Biomass historic CMIP5 data - mean picophytoplankton surface biomass estimated for climate models under the Historical scenario

Website: https://www.bco-dmo.org/dataset/783516
Data Type: model results
Version: 1
Version Date: 2019-12-04

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

Contributors	Affiliation	Role
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Abstract
Mean picophytoplankton surface biomass (mg/m3) estimated for the climate models (CanESM2, CESM1 BGC, GFDL ESM2G, HadGEM2 ES, IPSL CM5A MR, MIROC ESM, MPI, and NorESM1 ME) under the Historical scenario. Light fields were identical across simulations. Picophytoplankton biomass results from the sum of the biomass estimated for the Prochlorococcus, Synechococcus, and picoeukaryotic phytoplankton.

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Coverage

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

Dataset Description

Mean picophytoplankton surface biomass (mg/m³) estimated for the climate models under the Historical scenario. Light fields were identical across simulations. Picophytoplankton biomass results from the sum of the biomass estimated for the *Prochlorococcus*, *Synechococcus*, and picoeukaryotic phytoplankton.

Each cell corresponds to a 1x1 cell grid
Files 90 to -90
Columns 1 to 360
Biomass: mg/m3
Land mask NAN

Acquisition Description

We calculated mean total picophytoplankton biomass for 2070-2099 and 1970-1999 for the RCP8.5 and historical scenarios. We imposed a maximum sea surface temperature of 30°C as model predictions of higher temperature are uncertain due to poorly constrained atmospheric convection feedbacks. We used an ensemble of eight Earth System models, CanESM2, CESM1 BGC, GFDL ESM2G, HadGEM2 ES, IPSL CM5A MR, MIROC ESM, MPI, and NorESM1 ME.

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Related Publications

Flombaum, P., Gallegos, J. L., Gordillo, R. A., Rincon, J., Zabala, L. L., Jiao, N., … Martiny, A. C. (2013). Present and future global distributions of the marine Cyanobacteria Prochlorococcus and Synechococcus. Proceedings of the National Academy of Sciences, 110(24), 9824–9829. doi:10.1073/pnas.1307701110

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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
NSF Division of Ocean Sciences (NSF OCE)	OCE-1848576
Agencia Nacional de Promoción Científica y Tecnológica	PICT-2017-3020
Universidad de Buenos Aires	UBACyT 20020170100620BA

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