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TITLE: Ecosystem dynamics based on plankton functional types for global ocean biogeochemistry models

AUTHOR: ['Corinne Le Quéré', 'Sandy P. Harrison', 'I. Colin Prentice', 'Erik T. Buitenhuis', 'Olivier Aumont', 'Laurent Bopp', 'Hervé Claustre', 'Letícia Cotrim da Cunha', 'Richard J. Geider', 'Xavier Giraud', 'Christine Klaas', 'Karen E. Kohfeld', 'Louis Legendre', 'Manfredi Manizza', 'Trevor Platt', 'Richard B. Rivkin', 'Shubha Sathyendranath', 'Julia Uitz', 'Andrew J. Watson', 'Dieter Wolf-Gladrow']

ABSTRACT:

Abstract Ecosystem processes are important determinants of the biogeochemistry of the ocean, and they can be profoundly affected by changes in climate. Ocean models currently express ecosystem processes through empirically derived parameterizations that tightly link key geochemical tracers to ocean physics. The explicit inclusion of ecosystem processes in models will permit ecological changes to be taken into account, and will allow us to address several important questions, including the causes of observed glacial?interglacial changes in atmospheric trace gases and aerosols, and how the oceanic uptake of CO₂ is likely to change in the future. There is an urgent need to assess our mechanistic understanding of the environmental factors that exert control over marine ecosystems, and to represent their natural complexity based on theoretical understanding. We present a prototype design for a Dynamic Green Ocean Model (DGOM) based on the identification of (a) key plankton functional types that need to be simulated explicitly to capture important biogeochemical processes in the ocean; (b) key processes controlling the growth and mortality of these functional types and hence their interactions; and (c) sources of information necessary to parameterize each of these processes within a modeling framework. We also develop a strategy for model evaluation, based on simulation of both past and present mean state and variability, and identify potential sources of validation data for each. Finally, we present a DGOM?based strategy for addressing key questions in ocean biogeochemistry. This paper thus presents ongoing work in ocean biogeochemical modeling, which, it is hoped will motivate international collaborations to improve our understanding of the role of the ocean in the climate system.

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