Experimental results on inorganic carbon fluxes of Prochlorococcus MED4 cultured under high and low CO2 concentrations (OA phytoplankton physiology project)

Website: https://www.bco-dmo.org/dataset/563152
Version: 2015-07-29

Project
» Effects of pCO2 and pH on Photosynthesis, Respiration and Growth in Marine Phytoplankton (OA_phytoplankton_physiology)

Programs
» Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Dataset Description

Prochlorococcus MED4 was acclimated to low (150 ppm) or high (1000 ppm) CO2. The cultures were then concentrated and placed in the chamber of a membrane inlet mass spectrometer (MIMS; Pfieffer QMS220). Dissolved inorganic carbon (DIC) was gradually added to the culture and inorganic carbon fluxes were measured using MIMS as described in Hopkinson et al. 2014.

Relevant Reference:

Hopkinson, B.M., J.N. Young, A. L. Tansik, and B. J. Binder. 2014. The minimal CO2-concentrating mechanism of Prochlorococcus spp. MED4 is effective and efficient. Plant Physiology 166: 2205-2217.

Data Processing Description

The data represent averages from experiments that were done in at least triplicate.

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date, reference information
- renamed parameters to BCO-DMO standard

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Data Files

File
ProCCM.csv (Comma Separated Values (.csv), 1.04 KB) MD5:40981ce58e9272e4ce27909db48e4f14 Primary data file for dataset ID 563152

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Parameters

Parameter	Description	Units
DIC_assay	Dissolved inorganic carbon (DIC) concentrations in the assay solution	micromolar
CO2_culture	Culture CO2 concentrations	parts per million
photosyn_net	Net photosynthesis	mol/cell/sec
respiration	Respiration	mol/cell/sec
CO2_flux	CO2 flux	mol/cell/sec
HCO3_flux	HCO3- flux	mol/cell/sec
DIC_internal	DIC concentrations inside the cell	millimolar

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Instruments

Dataset-specific Instrument Name	membrane inlet mass spectrometer (MIMS)
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	Membrane Inlet Mass Spectrometer (MIMS; Pfieffer QMS220)
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

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Deployments

Hopkinson_lab

Website	https://www.bco-dmo.org/deployment/563377
Platform	Univ_Georgia
Start Date	2010-09-01
End Date	2015-12-31
Description	Microbial carbon flux studies

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Project Information

Effects of pCO2 and pH on Photosynthesis, Respiration and Growth in Marine Phytoplankton (OA_phytoplankton_physiology)

Coverage: Laboratory in Athens, Georgia

Extracted from the NSF award abstract:

Approximately one third of carbon dioxide emissions dissolve in the surface waters of the ocean and increase its acidity (the phenomenon of ocean acidification). Amongst the biological effects of seawater acidification are changes in the growth of phytoplankton, organisms that are the basis for marine food-webs. However, variable effects on phytoplankton growth of increasing carbon dioxide concentration have been reported, including an increase, no effect or a decrease. The objective of this project is to understand the physiological response of marine phytoplankton to increasing concentrations of carbon dioxide and acidity. This knowledge will make it possible to assess, and eventually predict, future changes in phytoplankton ecology and ocean productivity. The hypothesis to be tested is that the increase in carbon dioxide and the increase in acidity (a decrease in pH) both influence the growth of marine phytoplankton. It is postulated 1) that elevated carbon dioxide levels will lead to a higher photosynthetic efficiency, and 2) that a lower pH of seawater will decrease the energy that phytoplankton must spend to maintain their normal internal pH. Experiments will be carried out to test if differences in photosynthetic and respiratory physiology between phytoplankton species will result in different responses to carbon dioxide concentration and ocean acidity. These hypotheses will be tested in laboratory experiments and complementary field studies, using mass spectrometric techniques and the analysis of molecular markers to trace carbon and oxygen metabolism. Field experiments with natural phytoplankton will be carried out in New Jersey coastal waters, Bermuda, and iron-limited waters off California.

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Program Information

Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Website: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477

Coverage: global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

Solicitations issued under this program:
NSF 10-530, FY 2010-FY2011
NSF 12-500, FY 2012

NSF 12-600, FY 2013
NSF 13-586, FY 2014
NSF 13-586 was the final solicitation that will be released for this program.

PI Meetings:
1st U.S. Ocean Acidification PI Meeting(March 22-24, 2011, Woods Hole, MA)
2nd U.S. Ocean Acidification PI Meeting(Sept. 18-20, 2013, Washington, DC)
3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA – Tentative)

NSF media releases for the Ocean Acidification Program:

Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification

Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?

Discovery nsf.gov - National Science Foundation (NSF) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation (NSF)

Press Release 12-179 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation (NSF)

Press Release 13-102 World Oceans Month Brings Mixed News for Oysters

Press Release 13-108 nsf.gov - National Science Foundation (NSF) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation (NSF)

Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants

Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation (NSF)

Press Release 14-010 nsf.gov - National Science Foundation (NSF) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation (NSF)

Press Release 14-116 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: NSF awards $11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation (NSF)

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Emerging Frontiers Division (NSF EF)	EF-1041034

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