Picoeukaryotic phytoplankton observations from available public repositories and primary sources from from 1988-2007

Website: https://www.bco-dmo.org/dataset/783463
Data Type: Cruise Results, model results
Version: 1
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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
Picoeukaryotic phytoplankton observations from available public repositories and primary sources. Picoeukaryotic phytoplankton are defined as red fluorescent cells larger than Prochlorococcus and less than 2-3 µm in cell diameter. We only considered cell counts by flow cytometry. Samples covered a latitudinal range from 71.4˚N to 66.1˚S up to 400 m depth. Ancillary temperature and nitrate records were available for all but 2,334 and 6,530 observations, respectively, which we complemented with 1° monthly depth-dependent averages from the World Ocean Atlas (www.nodc.noaa.gov). To avoid analytical issues with detection limits, we imposed a minimum nitrate concentration of 0.01 µM. We calculated surface PAR (8 d averaged, 0.047° grid cell) using SeaWiFS and MODIS observations. Downward PAR was estimated using the attenuation coefficient K_{490} from SeaWiFS and MODIS (http://oceancolor.gsfc.nasa.gov) and corrected for chlorophyll a[30], and a minimum of 10^{-3} E/m^{2}d was imposed. Latitude, longitude, sample year, date and depth are provided with the field sample.

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Coverage

Spatial Extent: **N**:73.06 **E**:180 **S**:-66.1 **W**:-180
Temporal Extent: 1988-01-06 - 2007-08-20

Dataset Description

Picoeukaryotic phytoplankton observations from available public repositories and primary sources. Picoeukaryotic phytoplankton are defined as red fluorescent cells larger than *Prochlorococcus* and less than 2-3 µm in cell diameter. We only considered cell counts by flow cytometry. Samples covered a latitudinal range from 71.4˚N to 66.1˚S up to 400 m depth. Ancillary temperature and nitrate records were available for all but 2,334 and 6,530 observations, respectively, which we complemented with 1° monthly depth-dependent averages from the World Ocean Atlas (www.nodc.noaa.gov). To avoid analytical issues with detection limits, we imposed a minimum nitrate concentration of 0.01 µM. We calculated surface PAR (8 d averaged, 0.047° grid cell) using SeaWiFS and MODIS observations. Downward PAR was estimated using the attenuation coefficient K_{490} from SeaWiFS and MODIS (http://oceancolor.gsfc.nasa.gov) and corrected for chlorophyll a[30], and a minimum of 10^{-3} E/m^{2}d was imposed. Latitude, longitude, sample year, date and depth are provided with the field sample.

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Parameters

Parameter	Description	Units
year	year of sample	unitless
day	Julian Date (1-365)	unitless
longitude	longitude of sample (GMT=360 and dateline=180)	degrees
latitude	latitude of sample (Eq=0 and 90 : -90)	degrees
picoeukaryotes	picoeukaryotes concentration in the sample	cells per milliliter (cells/ml)
Temperature	water temperature in celsius degrees (Field observation or WOA)	degrees C
PAR	photosynthetically available radiation at depth m. Format: surface PAR (8 d averaged, 0.047 grid cell) using SeaWiFS and MODIS observations. Downward PAR was estimated using the attenuation coefficient K490 from SeaWiFS and MODIS (http://oceancolor.gsfc.nasa.gov) and corrected for chlorophyll a30, and a minimum of 10-3 E/m2d was imposed.	Einstein per square meter per day (Einstein m-2 day-1)
NO3	Nitrogen concentration (Field observation or WOA)	micromoles per liter (umol/L)

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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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