Carbonate chemistry from outdoor flumes at the UCB Gump Research Station Moorea, French Polynesia from November of 2015 to March of 2016

Website: https://www.bco-dmo.org/dataset/754694
Data Type: experimental
Version: 1
Version Date: 2019-05-21

Project
» RUI: Ocean Acidification- Category 1- The effects of ocean acidification on the organismic biology and community ecology of corals, calcified algae, and coral reefs (OA_Corals)

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

Contributors	Affiliation	Role
Carpenter, Robert	California State University Northridge (CSUN)	Principal Investigator
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Abstract
This dataset carbonate chemistry data from outdoor flumes at the UCB Gump Research Station Moorea, French Polynesia. These measurements were taken during an experiment designed to measure coral reef community metabolism responses to ocean acidification over a 4-month period from November 13th, 2015 to March 15th, 2016. These data were published in Carpenter et al. (2018).

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Coverage

Spatial Extent: **Lat**:-17.490483 **Lon**:-149.826367
Temporal Extent: 2015-11-13 - 2016-03-15

Methods & Sampling

See Carpenter et al. (2018) for a detailed overview of the methodology of the experiment designed to measure coral reef community metabolism responses to ocean acidification over a 4-month period from November 13th, 2015 to March 15th, 2016 in outdoor flumes at the UCB Gump Research Station Moorea, French Polynesia.

Carbonate chemistry data:
The pH, measured on the total hydrogen ion scale (pHT), was monitored daily at the down-stream end of the flumes with a handheld electrode (DG 115-SC electrode (Mettler-Toledo). Seawater carbonate chemistry and salinity were measured weekly, both in the day (02:00) and night (20:00); salinity was measured using a bench-top conductivity meter (Thermo Scientific, Orionstar A212, Waltham, MA, USA). The parameters of the seawater carbonate system were calculated from measurements of temperature, salinity, pHT, and AT, using the R package seacarb (Lavigne and Gattuso 2013).

Community composition:
~25% coral cover, comprised of 11% cover of massive Porites spp., 7% Porites rus, 4% Montipora spp. and 3% Pocillopora spp. There was ~7% cover of crustose coralline algae (CCA), with 4% Porolithon onkodes and 3% Lithophyllum kotschyanum, and ~5% cover of small pieces (i.e., ~1-cm diameter) of coral rubble (Fig. S2, Carpenter et al., 2018)."

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* Data submitted as sheet "carbonate chemistry" in original excel file exported as csv with the formatting that was set in Excel.
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions. Parameter names can not start with a number.
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.
* Various date formats in Date column changed from to yyyy-mm-dd (e.g. 2015-11-13).

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Data Files

File	
carbonate_chemistry.csv	(Comma Separated Values (.csv), 7.92 KB) MD5:22771150aa0f70b353613aab8ce56993
Primary data file for dataset ID 754694	

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Related Publications

Carpenter, R. C., Lantz, C. A., Shaw, E., & Edmunds, P. J. (2018). Responses of coral reef community metabolism in flumes to ocean acidification. Marine Biology, 165(4). doi:10.1007/s00227-018-3324-0
Results

Lavigne H, Gattuso JP (2013) Seacarb: seawater carbonate chemistry with R, R package version 2.4.8. http://CRAN.R-project.org/package=seacarb
Software

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Related Datasets

IsRelatedTo

Carpenter, R., Edmunds, P. (2020) **Coral community hourly metabolism from outdoor flumes at the UCB Gump Research Station Moorea, French Polynesia from November of 2015 to March of 2016.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date

2020-02-25 doi:10.1575/1912/bco-dmo.754685.1 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

Carpenter, R., Edmunds, P. (2020) **Coral community metabolism from outdoor flumes at the UCB Gump Research Station Moorea, French Polynesia from November of 2015 to March of 2016.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-02-25 doi:10.1575/1912/bco-dmo.754676.1 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

Carpenter, R., Edmunds, P. (2020) **Temperature and irradiance from outdoor flumes at the UCB Gump Research Station Moorea, French Polynesia from November of 2015 to March of 2016.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-02-25 doi:10.1575/1912/bco-dmo.754644.1 [view at BCO-DMO]
Relationship Description: Data from the same experiment.

