In situ biogeochemical measurements including pCO2, 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 pCO2, pH, alkalinity, oxygen, temperature and salinity for a time-series in Bermuda, September 2017.

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Coverage

Spatial Extent: **Lat**:32.46 **Lon**:-64.83
Temporal Extent: 2017-09-01 - 2017-09-22

Dataset Description

In situ biogeochemical measurements including pCO2, 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 MAPCO2 buoy for the surface measurements, and anchored to the reef below the buoy at ~7 meters depth.

Real-time temperature, pCO2, pH, salinity, alkalinity and dissolved oxygen were determined in situ. Discrete samples were collected and stored in glass bottles, preserved with HgCl2.

SAMI-CO2 sampled on a 15 minute interval. SAMI-CO2 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-CO2, 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 pCO2 to 2 decimals, pH to 4 places, alkalinity to 1 place.

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Data Files

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

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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)

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Instruments

Dataset-specific Instrument Name	CTD (Sea-Bird)
Generic Instrument Name	CTD Sea-Bird
Dataset-specific Description	CTD sensor measures conductivity, temperature and depth.
Generic Instrument Description	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: http://www.seabird.com/

Dataset-specific Instrument Name	SAMI-CO2 (Sunburst Sensors)
Generic Instrument Name	Submersible Autonomous Moored Instrument
Dataset-specific Description	Measures and logs levels of pCO2 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: http://www.sunburstsensors.com/ from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.
Generic Instrument Description	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: http://www.sunburstsensors.com/ from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

Dataset-specific Instrument Name	SAMI-pH (Sunburst Sensors)
Generic Instrument Name	Submersible Autonomous Moored Instrument
Dataset-specific Description	SAMI-pH measures and logs levels of pH in sea and freshwater.
Generic Instrument Description	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: http://www.sunburstsensors.com/ from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

Dataset-specific Instrument Name	SAMI-Alk (Sunburst Sensors)
Generic Instrument Name	Submersible Autonomous Moored Instrument
Dataset-specific Description	SAMI-Alk measures and logs levels of alkalinity in sea and fresh water.
Generic Instrument Description	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: http://www.sunburstsensors.com/ from the manufacturer, Sunburst Sensors, LLC, 1226 West Broadway, Missoula, MT 59802.

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Deployments

SAMI_2017-09

Website	https://www.bco-dmo.org/deployment/805580
Platform	MAPCO2 Mooring Bermuda Hog Reef
Start Date	2017-09-01
End Date	2017-09-22
Description	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. MAPCO2TM 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).

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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 CO2 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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459255

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