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Evaluation of regional patterns of light and nutrient colimitation in the global ocean

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Future trends of primary production (PP) in the ocean may be affected by changes in the availability of resources (nutrients and light), as result of shifts in ocean dynamics derived from climate change. Processes involved in phytoplankton nutrient uptake are not well understood, which leaves a question mark respect on how will ocean's biota respond to changes in resources availability. An optimal-growth model for phytoplankton has been used together with satellite and field data to analyze areas of colimitation by light and nutrients in the ocean. The optimal-growth model here used only accounts for nitrogen (N) and phosphorus (P) as nutrients. As a consequence, other micronutrients are not included in this analysis. North high latitudes beyond 40 $^{\circ}$ north in the Atlantic and Pacific oceans are under light limitation during winter, followed by nutrient limitation after the spring bloom. Tropical and subtropical regions are under permanent strong nutrient limitation, but phytoplankton here is also physiologically regulated by the availability of light. Southern regions are also predominantly nutrient limited, and the effect of light in these areas is greater than in subtropical regions, but lower than in high north latitudes. However, the latter is partly a consequence of the geographical selection of the evaluated regions. According to the model-based analysis presented here, nutrient limitation is in all cases primarily due to N. P was found to have a minor effect in different areas of the ocean. Even though N:P was considerably high for the global ocean, our approach leads us to conclude that N rather than P is the common limiting nutrient in the ocean, and that more comprehensive analyses should be performed in order to determine limitation of PP in the global ocean.