

# In situ biogeochemical measurements including pCO<sub>2</sub>, pH, alkalinity, oxygen, temperature and salinity for a time-series in Bermuda, September 2017

**Website:** <https://www.bco-dmo.org/dataset/783568>

**Data Type:** Other Field Results

**Version:** 1

**Version Date:** 2019-12-05

## Project

» [A new tool for ocean carbon cycle and ocean acidification studies](#) (Bermuda Biochem Timeseries)

Contributors	Affiliation	Role
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## Abstract

In situ biogeochemical measurements including pCO<sub>2</sub>, pH, alkalinity, oxygen, temperature and salinity for a time-series in Bermuda, September 2017.

## Table of Contents

- [Coverage](#)
- [Dataset Description](#)
  - [Methods & Sampling](#)
  - [Data Processing Description](#)
- [Data Files](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Funding](#)

## Coverage

**Spatial Extent:** Lat:32.46 Lon:-64.83

**Temporal Extent:** 2017-09-01 - 2017-09-22

## Dataset Description

In situ biogeochemical measurements including pCO<sub>2</sub>, pH, alkalinity, oxygen, temperature and salinity for a time-series in Bermuda, September 2017.

## Methods & Sampling

The instruments were deployed on Hog Reef, Bermuda (32.46 oN, 64.83 oW), attached to the PMEL MAPCO<sub>2</sub> buoy for the surface measurements, and anchored to the reef below the buoy at ~7 meters depth.

Real-time temperature, pCO<sub>2</sub>, pH, salinity, alkalinity and dissolved oxygen were determined in situ. Discrete samples were collected and stored in glass bottles, preserved with HgCl<sub>2</sub>.

SAMI-CO<sub>2</sub> sampled on a 15 minute interval. SAMI-CO<sub>2</sub> ran a non-absorbing blank measurement every 3.5 days.

SAMI-pH sampled on a 15 minute interval.

SAMI-Alk sampled on a 2 hour interval. SAMI-Alk ran a non-absorbing blank measurement for every measurement. A standard was run every 22 hours.

Dissolved oxygen was sampled on a 15 minute interval.

Temperature was recorded with SAMI-CO<sub>2</sub>, SAMI-pH on a 15 minute interval and with CTD on a 15 minute interval.

Salinity was recorded with CTD on a 15 minute interval.

## Data Processing Description

SAMI data were processed through a custom-written Matlab QC program.

### BCO-DMO Processing Notes:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- commented out units row
- reduced precision of temperature and pCO<sub>2</sub> to 2 decimals, pH to 4 places, alkalinity to 1 place.

[ [table of contents](#) | [back to top](#) ]

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## Data Files

File
<b>sami_2017.csv</b> (Comma Separated Values (.csv), 205.46 KB) MD5:aa1156febbda44e29b8e28ca12dabf45
Primary data file for dataset ID 783568

[ [table of contents](#) | [back to top](#) ]

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## Parameters

Parameter	Description	Units
Date_Time.UTC	sample collection date and time in UTC time; ISO-formatted as YYYY-MM-DDTHH:MMZ	unitless
CTD_Sal_7m	salinity from CTD at 7 meters depth	unitless
CTD_Temp_7m	temperature from CTD at 7 meters depth	degrees Celsius
S22_pCO2_surface	SAMI-22 surface pCO2	micro-atmospheres (uatm)
S22_Temp_surface	SAMI-22 surface temperature	degrees Celsius
S22_DO_surface	SAMI-22 surface dissolved oxygen concentration	micromol/kilogram (umol/kg)
S53_pCO2_7m	SAMI-53 pCO2 at 7 meters depth	micro-atmospheres (uatm)
S53_Temp_7m	SAMI-53 temperature at 7 meters depth	degrees Celsius
S53_DO_7m	SAMI-53 dissolved oxygen at 7 meters depth	micromol/kilogram (umol/kg)
S13_pH_7m	SAMI-13 pH at 7 meters depth	unitless; pH scale
S13_Temp_7m	SAMI-13 temperature at 7 meters depth	degrees Celsius
SA03_Date.UTC	SAMI-Alkalinity_03 UTC sample date and time; ISO-formatted as YYYY-MM-DDTHH:MMZ	unitless
SA03_Alkalinity_7m	SAMI-Alkalinity_03 alkalinity at 7 meters depth	micromol/kilogram (umol/kg)
SA03_Temp_7m	SAMI-Alkalinity_03 temperature at 7 meters depth	degrees Celsius
Benchtop_Date.UTC	UTC sample date and time; ISO-formatted as YYYY-MM-DDTHH:MMZ	unitless
Benchtop_Alkalinity	alkalinity measured using a benchtop unit	micromol/kilogram (umol/kg)

