Primary productivity measurements from the Hawaii Ocean Time-Series (HOT) project from 1988-2021 at Station ALOHA

Website: https://www.bco-dmo.org/dataset/737163
Data Type: Cruise Results
Version: 2
Version Date: 2023-08-12

Project
» [Current] Hawaii Ocean Time-series (HOT): 2023-2028; [Previous] Hawaii Ocean Time-series (HOT): Sustaining ocean ecosystem and climate observations in the North Pacific Subtropical Gyre (HOT)

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

Contributors	Affiliation	Role
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Abstract
Primary productivity measurements from the Hawaii Ocean Time-Series (HOT) from 1988 to 2021. The 14C-radiotracer method was used to measure the assimilation of dissolved inorganic carbon (DIC) by phytoplankton as an estimate of the rate of photosynthetic production of organic matter in the euphotic zone. All incubations from 1990 through mid-2000 were conducted in situ at eight depths (5, 25, 45, 75, 100, 125, 150 and 175m) over one daylight period using a free-drifting array as described by Winn et al. (1991). Starting October 2000 (HOT-119), samples were collected from only the upper six depths while the lower two depths were modeled based on the monthly climatology. During 2015, all incubations were conducted in situ on a free floating, surface tethered array. Integrated carbon assimilation rates were calculated using the trapezoid rule with the shallowest value extended to 0 meters and the deepest extrapolated to a value of zero at 200 meters.

Table of Contents

Coverage

Spatial Extent: **Lat**:22.75 **Lon**:-158
Temporal Extent: 1988-10-31 - 2021-10-29

Dataset Description

Monthly measurements of primary production were collected at station ALOHA as part of the HOT program.

Methods & Sampling

Photosynthetic production of organic matter was measured by the ^{14}C tracer method. All incubations from 1990 through mid-2000 were conducted in situ at eight depths (5, 25, 45, 75, 100, 125, 150 and 175m) over one daylight period using a free-drifting array as described by Winn et al. (1991). Starting October 2000 (HOT-119), samples were collected from only the upper six depths while the lower two depths were modeled based on the monthly climatology. During 2015, all incubations were conducted in situ on a free floating, surface tethered array. Integrated carbon assimilation rates were calculated using the trapezoid rule with the shallowest value extended to 0 meters and the deepest extrapolated to a value of zero at 200 meters.

A summary of methodology is listed below. Full details can be found at the HOT Field & Laboratory Protocols page. (http://hahana.soest.hawaii.edu/hot/protocols/protocols.html#) or below in Related Publications section (Karl et al.)

1. Principle
The ^{14}C method, originally proposed by Steeman-Nielsen (1952), is used to estimate the uptake of dissolved inorganic carbon (DIC) by planktonic algae in the water column. The method is based on the fact that the biological uptake of ^{14}C-labeled DIC is proportional to the biological uptake of ^{12}C-DIC. If one knows the initial concentration of DIC in a water sample, the amount of ^{14}C-DIC added, the ^{14}C retained in particulate organic matter (^{14}C-POC) at the end of the incubation and the metabolic discrimination between the two isotopes of carbon (i.e., 5% discrimination against the heavier ^{14}C isotope), then it is possible to estimate the total uptake of carbon from the following relationship:

$$\text{C uptake} = \frac{\text{DIC} * {}^{14}\text{C-POC} * 1.05}{{}^{14}\text{C-DIC added}}$$

2. Cleaning
Due to the potentially toxic effects of trace metals on phytoplankton metabolism in oligotrophic waters, the following procedure is used to minimize the contact between water samples and possible sources of contamination. HCl (Baker Instra-Analyzed) solution (1M) is prepared with high purity hydrochloric acid and freshly-prepared glass distilled deionized water (DDW). 500 ml polycarbonate bottles are rinsed twice with 1M HCl (Baker Instra-Analyzed) and left overnight filled with the same acid solution. The acid is removed by rinsing the bottles three times with DDW before air drying. Go-Flo bottles, fitted with teflon-coated springs, are rinsed three times with 1M HCl and DDW before use. Pipette tips used in the preparation of the isotope stock and in the inoculation of samples are rinsed three times with concentrated HCl (Baker Instra-Analyzed), three times with DDW and once with the sodium carbonate solution (Chapter 14, section 3.2) and stored in a clean polyethylene glove until used.

