Time-Series of Phytoplankton Taxonomy and Density collected by the CARIACO Ocean Time-Series Project from November 1995 to January 2017

Website: https://www.bco-dmo.org/dataset/3095
Data Type: Cruise Results
Version: 1
Version Date: 2019-08-14

Project
» CARIACO Ocean Time-Series Program (CARIACO)

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

Contributors	Affiliation	Role
Astor, Yrene	Estacion de Investigaciones Marinas de Margarita (EDIMAR-FLASA)	Principal Investigator
Muller-Karger, Frank	University of South Florida (USF)	Principal Investigator
Troccoli, Luis	Universidad de Oriente, Venezuela (UDO)	Principal Investigator, Scientist
Varela, Ramon	Estacion de Investigaciones Marinas de Margarita (EDIMAR-FLASA)	Principal Investigator
Diaz-Ramos, Rafael	Universidad de Oriente, Venezuela (UDO)	Scientist
Subero-Pino, Sonia	Universidad de Oriente, Venezuela (UDO)	Scientist
Rueda-Roa, Digna	University of South Florida (USF)	Contact, Data Manager
Klein, Eduardo	Universidad Simón Bolívar - Instituto de Tecnología y Ciencias Marinas (USB-INTECMAR)	Data Manager
Biddle, Mathew	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager
McKee, Theresa	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
The CARIACO Ocean Time-Series Program (formerly known as CArbon Retention In A Colored Ocean) started on November 1995 (CAR-001) and ended on January 2017 (CAR-232). Monthly cruises were conducted to the CARIACO station (10.50° N, 64.67° W) onboard the R/V Hermano Ginés of the Fundación La Salle de Ciencias Naturales de Venezuela. The program studied the relationship between surface primary production, physical forcing variables like the wind, and the settling flux of particulate carbon in the Cariaco Basin. This depression, located on the continental shelf of Venezuela, shows marked seasonal and interannual variation in hydrographic properties and primary production (carbon fixation rates by photosynthesis of planktonic algae). One of the monthly measurements taken by the program was water sampling at different depths for phytoplankton taxonomy (occurrence and density). Those water samples were collected with Niskin bottles during the first CTD Cast of the morning at 1, 7, 25, 35, 75, and 100 m depth. Phytoplankton taxonomy and density was determined at each depth at the level of species or genera. Values of zero are real and denote that a specific species was not found at that cruise/depth.

Table of Contents

Coverage

Spatial Extent: **N**:10.517 **E**:-64.658 **S**:10.475 **W**:-64.693
Temporal Extent: 1995-11-08 - 2017-01-12

Dataset Description

The CARIACO Ocean Time-Series Program (formerly known as CArbon Retention In A Colored Ocean) started on November 1995 (CAR-001) and ended on January 2017 (CAR-232). Monthly cruises were conducted to the CARIACO station (10.50° N, 64.67° W) onboard the R/V Hermano Ginés of the Fundación La Salle de Ciencias Naturales de Venezuela. The program studied the relationship between surface primary production, physical forcing variables like the wind, and the settling flux of particulate carbon in the Cariaco Basin. This depression, located on the continental shelf of Venezuela, shows marked seasonal and interannual variation in hydrographic properties and primary production (carbon fixation rates by photosynthesis of planktonic algae).

One of the monthly measurements taken by the program was water sampling at different depths for phytoplankton taxonomy (occurrence and density). Those water samples were collected with Niskin bottles during the first CTD Cast of the morning at 1, 7, 25, 35, 75, and 100 m depth. Phytoplankton taxonomy and density was determined at each depth at the level of species or genera. Values of zero are real and denote that a specific species was not found at that cruise/depth.

Web page of the CARIACO Ocean Time-Series Program: http://imars.usf.edu/cariaco

A complete list of publications from the CARIACO Ocean Time-Series project can be found at: http://imars.usf.edu/view/biblio/803738/year

These data were also funded by the following awards:
- 23914: Ley Orgánica de Ciencia, Tecnología e Innovación, LOCTI (Estación de Investigaciones Marinas), Venezuela.
- 2011000353: Inter-American Institute for Global Change Research, IAI (IAI-CRN3094).

