Niskin bottle water samples and CTD measurements at water sample depths collected at Bermuda Atlantic Time-Series sites in the Sargasso Sea ongoing from 1988

Website: https://www.bco-dmo.org/dataset/3782
Data Type: Cruise Results
Version: 1
Version Date: 2023-04-07

Project
» Bermuda Atlantic Time-series Study (BATS)

Programs
» Ocean Time-series Sites (Ocean Time-series)
» Ocean Carbon and Biogeochemistry (OCB)
» U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Contributors	Affiliation	Role
Johnson, Rodney J.	Bermuda Institute of Ocean Sciences (BIOS)	Chief Scientist
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Coverage

Spatial Extent: **N**:39.455 **E**:-59.649 **S**:19.225 **W**:-74.6
Temporal Extent: 1988-10-20 - 2022-12-16

Dataset Description

CTD measurements at water sample depths and Niskin bottle water samples from the Bermuda Atlantic Time-series Study (BATS) and from Station S, located 25 km SE of Bermuda (32°10N, 64°30W) Measurements have been collected since 1988 and include nutrients, biogeochemical concentration, bacterial enumeration, and cyanobacteria.

Data Processing Description

Current preliminary version: 2023.04.07 has not been processed by BCO-DMO

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Data Files

File	
Niskin bottle samples filename: bats_bottle_20230407.txt This file is in as-received format and has not yet been processed by BCO-DMO.	(Plain Text, 19.03 MB) MD5:ef3e6373753a4ec3f6a9edeb3c959dcb
niskin.csv Primary data file for dataset ID 3782	(Comma Separated Values (.csv), 28.07 MB) MD5:c933409e008687ae5cc4fee2d468de16

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Related Publications

BATS (1997). (technical report). Sampling Methods for the Suite of Measurements Routinely Collected for the Bermuda Atlantic Time-series Study. Retrieved from: http://www.bios.edu/uploads/BATS_report_methods.pdf *Methods*

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Parameters

Parameter	Description	Units
Id	A unique bottle id which identifies cruise; cast; and Niskin number	unitless
decy	Decimal Year	unitless
lat	Latitude with positive values North	decimal degrees
lon	Longitude with positive values East	decimal degrees
Depth	Depth	meters (m)
Temp	Temperature ITS-90	degrees Celsius
CTD_S	CTD Salinity	PSS-78
Sal1	Salinity-1	PSS-78
SigTh	Sigma-Theta	kilogram per meter cubed (kg/m3)
O2(1)	Oxygen-1	micromole per kilogram (umol/kg)
OxFixT	Oxygen Fix Temp	degrees Celsius
Anom1	Oxy Anomaly-1	micromole per kilogram (umol/kg)
CO2	dissolved inorganic carbon	micromole per kilogram (umol/kg)
Alk	Alkalinity	uequiv
NO31	Nitrate+Nitrite-1	micromole per kilogram (umol/kg)
NO21	Nitrite-1	micromole per kilogram (umol/kg)

PO41	Phosphate-1	micromole per kilogram (umol/kg)
Si1	Silicate-1	micromole per kilogram (umol/kg)
POC	POC	microgram per kilogram (ug/kg)
PON	PON	microgram per kilogram (ug/kg)
TOC	TOC	micromole per kilogram (umol/kg)
TN	TN NOTE: Prior to BATS 121; DON is reported instead of TON	micromole per kilogram (umol/kg)
Bact	Bacteria enumeration	cells*10^8/kg
POP	POP	micromole per kilogram (umol/kg)
TDP	Total dissolved Phosphorus	nanomole per kilogram (nmol/kg)
SRP	Low-level phosphorus	nanomole per kilogram (nmol/kg)
BSi	Particulate biogenic silica	micromole per kilogram (umol/kg)
LSi	Particulate lithogenic silica	micromole per kilogram (umol/kg)
Pro	Prochlorococcus	cells per milliliter (cells/ml)
Syn	Synechococcus	cells per milliliter (cells/ml)
Piceu	Picoeukaryotes	cells per milliliter (cells/ml)
Naneu	Nanoeukaryotes	cells per milliliter (cells/ml)
NO3	Nitrate+Nitrite-1	micromole per kilogram (umol/kg)
NO2	Nitrite-1	micromole per kilogram (umol/kg)
PO4	Phosphate-1	micromole per kilogram (umol/kg)
Si	Silicate-1	micromole per kilogram (umol/kg)
Pres	Pressure	decibar (dbar)
ISO_datetime	date and time represented in ISO 8601 format	unitless
cruise_type	Cruise type; 1=BATS core; 2=BATS Bloom a; 3=BATS Bloom b; 5=BATS Validation cruise; 6=Hydrostation	unitless
cruise_number	cruise number	unitless
cast_number	cast number Cast number; 1-80=CTD casts; 81-99=Hydrocasts (i.e. 83 = Data from Hydrocast number 3)	unitless
niskin_number	Niskin number	unitless
cruise_type_text	textual description of the cruise type	unitless