[ [table of contents](#) | [back to top](#) ]

## Instruments

<b>Dataset-specific Instrument Name</b>	CTD (Sea-Bird)
<b>Generic Instrument Name</b>	CTD Sea-Bird
<b>Dataset-specific Description</b>	CTD sensor measures conductivity, temperature and depth.
<b>Generic Instrument Description</b>	A Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics. This instrument designation is used when specific make and model are not known or when a more specific term is not available in the BCO-DMO vocabulary. Refer to the dataset-specific metadata for more information about the specific CTD used. More information from: <a href="http://www.seabird.com/">http://www.seabird.com/</a>

<b>Dataset-specific Instrument Name</b>	SAMI-Alk (Sunburst Sensors)
<b>Generic Instrument Name</b>	Submersible Autonomous Moored Instrument
<b>Dataset-specific Description</b>	SAMI-Alk measures and logs levels of alkalinity in sea and fresh water.
<b>Generic Instrument Description</b>	The Submersible Autonomous Moored Instrument (SAMI) measures and logs levels of dissolved chemicals in sea and fresh water. It is a plastic cylinder about 6 inches wide and 2 feet long that is self-powered and capable of hourly measurements for up to one year. All data collected are logged to an internal memory chip to be downloaded later. SAMI sensors usually are placed a few feet underwater on permanent moorings, while others on floating drifters sample the water wherever the wind and currents carry them. The instruments have been used by researchers around the globe in a variety of studies since 1999. Dr. Mike DeGrandpre, University of Montana, developed the SAMI between 1990 and 1993 during his postdoctoral work at the Woods Hole Oceanographic Institution (Woods Hole, MA, USA). For additional information, see URL: <a href="http://www.sunburstsensors.com/">http://www.sunburstsensors.com/</a> from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

<b>Dataset-specific Instrument Name</b>	SAMI-CO2 (Sunburst Sensors)
<b>Generic Instrument Name</b>	Submersible Autonomous Moored Instrument
<b>Dataset-specific Description</b>	Measures and logs levels of pCO <sub>2</sub> in sea and freshwater. It is a plastic cylinder about 6 inches wide and 2 feet long that is self-powered and capable of hourly measurements for up to one year. All data collected are logged to an internal memory chip to be downloaded later. SAMI sensors usually are placed a few feet underwater on permanent moorings, while others on floating drifters sample the water wherever the wind and currents carry them. The instruments have been used by researchers around the globe in a variety of studies since 1999. Dr. Mike DeGrandpre, University of Montana, developed the SAMI between 1990 and 1993 during his postdoctoral work at the Woods Hole Oceanographic Institution (Woods Hole, MA, USA). For additional information, see URL: <a href="http://www.sunburstsensors.com/">http://www.sunburstsensors.com/</a> from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.
<b>Generic Instrument Description</b>	The Submersible Autonomous Moored Instrument (SAMI) measures and logs levels of dissolved chemicals in sea and fresh water. It is a plastic cylinder about 6 inches wide and 2 feet long that is self-powered and capable of hourly measurements for up to one year. All data collected are logged to an internal memory chip to be downloaded later. SAMI sensors usually are placed a few feet underwater on permanent moorings, while others on floating drifters sample the water wherever the wind and currents carry them. The instruments have been used by researchers around the globe in a variety of studies since 1999. Dr. Mike DeGrandpre, University of Montana, developed the SAMI between 1990 and 1993 during his postdoctoral work at the Woods Hole Oceanographic Institution (Woods Hole, MA, USA). For additional information, see URL: <a href="http://www.sunburstsensors.com/">http://www.sunburstsensors.com/</a> from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

