Time series sediment trap flux data from B/O Hermano Gines in the CARIACO basin ongoing from 1995(CARIACO project)

Website: https://www.bco-dmo.org/dataset/3094
Version: 03 August 2011
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Project
» CARIACO Ocean Time-Series Program (CARIACO)

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

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Dataset Description

CARIACO time series sediment trap flux data

dates: 08 November 1995 to (ongoing)
location: CARIACO station, Cariaco Basin (10.5 N, 64.67 W)
project/cruise: CARIACO time series cruises
platform: Moored Sediment Traps

CARIACO Field Progam general description

Change history:
020208: Excel Spreadsheet retrieved from CARIACO website (contributed by Laura Laurenzoni, CARIACO Data Manager (IMaRS, USF))
021308: files reformatted (one for each sediment trap) by Terry McKee (WHOI, BCO DMO) added to database by Cyndy Chandler (WHOI, BCO-DMO)
080111: corrections made to MFCaCO3 values in samples 131 through 143 of Trab B as noted by Laura Lorenzoni in an email to Terry McKee on July 28, 2011
080311: Data for samples 261 (5/17/2006) through 364 (10/29/2009) were added to the database by Terry McKee (WHOI, BCO DMO)

Methods & Sampling

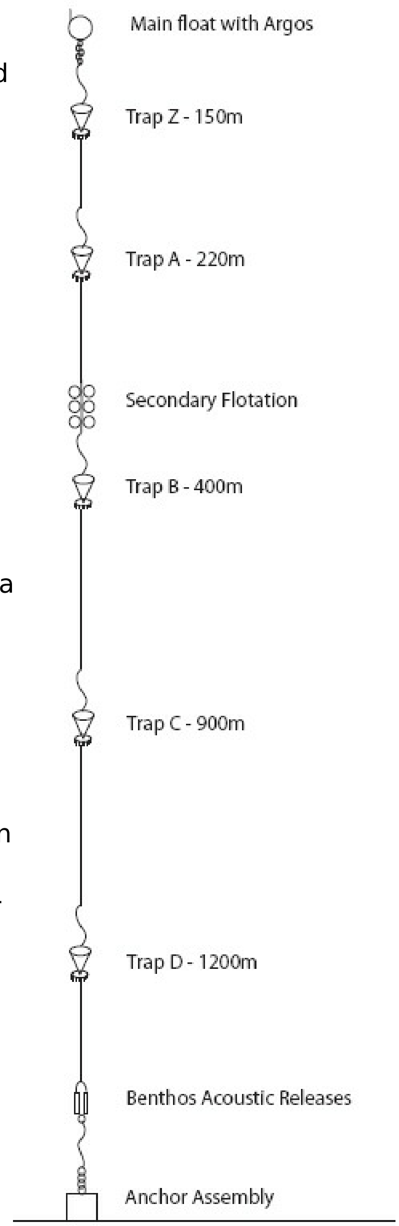
Sediment Trap Methodology

13 February 2008: Prepared for OCB data system by Terry McKee (BCO-DMO) from documentation contributed by Laura Lorenzoni (IMaRS, USF).

To measure settling particle flux at the CARIACO time-series site, five automated sediment traps were placed at 150, 225, 410, 810, and 1210 m on a mooring. These funnel-shaped traps are synchronized to collect samples over 2 week periods into a series of jars. The traps are retrieved and re-deployed every 6 months (May and November), and samples are collected to estimate carbonate, organic carbon, nitrogen, and biogenic silica fluxes and various other geochemical parameters.

This sediment trap dataset includes all sediment trap flux records collected during the CARIACO Time-Series project to date.

May 1996 - October 1996 is not available due to clogging of all 4 traps
May 2001- November 2001 is not available due to clogging of all 4 traps



Sediment trap mooring description

A mooring with five automated sediment traps (Z, A-D) is located in the eastern Cariaco Basin (10°30'N; 64°40'W). (the original full sized diagram is available as a PDF file). Traps A-D have been in place since November 1995. Trap A is located in oxic waters at 226±6 m. Trap B-D are in the anoxic portion at 407 ± 3 m, 807±2 m and 1205 ± 3 m, respectively (Benitez-Nelson et al., 2007). The fifth trap, Z, was added in November 2003 and currently resides at 150 ± 2 m. All five sediment traps are funnel-shaped with a 0.5 m^2 opening that is covered with a baffle top to reduce turbulence. The mooring is deployed for six-month intervals (retrieved and re-deployed about every 6 months in May and November) and each sample collection cup is filled with a buffered 3.2% formalin solution as a preservative for the accumulating organic matter (settling particles). The cups rotate every two weeks and are numbered 1-13, with cup 1 collecting for the two-week interval immediately following deployment, and cup 13 collecting for the 2 weeks immediately before recovery (Thunell et al., 1999; Müller-Karger et al., 2000; Thunell et al., 2000; Müller-Karger et al., 2001; Taylor et al., 2001; Goñi et al., 2003; Benitez-Nelson et al., 2007; Thunell et al., 2007).