Methods & Sampling

Water was collected with a SeaBird rosette equipped with 12 (8 liter) teflon-coated Niskin bottles (bottle springs were also teflon-coated) at different depths. Water samples for phytoplankton taxonomy analysis were usually collected during the first CTD/Niskin Cast of the morning for the following depths: 1, 7, 25, 35, 75, and 100 m.

The determination of microalgal taxonomy and abundance was carried out at the Laboratory of Phytoplankton of the Instituto Oceanográfico de Venezuela, Universidad de Oriente (Cumana, Venezuela), according to the Utermöhl sedimentation method that is described by Edler and Elbrächter (2010). Phytoplankton species were identified according to the works of Cupp (1943), Hasle et al. (1997), Berard-Thierrault et al. (1999) and Tenenbaum (2006).

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions

[table of contents | back to top]

Data Files

File
phytoplankton.csv (Comma Separated Values (.csv), 15.94 MB) MD5:64ad2bda96a30a325fb76c756668e91e Primary data file for dataset ID 3095

[table of contents | back to top]

Related Publications

Bérard-Therriault, L., Poulin, M. and Bossé, L., 1999. Guide d'identification du phytoplancton marin de l'estuaire et du golfe du Saint-Laurent: incluant également certains protozoaires (No. 128). NRC Research Press. Ottawa. 387 p.
Methods

Cupp, E. 1943. Marine plankton diatoms of North America. Bull. Scripps Inst. Oceanogr. Univ. Calif. 5:1-238
Methods

Edler, L. and Elbrächter, M., 2010. The Utermöhl method for quantitative phytoplankton analysis. 13-20. Microscopic and molecular methods for quantitative phytoplankton analysis.
Methods

Hasle, G.R., Syvertsen, E.E., Steidinger, K.A., Tangen, K. and Tomas, C.R., 1996. Identifying marine diatoms and dinoflagellates. Carmelo Tomas (Editor), Academic Press, New York. 858 p. https://isbnsearch.org/isbn/0-12-693015-5
Methods

Tenenbaum, D.R. 2006. Dinoflagelados e tintinídeos da região central da Zona Econômica Exclusiva Brasileira: guia de identificação. Rio de Janeiro: Museu Nacional, 287 p.
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Cruise	number of cruise	unitless
Cruise_ID_2	cruise ID for the CARIACO project	unitless
Leg	cruise leg number	unitless
Cast	CTD cast number	unitless
Latitude	Latitude of observations with positive values indicating North	decimal degrees
Longitude	Longitude of observations with negative values indicating West	decimal degrees
Year_local	year of sampling in yyyy format	unitless
Month_local	month of sampling in mm format	unitless
Day_local	day of sampling in dd format	unitless
Time_start_local	start time of hydrocast in Venezuelan Standard Time (VET)	unitless
Time_end_local	end time of hydrocast in Venezuelan Standard Time (VET)	unitless
Datetime_local	date and time in Venezuelan Standard Time (VET)	unitless
Datetime_UTC	date and time in UTC	unitless
SpeciesNameOriginal	species name as the person who did the taxonomy recorded it	unitless
SpeciesNameCleaned	cleaned species name	unitless
ScientificName_accepted	Accepted scientific name of the species.	unitless
AphiaID	Aphia ID	unitless
d_1m	species count in 1 meter depth bottle sample	cells per milliliter (cells/mL)
d_7m	species count in 7 meter depth bottle sample	cells per milliliter (cells/mL)
d_15m	species count in 15 meter depth bottle sample	cells per milliliter (cells/mL)
d_25m	species count in 25 meter depth bottle sample	cells per milliliter (cells/mL)
d_35m	species count in 35 meter depth bottle sample	cells per milliliter (cells/mL)
d_55m	species count in 55 meter depth bottle sample	cells per milliliter (cells/mL)
d_75m	species count in 75 meter depth bottle sample	cells per milliliter (cells/mL)
d_100m	species count in 100 meter depth bottle sample	cells per milliliter (cells/mL)
Total_sum	species count for profile	count

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Microscopes
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Microscopes
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

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.

