Global cell abundance of picoeukaryotic phytoplankton, predicted by neural network models using average temperatures and nitrate from the World Ocean Atlas 2005

Website: https://www.bco-dmo.org/dataset/783537
Data Type: model results
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Project
» Convergence: RAISE: Linking the adaptive dynamics of plankton with emergent global ocean biogeochemistry (Ocean_Stoichiometry)

Contributors	Affiliation	Role
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Abstract
Global cell abundance of picoeukaryotic phytoplankton, predicted by our neural network models using average temperatures and nitrate from the World Ocean Atlas 2005 (1°x1° resolution), and 8 d average PAR and K490 values derived from satellite data (SeaWiFS 0.083°x0.083°) and obtained as an output cells/ml for each set of conditions in a 1°x1° resolution.

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Coverage

Spatial Extent: **N**:90 **E**:180 **S**:-90 **W**:-180

Dataset Description

Global cell abundance of picoeukaryotic phytoplankton, predicted by our neural network models using average temperatures and nitrate from the World Ocean Atlas 2005 (1°x1° resolution), and 8 d average PAR and K490 values derived from satellite data (SeaWiFS 0.083°x0.083°) and obtained as an output cells/ml for each set of conditions in a 1°x1° resolution.

Each cell corresponds to a 1x1 cell grid
Files 90 to -90
Columns 1 to 360
Cell concentration: cells/ml
Land mask NAN

Acquisition Description

To estimate global cell abundance of picoeukaryotic phytoplankton, we used neural network models monthly average temperatures and nitrate from the World Ocean Atlas 2005 (1˚x1˚ resolution), and PAR and K_{490} values derived from satellite data (SeaWiFS 0.083˚x0.083˚) and obtained predicted abundances for each set of conditions.

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Convergence: RAISE: Linking the adaptive dynamics of plankton with emergent global ocean biogeochemistry (Ocean_Stoichiometry)

NSF Award Abstract: Due to their sheer abundance and high activity, microorganisms have the potential to greatly influence how ecosystems are affected by changes in their environment. However, descriptions of microbial physiology and diversity are local and highly complex and thus rarely considered in Earth System Models. Thus, the researchers focus on a convergence research framework that can qualitatively and quantitatively integrate eco-evolutionary changes in microorganisms with global biogeochemistry. Here, the investigators will develop an approach that integrates the knowledge and tools of biologists, mathematicians, engineers, and geoscientists to understand the link between the ocean nutrient and carbon cycles. The integration of data and knowledge from diverse fields will provide a robust, biologically rich, and computationally efficient prediction for the variation in plankton resource requirements and the biogeochemical implications, addressing a fundamental challenge in ocean science. In addition, the project can serve as a road map for many other research groups facing a similar lack of convergence between biology and geoscience. Traditionally, the cellular elemental ratios of Carbon, Nitrogen, and Phosphorus (C:N:P) of marine communities have been considered static at Redfield proportions but recent studies have demonstrated strong latitudinal variation. Such regional variation may have large - but poorly constrained - implications for marine biodiversity, biogeochemical functioning, and atmospheric carbon dioxide levels. As such, variations in ocean community C:N:P may represent an important biological feedback. Here, the investigators propose a convergence research framework integrating cellular and ecological processes controlling microbial resource allocations with an Earth System model. The approach combines culture experiments and omics measurements to provide a molecular understanding of cellular resource allocations. Using a mathematical framework of increasing complexity describing communicating, moving demes, the team will quantify the extent to which local mixing, environmental heterogeneity and evolution lead to systematic deviations in plankton resource allocations and C:N:P. Optimization tools from engineering science will be used to facilitate the quantitative integration of models and observations across a range of scales and complexity levels. Finally, global ocean modeling will enable understanding of how plankton resource use impacts Earth System processes. By integrating data and knowledge across fields, scales and complexity, the investigators will develop a robust link between variation in plankton C:N:P and global biogeochemical cycles.

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Funding

Funding Source	Award
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