3. Isotope Stock
The preparation of the isotope stock is performed wearing polyethylene gloves. A 25 ml acid-washed teflon bottle and a 50 ml acid-washed polypropylene centifuge tube are rinsed three times with DDW. 0.032 g of anhydrous Na_2CO_3 (ALDRICH 20,442-0, 99.999% purity) are dissolved in 50 ml DDW in the centrifuge tube to provide a solution of 6 mmol Na_2CO_3 per liter. 3.5 ml of NaH-$^{14}CO_3$ (53 mCi mmol-1; Research Products Inc.) are mixed with 16.5 ml of the above prepared Na_2CO_3 solution in the teflon bottle. The new stock activity is checked by counting triplicate 10 µl samples with 1 ml β-phenethylamine in 10 ml Aquasol-II. Triplicate 10 µl stock samples are also acidified with 1 ml of 2 M HCl, mixed intermittently for 1-2 hours and counted in 10 ml Aquasol-II to confirm that there is no ^{14}C-organic carbon contamination. The acidification is done under the hood. The acidified dpm should be <0.001% of the total dpm of the ^{14}C preparation.

4. Incubation Systems
Typically primary production is measured using in situ incubation techniques. A free-floating array equipped with VHF radio and strobe light is used for the in situ incubations. Incubation bottles are attached to a horizontal polycarbonate spreader bar which is then attached to the 200 m, 1/2" polypropylene in situ line at the depths corresponding to the sample collections. Generally eight incubation depths are selected (5-175 m, approximately).

5. Sampling

Approximately 3 hours before local sunrise, seawater samples are collected with acid-washed, 12-liter Go-Flo bottles using Kevlar line, metal-free sheave, Teflon messengers and a stainless steel bottom weight. A dedicated hydrowinch is used for the primary productivity sampling procedures in a further effort to reduce/eliminate all sources of trace metal contamination. Under low light conditions, water samples are transferred to the incubation bottles (500 ml polycarbonate bottles) and stored in the dark. Polyethylene gloves are worn during sample collection and inoculation procedures. No drawing tubes are used.

6. Isotope Addition and Sample Incubation
Three light bottles, three dark bottles and 1 time-zero control (see HOT Protocols Chapter 14, section 8) are collected at each depth for in situ incubation. In situ dark bottles are deployed in specially- designed, double-layered cloth bags with Velcro closures. After all water samples have been drawn from the appropriate Go-Flo bottles, 250 µl of the 14C-sodium carbonate stock solution is added to each sample using a specially-cleaned pipette tip. The samples are deployed before dawn on a free-floating, drifter buoy array. At local sunset, the free-floating array is recovered and all in situ bottles are immediately placed in the dark and processed as soon as possible. The time of recovery is recorded.

7. Filtration
Filtration of the samples is done under low light conditions and begins as soon as the incubation bottles are recovered from the in situ array. 200 µl are removed and placed into a second LSC vial containing 0.5 ml of β-phenethylamine. This sample is used for the determination of total radioactivity in each sample.The remainder is filtered through a 25 mm diameter GF/F filters. The filters are placed into prelabelled, clean glass liquid scintillation counting vials (LSC vials) and stored at -20 °C.

8. ^{14}C Sample Processing
One ml of 2 M HCl is added to each sample vial (under the hood). Vials are covered with their respective caps and shaken in a vortex mixer for at least 1 hour with venting at 20 minute intervals. To vent, the vials are removed from the shaker, and the cap opened (under the hood). After shaking is completed, the vials are left open to vent under the hood for an additional 24 hours. Ten milliliters of Aquasol-II are added per vial (including vials for total ^{14}C radioactivity) and the samples are counted in a liquid scintillation counter. Samples are counted again after 2 and 4 weeks, before discarding. Counts have shown a consistent increase during the first two weeks and become stable between the second and the fourth week. This is probably the result of sample hydrolysis or diffusion of radioactivity from the GF/F filter matrix, thereby reducing the extent of self-absorption. Therefore, only the 4-week count is used for ^{14}C calculations. Counts per min (CPM) are converted to disintegration per min (DPM) using the channels ratio program supplied by the manufacturer (Packard Instrument Co.)