[table of contents | back to top]

Deployments

HG93_CARIACO

Website	https://www.bco-dmo.org/deployment/57845
Platform	B/O Hermano Gines
Start Date	1995-11-08
Description	Monthly oceanographic cruises to the CARIACO station (10.5 degrees N, 64.67 degrees W) have been conducted since November 1995 to examine the hydrography, primary production, and settling flux of particulate material. The research vessel is the 75-foot B/O (Barco Oceanografico) Hermano Gines of the Fundaciòn La Salle de Ciencias Naturales (FLASA) located on Margarita Island, Venezuela. Water is collected using a rosette ensemble equipped with twelve 8-liter bottles and a CTD (conductivity-temperature-depth meter); the CTD also has an oxygen sensor, a fluorometer for chlorophyll-a estimates, and a transmissometer. Data are read out real-time on a computer screen on board the ship as the rosette ensemble is lowered to approximately 1,380 m, the bottom of the Cariaco Basin. Water samples are analyzed for various parameters including phytoplankton biomass, dissolved and particulate nutrient and carbon concentration, primary productivity rates and total bacterial production.

[table of contents | back to top]

Project Information

CARIACO Ocean Time-Series Program (CARIACO)

Website: http://www.imars.usf.edu/CAR/index.html

Coverage: CARIACO basin

Since 1995, 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. This depression, located on the continental shelf of Venezuela (Map), shows marked seasonal and interannual variation in hydrographic properties and primary production (carbon fixation rates by photosynthesis of planktonic algae).

This peculiar basin is anoxic below ~250 m, due its restricted circulation and high primary production (Muller-Karger et al., 2001). CARIACO observations show annual primary production rates exceed 500 gC/m^2y, of which over 15-20% can be accounted for by events lasting one month or less. Such events are observed in other locations where time series observations are collected, and suggest that prior estimates of regional production based on limited sampling may have been underestimated. The annual primary production rates in the Cariaco Basin are comparable to rates estimated using time series observations for Monterey Bay (460 gC/m^2y; Chavez, 1996), and higher than previous rates estimated for Georges Bank, the New York Shelf, and the Oregon Shelf (380, 300, and 190 gC/m^2y, respectively; Walsh, 1988).

The Cariaco Basin has long been the center of attention of scientists trying to explain paleoclimate. Due to its high rates of sedimentation (30 to >100 cm/ky; Peterson et al., 2000) and excellent preservation, the varved sediments of the Cariaco Basin offer the opportunity to study high resolution paleoclimate and better understand the role of the tropics in global climate change (Black et al., 1999; Peterson et al., 2000; Haug et al., 2001; Black et al., 2004; Hughen et al., 2004).

Now, the CARIACO program provides a link between the sediment record and processes near the surface of the ocean. Sediment traps maintained by the CARIACO program show that over 5% of autochtonous material reaches 275 m depth, and that nearly 2% reaches 1,400 m. The significance of this flux is that it represents a sink for carbon and that it helps explain the record of ancient climate stored at the bottom of the Cariaco Basin.

Acknowledgements: This work was supported by the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and Venezuela's Fondo Nacional de Ciencia, Tecnología e Innovación (FONACIT). For more information please see this Acknowledgements link.

[table of contents | back to top]

Program Information

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).

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-9401537
NSF Division of Ocean Sciences (NSF OCE)	OCE-9729697
NSF Division of Ocean Sciences (NSF OCE)	OCE-0326268
NSF Division of Ocean Sciences (NSF OCE)	OCE-9216626
NSF Division of Ocean Sciences (NSF OCE)	OCE-9711318
National Aeronautics & Space Administration (NASA)	NAS5-97128
NSF Division of Ocean Sciences (NSF OCE)	OCE-9415790
NSF Division of Ocean Sciences (NSF OCE)	OCE-9729284
National Aeronautics & Space Administration (NASA)	NAG5-6448
NSF Division of Ocean Sciences (NSF OCE)	OCE-0963028
NSF Division of Ocean Sciences (NSF OCE)	OCE-0752139
Fondo Nacional de Ciencia, Tecnología e Innovación of Venezuela (FONACIT)	96280221
NSF Division of Ocean Sciences (NSF OCE)	OCE-0326313
National Aeronautics & Space Administration (NASA)	NNX14AP62A
Fondo Nacional de Ciencia, Tecnología e Innovación of Venezuela (FONACIT)	2000001702
Fondo Nacional de Ciencia, Tecnología e Innovación of Venezuela (FONACIT)	2011000353

[table of contents | back to top]