Benitez-Nelson, C. R., L. O. Madden, R. M. Styles, R. C. Thunell, and Y. Astor (**2007**) Inorganic and organic sinking particulate phosphorus fluxes across the oxic/anoxic water column of Cariaco Basin, Venezuela, Marine Chemistry, 105, 90-100.

Goñi, M., Aceves, H., Thunell, R., Tappa, E. and Black, D. **2003**. Biogenic fluxes in the Cariaco Basin: A combined study of sinking particulates and underlying sediments, Deep-Sea Research 50, 781-807.

Müller-Karger, F., R. Varela, R. Thunell, M. Scranton, R. Bohrer, G. Taylor, J. Capelo, Y. Astor, E. Tappa, T.-Y. Ho, M. Iabichella, J. J. Walsh, and J. R. Diaz, "The CARIACO Project: Understanding the Link between the Ocean Surface and the Sinking Flux of Particulate Carbon in the Cariaco Basin", EOS. AGU Transactions, vol. 81:45, (**2000**), p. 529.

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Thunell, R., E. Tappa, R. Varela, M. Llano, Y. Astor, F. Müller-Karger, and R.Bohrer., "Increased marine sediment suspension fluxes following an earthquake", Nature, vol. 398, (**1999**), p. 233.

Thunell, R., R. Varela, M. Llano, J. Collister, F. Müller-Karger, and R. Bohrer, "Organic carbon fluxes and regeneration rates in an anoxic water column: Sediment trap results from the Cariaco Basin", Limnology and Oceanography, vol. 45, (**2000**), p. 300.

Sediment trap sampling and analytical protocols

Sediment trap samples are sealed and refrigerated immediately after collection. Processing is usually carried out within 1-3 weeks after recovery. The supernatant and any swimmers are discarded and whole traps samples are split using a precision rotary splitter. A quarter of each sample is used for bulk geochemical analyses. Particulate organic carbon (POC) and particulate nitrogen (PN) analyses are conducted according to the methods described in Thunell et al. (2000), using a Perkin Elmer 2400 elemental analyzer.

Data Processing Description

BCO-DMO processing notes

The OCB DMO makes very few modifications to the data sets contributed by the CARIACO team.

Data from Sediment Traps A, B, C, and D were contributed to BCO-DMO or 247 of the 260 samples that were taken between November 8, 1995 and May 2, 1996. A gap, caused by clogging of all four traps, exists between May, 1996 and October 1996 (samples 14 -26). Data from Trap Z, deployed on November 6, 2003 was also contributed. Sample numbers are consecutive starting with November 8, 1995 for all traps.

The original data in several Microsoft Excel spreadsheets were downloaded from the CARIACO Web site. Mathworks® routine, xls2csv.m, was used to extract the data and other routines reformatted them to database standards.

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Data Files

File
Sediment_Trap.csv (Comma Separated Values (.csv), 128.29 KB) MD5:ceebd9d481fe39b3e69639f23529acd0 Primary data file for dataset ID 3094

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Parameters

Parameter	Description	Units
trap_ID	Sediment Trap Identifier	text
depth_trap	Sediment Trap Depth	meters
lon	longitude, negative denotes West	decimal degrees
lat	latitude, negative denotes South	decimal degrees
sample_num	Sediment Trap sample number	dimensionless
date_open	date of sampling (local time) Time=0000	YYYYMMDD
Year	year of sampling	YYYY
Month	month of sampling	MM
Day	day of sampling	DD
duration_d	Duration of sample collection	days
MF_Total	Total Mass Flux	grams/meter^2/day
MF_Corg	Mass Flux of organic Carbon (Corg)	grams/meter^2/day
MF_CaCO3	Mass Flux of calcium carbonate (CaCO3)	grams/meter^2/day
MF_Sibio	Mass Flux of biogenic Silica (Opal)	grams/meter^2/day
MF_Terr	Mass Flux of terrigenous origin	grams/meter^2/day
MF_N	Mass Flux of Nitrogen (N) nd indicates no data, trap malfunction or sample too small to analyze	grams/meter^2/day

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Instruments

Dataset-specific Instrument Name	Sediment Trap
Generic Instrument Name	Sediment Trap
Generic Instrument Description	Sediment traps are specially designed containers deployed in the water column for periods of time to collect particles from the water column falling toward the sea floor. In general a sediment trap has a jar at the bottom to collect the sample and a broad funnel-shaped opening at the top with baffles to keep out very large objects and help prevent the funnel from clogging. This designation is used when the specific type of sediment trap was not specified by the contributing investigator.

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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.

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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^{2}y, 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^{2}y; 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^{2}y, 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.

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Program Information

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.

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.

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Funding

Funding Source	Award
Fondo Nacional de Ciencia, Tecnología e Innovación of Venezuela (FONACIT)	unknown CARIACO FONACIT
NSF Division of Ocean Sciences (NSF OCE)	OCE-0118566
NSF Division of Ocean Sciences (NSF OCE)	OCE-9401537
NSF Division of Ocean Sciences (NSF OCE)	OCE-0118491
NSF Division of Ocean Sciences (NSF OCE)	OCE-9729697

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