Analysis History for HOT program

- HOT-1 to HOT-7, on deck incubations only
- HOT-8 to HOT-17, on deck and *in situ* incubations
- HOT-18 to present, *in situ* incubations only
- HOT 97 to present samples from CTD rosette mounted PVC bottles only (previously using Go-Flo bottles, Kevlar line, Teflon messengers)
- HOT 119 to present, six incubation depths (5-125 m), light bottles only. Previously eight depths (5-175 m) and light and dark incubations
- HOT 178 switch from Aquasol II to Ultima Gold LLT scintillation cocktail

Data Processing Description

From the data derived we can estimate several properties of the phytoplankton populations at Station ALOHA:

1. Total daylight organic carbon production is calculated from the 12-hour uptake data (after corrections for 12-hour dark activities).
2. Net daily organic carbon production is calculated from the 24-hour light/dark samples (corrected for the time-zero blank activities).
3. Phytoplankton population respiration is taken as the difference between the 12-hour light and the 24-hour light/dark incubations.
4. Net primary production is used as the estimate of phytoplankton carbon production for the purposes of comparison to other ecosystem-level processes (e.g., standing stock assessments, vertical C-flux, etc.).

Quality Flags
Quality Flags were assigned for the bottle, chlorophyll, pheopigments, light incubation, dark incubation, salinity & bacteria values respectively.
1: not quality controlled
2: good data
3: suspect (questionable) data
4: bad data
5: missing value
9: variable not measured during this cast

BCO-DMO Processing Description

Concatenated new data from 2020 and 2021 to previous 30 years of primary production data

- Minor modification within Excel prior to running through BCO-DMO pipeline processing tool to accommodate filetype formatting
- Adjusted parameter/column names to conform with BCO-DMO naming conventions.
- Combined separate date and time columns into a single ISO8601 formatted date
- Added columns for latitude and longitude of station ALOHA
- Added columns for individual parameter flags
- Added column for data source filename (e.g. hot326-334.pp)
- Checked for missing cruises

[table of contents | back to top]

Data Files

File
737163_v2_HOT_prim_prod_1988_2021.csv (Comma Separated Values (.csv), 446.56 KB) MD5:5229aa13a65708aed2687e9e502fee03 Primary data file for dataset 737163 version 2. HOT TimeSeries Primary Production 1988-2021

[table of contents | back to top]

Related Publications

Karl, D., Winn, C., Hebel, D., and Letelier, R. Hawai'i Ocean Time-Series Program Field and Laboratory Protocols. https://hahana.soest.hawaii.edu/hot/protocols/protocols.html#
Methods

Nielsen, E. S. (1952). The Use of Radio-active Carbon (C14) for Measuring Organic Production in the Sea. ICES Journal of Marine Science, 18(2), 117–140. doi:10.1093/icesjms/18.2.117
Methods

Winn, C., C. Sabine, D. Hebel, F. Mackenzie and D. M. Karl. (1991) Inorganic carbon system dynamics in the central Pacific Ocean: Results of the Hawaii Ocean Time-series program. EOS, Transactions of the American Geophysical Union 72, 70.
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
Cruise	Cruise number	unitless

Latitude	Latitude	decimal degrees
Longitude	Longitude (West is negative)	decimal degrees
ISO_StartTime_UTC	Start date and time in ISO 8601 format	unitless
ISO_EndTime_UTC	End date and time in ISO 8601 format	unitless
Depth	Depth	meters (m)
Incubation	Incubation type. O = GO-FLO sampled on deck incubation, I = GO-FLO sampled in-situ incubation, R = Rosette sampled in-situ incubation, N = External closing Niskin sampled in-situ incubation	unitless
Time_duration	Incubation time	hours
Chl_a_mean	Chlorophyll a mean value	miligrams per cubic meter (mg/m3)
Chl_a_sd	Chlorophyll a standard deviation	miligrams per cubic meter (mg/m3)
Pheo_mean	Pheopigments mean	miligrams per cubic meter (mg/m3)
Pheo_sd	Pheopigments standard deviation	miligrams per cubic meter (mg/m3)
Light_rep1	Light replicate #1	miligrams Carbon per cubic meter (mg C/m3)
Light_rep2	Light replicate #2	miligrams Carbon per cubic meter (mg C/m3)
Light_rep3	Light replicate #3	miligrams Carbon per cubic meter (mg C/m3)
Dark_rep1	Dark replicate #1	miligrams Carbon per cubic meter (mg C/m3)
Dark_rep2	Dark replicate #2	miligrams Carbon per cubic meter (mg C/m3)
Dark_rep3	Dark replicate #3	miligrams Carbon per cubic meter (mg C/m3)
Salt	Salinity (PSS-78)	unitless

