually derived using the satellite ocean colour data, our analyses revealed that primary productivity of some phytoplankton groups could be largely influenced by their physiology rather than their biomass. This implies the importance of physiological observation of phytoplankton for a better understanding of ocean biogeochemical processes and ecology.

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