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Parameters

Parameter	Description	Units
Flume	Flume number (1; 2; 3; 4)	unitless
Treatment	pCO2 treatment (values 344; 633; 870; 1146)	unitless
Date	Date (HST) of measurement in ISO 8601 format yyyy-mm-dd	unitless
pH_24h	pH averaged across 24 h. Potentiometric.	total hydrogen ion scale (pHT)
pH_Day	pH averaged during daylight hours. Potentiometric.	total hydrogen ion scale (pHT)
pH_night	pH averaged during nightime hours. Potentiometric.	total hydrogen ion scale (pHT)
pCO2_24h	pCO2 averaged across 24 h. Calculated using seacarb by Lavigne and Gattuso 2013.	microatmospheres (µatm)
pCO2_Day	pCO2 averaged during daylight hours. Calculated using seacarb by Lavigne and Gattuso 2013.	microatmospheres (µatm)
pCO2_Night	pCO2 averaged during nightime hours. Calculated using seacarb by Lavigne and Gattuso 2013.	microatmospheres (µatm)
DIC_24h	DIC averaged across 24 h. Calculated using seacarb by Lavigne and Gattuso 2013.	micromoles per kilogram (µmol kg-1)
DIC_Day	DIC averaged during daylight hours. Calculated using seacarb by Lavigne and Gattuso 2013.	micromoles per kilogram (µmol kg-1)
DIC_Night	DIC averaged during nightime hours. Calculated using seacarb by Lavigne and Gattuso 2013.	micromoles per kilogram (µmol kg-1)
TA_24h	Alkalinity averaged across 24 h. Potentiometric titration.	micromoles per kilogram (µmol kg-1)
TA_Day	Alkalinity averaged during daylight hours. Potentiometric titration.	micromoles per kilogram (µmol kg-1)
TA_Night	Alkalinity averaged during nightime hours. Potentiometric titration.	micromoles per kilogram (µmol kg-1)
Omega_24h	Aragonite saturation state averaged across 24 h. Calculated using seacarb by Lavigne and Gattuso 2013.	omega aragonite (Ωa)
Omega_Day	Aragonite saturation state averaged during daylight hours. Calculated using seacarb by Lavigne and Gattuso 2013.	omega aragonite (Ωa)
Omega_Night	Aragonite saturation state averaged during nightime hours. Calculated using seacarb by Lavigne and Gattuso 2013.	omega aragonite (Ωa)

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Instruments

Dataset-specific Instrument Name	DG 115-SC electrode
Generic Instrument Name	pH Sensor
Dataset-specific Description	Handheld electrode (DG 115-SC electrode (Mettler-Toledo)).
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	Orionstar A212
Generic Instrument Name	Salinity Sensor
Dataset-specific Description	Bench-top conductivity meter (Thermo Scientific, Orionstar A212, Waltham, MA, USA)
Generic Instrument Description	Category of instrument that simultaneously measures electrical conductivity and temperature in the water column to provide temperature and salinity data.

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Project Information

RUI: Ocean Acidification- Category 1- The effects of ocean acidification on the organismic biology and community ecology of corals, calcified algae, and coral reefs (OA_Corals)

Coverage: Moorea, French Polynesia

While coral reefs have undergone unprecedented changes in community structure in the past 50 y, they now may be exposed to their gravest threat since the Triassic. This threat is increasing atmospheric CO2, which equilibrates with seawater and causes ocean acidification (OA). In the marine environment, the resulting decline in carbonate saturation state (Omega) makes it energetically less feasible for calcifying taxa to mineralize; this is a major concern for coral reefs. It is possible that the scleractinian architects of reefs will cease to exist as a mineralized taxon within a century, and that calcifying algae will be severely impaired. While there is a rush to understand these effects and make recommendations leading to their mitigation, these efforts are influenced strongly by the notion that the impacts of pCO2 (which causes Omega to change) on calcifying taxa, and the mechanisms that drive them, are well-known. The investigators believe that many of the key processes of mineralization on reefs that are potentially affected by OA are only poorly known and that current knowledge is inadequate to support the scaling of OA effects to the community level. It is vital to measure organismal-scale calcification of key taxa, elucidate the mechanistic bases of these responses, evaluate community scale calcification, and finally, to conduct focused experiments to describe the functional relationships between these scales of mineralization.

This project is a 4-y effort focused on the effects of Ocean Acidification (OA) on coral reefs at multiple spatial and functional scales. The project focuses on the corals, calcified algae, and coral reefs of Moorea, French Polynesia, establishes baseline community-wide calcification data for the detection of OA effects on a decadal-scale, and builds on the research context and climate change focus of the Moorea Coral Reef LTER.

This project is a hypothesis-driven approach to compare the effects of OA on reef taxa and coral reefs in Moorea. The PIs will utilize microcosms to address the impacts and mechanisms of OA on biological processes, as well as the ecological processes shaping community structure. Additionally, studies of reef-wide metabolism

will be used to evaluate the impacts of OA on intact reef ecosystems, to provide a context within which the experimental investigations can be scaled to the real world, and critically, to provide a much needed reference against which future changes can be gauged.

Datasets listed in the "Dataset Collection" section include references to results journal publications published as part of this project.

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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)

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1415268

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