

Benthic Ecosystem and Acidification Measuring System (BEAMS) data from two sites on the western terrace of the Palmyra Atoll collected during 2014 (BEAMS project)

Website: <https://www.bco-dmo.org/dataset/666280>

Data Type: Other Field Results

Version: 1

Version Date: 2016-11-29

Project

» [Quantifying the potential for biogeochemical feedbacks to create refugia from ocean acidification on tropical coral reefs](#) (BEAMS)

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Abstract

Benthic Ecosystem and Acidification Measuring System (BEAMS) data from two sites on the western terrace of the Palmyra Atoll collected during 2014 (BEAMS project)

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Coverage

Spatial Extent: N:5.883 E:-162.119 S:5.877 W:-162.122

Temporal Extent: 2014-09-07 - 2014-09-23

Dataset Description

Benthic Ecosystem and Acidification Measuring System (BEAMS) data from two sites (LL and RT4) on the western terrace of the Palmyra Atoll. The data was collected in 2014.

Methods & Sampling

This dataset was collected using the Benthic Ecosystem and Acidification Measuring System (BEAMS). The

details of this technique and dataset can be in the reference provided below. BEAMS uses autonomous sensors to quantify mean gradients of pH and O₂ and the current velocity profile in the BBL to calculate benthic fluxes of O₂ (NCP) and TA (NCC). The NCP and NCC provided here represent metabolic rates under completely natural (e.g. flow and light) conditions.

Data Processing Description

Questionable rates have been removed through a quality control procedure described in detail in the reference above. Briefly, 1) measurements when the benthic boundary layer was stratified were removed, and 2) Spikes in the data were removed based on the observed DeltapH/DeltaO₂ relationship.

BCO-DMO Data Processing Notes:

- combined 2 datasets (one from each site) into one file
- replaced "NaN" with "nd"
- separated date and time into two columns
- reformatted column names to comply with BCO-DMO standards

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Data Files

File
BEAMSdata.csv (Comma Separated Values (.csv), 432.02 KB) MD5:7c4343e08d5d23c8a421bd130a52ee8
Primary data file for dataset ID 666280

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Related Publications

Takeshita, Y., McGillis, W., Briggs, E. M., Carter, A. L., Donham, E. M., Martz, T. R., ... Smith, J. E. (2016). Assessment of net community production and calcification of a coral reef using a boundary layer approach. *Journal of Geophysical Research: Oceans*, 121(8), 5655–5671. doi:10.1002/2016jc011886
<https://doi.org/10.1002/2016JC011886>
Methods

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Parameters

Parameter	Description	Units
site	Site in Palmyra where data were collected.	unitless
date	Date data were collected; mm/dd/yy	unitless
time	Time data were collected; HH:MM	unitless
pH_1_1m	In situ pH on the total hydrogen ion scale; 3 x n matrix; data collected at 1.1m above the benthos.	pH

pH_0_5m	In situ pH on the total hydrogen ion scale; 3 x n matrix; data collected at 0.5m above the benthos.	pH
pH_0_3m	In situ pH on the total hydrogen ion scale; 3 x n matrix; data collected at 0.3m above the benthos.	pH
temp_1_1m	Temperature in Celsius; 3 x n matrix; data collected at 1.1m above the benthos.	celsius
temp_0_5m	Temperature in Celsius; 3 x n matrix; data collected at 0.5m above the benthos.	celsius
temp_0_3m	Temperature in Celsius; 3 x n matrix; data collected at 0.3m above the benthos.	celsius
DO_1_1m	Dissolved O2; 3 x n matrix; data collected at 1.1m above the benthos.	umol/kg
DO_0_5m	Dissolved O2; 3 x n matrix; data collected at 0.5m above the benthos.	umol/kg
DO_0_3m	Dissolved O2; 3 x n matrix; data collected at 0.3m above the benthos.	umol/kg
OMEGA_1_1m	Aragonite Saturation State; 3 x n matrix; data collected at 1.1m above the benthos.	unitless
OMEGA_0_5m	Aragonite Saturation State; 3 x n matrix; data collected at 0.5m above the benthos.	unitless
OMEGA_0_3m	Aragonite Saturation State; 3 x n matrix; data collected at 0.3m above the benthos.	unitless
PAR	Photosynthetically Available Radiation	umol photons m-2 s-1
pressure	Pressure; 3 x n matrix.	decibars
current_speed	Current speed at 1.4 m above benthos.	meters per second
salinity	Salinity	practical salinity units
NCP	Net Community Production	mmol O2 m-2 hr-1