<b>Dataset-specific Instrument Name</b>	SAMI-pH (Sunburst Sensors)
<b>Generic Instrument Name</b>	Submersible Autonomous Moored Instrument
<b>Dataset-specific Description</b>	SAMI-pH measures and logs levels of pH in sea and freshwater.
<b>Generic Instrument Description</b>	The Submersible Autonomous Moored Instrument (SAMI) measures and logs levels of dissolved chemicals in sea and fresh water. It is a plastic cylinder about 6 inches wide and 2 feet long that is self-powered and capable of hourly measurements for up to one year. All data collected are logged to an internal memory chip to be downloaded later. SAMI sensors usually are placed a few feet underwater on permanent moorings, while others on floating drifters sample the water wherever the wind and currents carry them. The instruments have been used by researchers around the globe in a variety of studies since 1999. Dr. Mike DeGrandpre, University of Montana, developed the SAMI between 1990 and 1993 during his postdoctoral work at the Woods Hole Oceanographic Institution (Woods Hole, MA, USA). For additional information, see URL: <a href="http://www.sunburstsensors.com/">http://www.sunburstsensors.com/</a> from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

[ [table of contents](#) | [back to top](#) ]

## Deployments

SAMI\_2017-09

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/805580">https://www.bco-dmo.org/deployment/805580</a>
<b>Platform</b>	MAPCO2 Mooring Bermuda Hog Reef
<b>Start Date</b>	2017-09-01
<b>End Date</b>	2017-09-22
<b>Description</b>	The PMEL carbon group is working with researchers at the Bermuda Institute of Ocean Sciences (BIOS) to better understand carbon dioxide variability on the Bermuda Pedestal. The benthic marine ecosystem of Bermuda is highly dominated by calcifying organisms including, for example, corals, coralline and calcifying algae, foraminifera, echinoderms, barnacles, bryozoans and many others that may be sensitive to ocean acidification. MAPCO2 <sup>TM</sup> systems are deployed on buoys at Hog Reef (32.46°N, 64.83°W)(and at Crescent Reef (32.40°N, 64.79°W) on the Bermuda Pedestal).

[ [table of contents](#) | [back to top](#) ]

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## Project Information

### A new tool for ocean carbon cycle and ocean acidification studies (Bermuda Biochem Timeseries)

**Coverage:** Bermuda

NSF abstract:

The ocean inorganic carbon system is of great interest to marine scientists, and indeed all people, because it contains important information about ocean productivity, the sources and sinks of anthropogenic carbon dioxide, and ocean acidification. Total alkalinity is one of the critical inorganic carbon parameters and has been widely measured through ship and laboratory-based methodologies. At this time, there are no commercially-available in situ sensors for total alkalinity. In this project, researchers at the University of Montana will further develop and test a new autonomous system, known as the SAMI-alk, for measuring total alkalinity. This new system will expand understanding of total alkalinity and the inorganic carbon cycle by making near continuous measurements in locations not frequented by ships. The development of this instrument will have important broader implications for the oceanographic community and ocean acidification research by providing a novel instrument for ocean research. This project will also provide training opportunities to graduate and undergraduate students, and will continue to support public outreach on ocean acidification through a university-affiliated museum.

Studies focused on the marine carbon cycle and ocean acidification pose a number of measurement challenges. While pH is the ocean acidification "smoking gun" and partial pressure of CO<sub>2</sub> is critical for gas exchange calculations, the full inorganic carbon system must be quantified for most inorganic carbon studies. Using autonomous sensors to accurately and precisely quantify all of the inorganic carbon species has been a long-standing objective for marine biogeochemists, but full characterization of the inorganic carbon system has, until recently, been limited to ship and laboratory-based measurements. Total alkalinity is one such parameter as its research has been limited by the lack of instrument capable of making in situ measurements. This research will address this problem and advance inorganic carbon studies through the further development of an autonomous, in situ system to measure seawater total alkalinity, known as the submersible autonomous moored instrument for total alkalinity (SAMI-alk). Preliminary testing of the instrument showed great promise, and through this project, researchers will conduct lab experiments to improve its performance. Two new prototype instruments will be tested in laboratory and field evaluations.

[ [table of contents](#) | [back to top](#) ]

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1459255</a>

[ [table of contents](#) | [back to top](#) ]