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Instruments

Dataset-specific Instrument Name	CTD Sea-Bird 911
Generic Instrument Name	CTD Sea-Bird 911
Generic Instrument Description	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

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Deployments

BATS_cruises

Website	https://www.bco-dmo.org/deployment/58883
Platform	Unknown Platform
Report	http://bats.bios.edu/bats-data/
Start Date	1988-10-20
Description	Bermuda Institute of Ocean Science established the Bermuda Atlantic Time-series Study with the objective of acquiring diverse and detailed time-series data. BATS makes monthly measurements of important hydrographic, biological and chemical parameters throughout the water column at the BATS Study Site, located at 31 40N, 64 10W.

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Project Information

Bermuda Atlantic Time-series Study (BATS)

Website: http://bats.bios.edu

Coverage: Northwest Sargasso Sea at 31 deg 40' N, 64 deg 10' W

A full description of the BATS research program (including links to the processed BATS data) is available from the BATS Web site (see above for Project URL/ Project Website links). Any data contributed from selected ancillary projects are listed (linked) in the 'Datasets Collection' section below.

Collaborative Research: The Bermuda Atlantic Time-series Study: Sustained Biogeochemical, Ecosystem and Ocean Change Observations and Linkages in the North Atlantic (Years 31-35) ***Awards OCE-1756105, OCE-1756054, and OCE-1756312)***

NSF award abstract

Long-term observations over several decades are a powerful tool for investigating ocean physics, biology, and chemistry, and the response of the oceans to environmental change. The Bermuda Atlantic Time-Series Study, known as BATS, has been running continuously since 1988. The research goals of the BATS program are: (1) to improve our understanding of the time-varying components of the ocean carbon cycle and the cycles of related nutrient elements such as nitrogen, phosphorus, and silicon; and, (2) to identify the relevant physical, chemical and ecosystem properties responsible for this variability. In addition, the BATS program has strong and diverse broader impacts, contributing to the field of ocean sciences by providing high quality ocean observations and data for seagoing scientists and modelers, and a framework through which researchers can conceive and test hypotheses. This award will support the operations of the BATS program for five more years.

The primary BATS research themes are as follows: (1) Quantify the role of ocean-atmosphere coupling and climate variability on air-sea exchange of CO2, and carbon export to the ocean interior; (2) Document trends and the controls on the interannual to decadal scale variability in carbon and nutrient cycles to their coupling in the surface and deep ocean via the Redfield Ratio paradigm; (3) Quantify the response of planktonic community structure and function, and impact on biogeochemical cycles to variability in surface fluxes and dynamical processes; (4) Facilitate development, calibration and validation of next generation oceanographic sensors, tools and technologies; and, (5) Generate a dataset that can be utilized by empiricists, modelers and students. This research integrates ocean physics, chemistry and biology into a framework for understanding oceanic processes and ocean change in the North Atlantic subtropical gyre. The existing 29 years of BATS data provide robust constraints on seasonal and interannual variability, the response of the Sargasso Sea ecosystem to natural climate variability, and signal detection of potential ocean changes. This project would extend the BATS program through years 31-35 to address a series of ten interlinked questions through integrated research approaches and a multitude of collaborative efforts. In addition to the themes above, and embedded into the ten questions and approaches, the BATS team will focus on, for example, coupling of particle production and biogeochemistry; revisiting the complexities of the biological carbon pump; oxygen decline; and changes in the hydrography, physics, ocean carbon cycle and biogeochemistry of the Sargasso Sea. The highest quality data observation and collection will be maintained and used to address these questions. Importantly, a wide range of collaborations at the BATS site, spanning the physical and biogeochemical disciplines, will aid these broad goals. Strong links to community stakeholders, and close collaboration (including methods intercomparisons and personnel exchanges) with the Hawaii Ocean Time-series are proposed. This work will extend the research findings of the project into educational and training opportunities within and beyond the oceanographic community, including training and mentorship of both undergraduate and graduate students.