NCC_Q_0_8	Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 0.8	mmol CaCO ₃ m ⁻² hr ⁻¹
NCC_Q_0_9	Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 0.9	mmol CaCO ₃ m ⁻² hr ⁻¹
NCC_Q_1_0	Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 1.0	mmol CaCO ₃ m ⁻² hr ⁻¹
NCC_Q_1_1	Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 1.1	mmol CaCO ₃ m ⁻² hr ⁻¹
NCC_Q_1_2	Net Community Calcification; 5 x n matrix; NCC value calculated using Q of 1.2	mmol CaCO ₃ m ⁻² hr ⁻¹
ISO_DateTime.UTC	Date/Time (UTC) ISO formatted	unitless
lat	Latitude; N is positive.	decimal degrees
lon	Longitude; E is positive	decimal degrees

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Instruments

Dataset-specific Instrument Name	Flow meter
Generic Instrument Name	Flow Meter
Dataset-specific Description	Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS)
Generic Instrument Description	General term for a sensor that quantifies the rate at which fluids (e.g. water or air) pass through sensor packages, instruments, or sampling devices. A flow meter may be mechanical, optical, electromagnetic, etc.

Dataset-specific Instrument Name	Light Meter
Generic Instrument Name	Light Meter
Dataset-specific Description	Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS)
Generic Instrument Description	Light meters are instruments that measure light intensity. Common units of measure for light intensity are $\mu\text{mol}/\text{m}^2/\text{s}$ or $\mu\text{E}/\text{m}^2/\text{s}$ (micromoles per meter squared per second or microEinsteins per meter squared per second). (example: LI-COR 250A)

Dataset-specific Instrument Name	autonomous oxygen sensor
Generic Instrument Name	Oxygen Sensor
Dataset-specific Description	Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS)
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O_2) in the gas or liquid being analyzed

Dataset-specific Instrument Name	autonomous pH sensor
Generic Instrument Name	pH Sensor
Dataset-specific Description	Used by the Benthic Ecosystem and Acidification Measuring System (BEAMS)
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^+).

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Deployments

BEAMS_Palmyra

Website	https://www.bco-dmo.org/deployment/666435
Platform	shoreside Palmyra
Start Date	2014-09-07
End Date	2014-09-24
Description	Sites where Benthic Ecosystem and Acidification Measuring System (BEAMS) data were collected.

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Project Information

Quantifying the potential for biogeochemical feedbacks to create 'refugia' from ocean acidification on tropical coral reefs (BEAMS)

Description from NSF award abstract:

Rising sea surface temperatures and ocean acidification (OA) may threaten the ability of calcified organisms to build carbonate reefs, but it is unclear if particular reefs have the capacity to tolerate global change. Current understanding of the effects of OA on coral reefs originates from single-species laboratory studies largely focused on scleractinian corals. Traditionally, these experiments attempt to mimic static future conditions under the assumption that coastal regimes are as constant as -- and will acidify at the same rate as -- open ocean surface waters. Predictions based on these oversimplified scenarios are unrealistic because numerous benthic organisms, including calcifiers and primary producers, significantly alter the bulk seawater carbonate chemistry over a diurnal cycle. Further, the prevalence of recently appreciated extreme diel fluctuations in pH across some reefs suggests that benthic species may be acclimated to future carbonate conditions.

To look for potential OA refugia on reefs, a research team from the Scripps Institute of Oceanography (University of California at San Diego) and the Lamont Dougherty Earth Observatory (Columbia University) will undertake a unique mechanistic study on Palmyra Atoll, a remote uninhabited island in the central Pacific that lacks degradation from local human influence. They will explore the strengths and controls of biogeochemical feedbacks from coral reef benthic community assemblages to the seawater chemistry above and experimentally determine how this natural fluctuation affects physiological responses of key taxa to OA. Specifically they will: (1) tightly integrate a novel benthic flux technique in situ that allows continuous, high-temporal resolution measurements of net ecosystem metabolic rates (production and calcification) with an ongoing high spatial resolution benthic community dynamics study to quantify feedbacks of known species assemblages to observed natural spatiotemporal variability in seawater carbonate chemistry; and (2) use small scale common garden CO₂ enrichment experiments and productivity/respiration assays in the lab paired with reciprocal transplant experiments in situ to empirically quantify the effects of elevated and/or fluctuating pCO₂ on growth, calcification and photophysiology of common framework building organisms and their benthic competitors. This should allow them to examine the coupled interactions between OA and diverse benthic coral reef organisms in their natural environment in the absence of other confounding human impacts.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1316006
NSF Division of Ocean Sciences (NSF OCE)	OCE-1316047

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