Do we need complex mechanistic photoacclimation models for phytoplankton?

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ABSTRACT: The outputs of simple models relating phytoplankton growth and chlorophyll *a* (Chl *a*) to irradiance and nutrient (nitrogen [N] and/or iron [Fe]) availability are compared with those of complex mechanistic models. Mechanistic models, which are significantly more expensive in computational terms, are required for a proper description of high-resolution dynamics of light acclimation with or without changes in nutrient status (for example, with diurnal light-dark periodicity or Fe fertilization). However, for instances in which such detailed descriptions of growth and Chl : carbon (C) are not required, there appears to be no justification for using mechanistic models to simulate nutrient-light interaction. Multinutrient models based on modified quota-type models, coupled with a simple photosynthesis-irradiance growth rate equation and an empirically derived Chl *a* :C relationship linking irradiance to growth rate, should be adequate for most oceanographic modeling scenarios.