Please see the BATS Web site (http://bats.bios.edu) for additional information.

List of References (PDF)

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Program Information

Ocean Time-series Sites (Ocean Time-series)

Coverage: Bermuda, Cariaco Basin, Hawaii

Program description text taken from Chapter 1: Introduction from the **Global Intercomparability in a Changing Ocean: An International Time-Series Methods Workshop** report published following the workshop held November 28-30, 2012 at the Bermuda Institute of Ocean Sciences. The full report is available from the workshop Web site hosted by US OCB: http://www.whoi.edu/website/TS-workshop/home

Decades of research have demonstrated that the ocean varies across a range of time scales, with anthropogenic forcing contributing an added layer of complexity. In a growing effort to distinguish between natural and human-induced earth system variability, sustained ocean time-series measurements have taken on a renewed importance. Shipboard biogeochemical time-series represent one of the most valuable tools scientists have to characterize and quantify ocean carbon fluxes and biogeochemical processes and their links to changing climate (Karl, 2010; Chavez et al., 2011; Church et al., 2013). They provide the oceanographic community with the long, temporally resolved datasets needed to characterize ocean climate, biogeochemistry, and ecosystem change.

The temporal scale of shifts in marine ecosystem variations in response to climate change are on the order of several decades. The long-term, consistent and comprehensive monitoring programs conducted by time-series sites are essential to understand large-scale atmosphere-ocean interactions that occur on interannual to decadal time scales. Ocean time-series represent one of the most valuable tools scientists have to characterize and quantify ocean carbon fluxes and biogeochemical processes and their links to changing climate.

Launched in the late 1980s, the US JGOFS (Joint Global Ocean Flux Study; http://usjgofs.whoi.edu) research program initiated two time-series measurement programs at Hawaii and Bermuda (HOT and BATS, respectively) to measure key oceanographic measurements in oligotrophic waters. Begun in 1995 as part of the US JGOFS Synthesis and Modeling Project, the CARIACO Ocean Time-Series (formerly known as the CArbon Retention In A Colored Ocean) Program has studied the relationship between surface primary production, physical forcing variables like the wind, and the settling flux of particulate carbon in the Cariaco Basin.

The objective of these time-series effort is to provide well-sampled seasonal resolution of biogeochemical variability at a limited number of ocean observatories, provide support and background measurements for process-oriented research, as well as test and validate observations for biogeochemical models. Since their creation, the BATS, CARIACO and HOT time-series site data have been available for use by a large community of researchers.

Data from those three US funded, ship-based, time-series sites can be accessed at each site directly or by selecting the site name from the Projects section below.

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.

U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Website: http://usjgofs.whoi.edu/

Coverage: Global

The United States Joint Global Ocean Flux Study was a national component of international JGOFS and an integral part of global climate change research.

The U.S. launched the Joint Global Ocean Flux Study (JGOFS) in the late 1980s to study the ocean carbon cycle. An ambitious goal was set to understand the controls on the concentrations and fluxes of carbon and associated nutrients in the ocean. A new field of ocean biogeochemistry emerged with an emphasis on quality measurements of carbon system parameters and interdisciplinary field studies of the biological, chemical and physical process which control the ocean carbon cycle. As we studied ocean biogeochemistry, we learned that our simple views of carbon uptake and transport were severely limited, and a new "wave" of ocean science was born. U.S. JGOFS has been supported primarily by the U.S. National Science Foundation in collaboration with the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the Department of Energy and the Office of Naval Research. U.S. JGOFS, ended in 2005 with the conclusion of the Synthesis and Modeling Project (SMP).

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0752366
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756105

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