Prochl	Prochlorococcus	count per milliliter
Hetero	Heterotrophic bacteria	count per milliliter
Synecho	Synechococcus	count per milliliter
Euk	Eukaryotes	count per milliliter
Flag	Quality Flags for the bottle, chlorophyll, pheopigments, light incubation, dark incubation, salinity & bacteria values respectively. 1: not quality controlled, 2: good data, 3: suspect (questionable) data, 4: bad data, 5: missing value, 9: variable not measured during this cast	unitless
Flag_Bottle	Quality flag for Bottle sample	unitless
Flag_Chla	Quality flag for Chlorophyll a measurement	unitless
Flag_Pheo	Quality flag for Pheopigment measurement	unitless
Flag_Light	Quality flag for Light incubation bottles	unitless
Flag_Dark	Quality flag for Dark incubation bottles	unitless
Flag_Salt	Quality flag for Salinity	unitless
Flag_Prochl	Quality flag for Prochlorococcus	unitless
Flag_Hetero	Quality flag for Heterotropic Bacteria	unitless
Flag_Synecho	Quality flag for Synechococcus	unitless
Flag_Euk	Quality flag for Eukaryotes	unitless
PrimProd_filename	Original filename of the primary production data from HOT	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Go-Flo bottles
Generic Instrument Name	GO-FLO Bottle
Dataset-specific Description	Go-Flo bottles
Generic Instrument Description	GO-FLO bottle cast used to collect water samples for pigment, nutrient, plankton, etc. The GO-FLO sampling bottle is specially designed to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

Dataset-specific Instrument Name	liquid scintillation counter
Generic Instrument Name	Liquid Scintillation Counter
Dataset-specific Description	liquid scintillation counter (Packard model 4640; United Technologies Inc.)
Generic Instrument Description	Liquid scintillation counting is an analytical technique which is defined by the incorporation of the radiolabeled analyte into uniform distribution with a liquid chemical medium capable of converting the kinetic energy of nuclear emissions into light energy. Although the liquid scintillation counter is a sophisticated laboratory counting system used the quantify the activity of particulate emitting (ß and a) radioactive samples, it can also detect the auger electrons emitted from 51Cr and 125I samples.

Dataset-specific Instrument Name	External closing niskin
Generic Instrument Name	Niskin bottle
Dataset-specific Description	External closing niskin sampled in-situ Incubation.
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.

Dataset-specific Instrument Name	NORDA/USM incubation system
Generic Instrument Name	Shipboard Incubator
Dataset-specific Description	temperature- and light-controlled deck incubation system (NORDA/USM incubation system)
Generic Instrument Description	A device mounted on a ship that holds water samples under conditions of controlled temperature or controlled temperature and illumination.

[table of contents | back to top]

Deployments

HOT_cruises

Website	https://www.bco-dmo.org/deployment/58879
Platform	Unknown Platform
Report	http://hahana.soest.hawaii.edu/hot/
Start Date	1988-10-31
Description	Since October 1988, the Hawaii Ocean Time-series (HOT) program has investigated temporal dynamics in biology, physics, and chemistry at Stn. ALOHA (22°45' N, 158°W), a deep ocean field site in the oligotrophic North Pacific Subtropical Gyre (NPSG). HOT conducts near monthly ship-based sampling and makes continuous observations from moored instruments to document and study NPSG climate and ecosystem variability over semi-diurnal to decadal time scales.

[table of contents | back to top]

Project Information

[Current] Hawaii Ocean Time-series (HOT): 2023-2028; [Previous] Hawaii Ocean Time-series (HOT): Sustaining ocean ecosystem and climate observations in the North Pacific Subtropical Gyre (HOT)

Website: https://hahana.soest.hawaii.edu/hot/

Coverage: North Pacific Subtropical Gyre; 22 deg 45 min N, 158 deg W

Hawai'i Ocean Time-Series Project Summary
This continuing award for the HOT research program sustains the open-ocean climatology of biological, chemical, and physical observations into a 4th decade.

Intellectual Merit
The scientific mission of HOT continues to be monitoring of temporal dynamics in the cycling of carbon and associated bioelements, and observations of the variability of hydrological and ecological properties, heat fluxes, and circulation of the North Pacific Subtropical Gyre (NPSG). The proposed research will rely on shipboard observations and experiments conducted on 10 separate 5-day expeditions per annum along with near-continuous moored platform measurements of air-sea interactions, ocean mixing, and physical characteristics of the deep sea. The HOT program maintains the high-quality suite of biogeochemical and physical measurements required for continued assessment of dynamics in ocean carbon and nutrient pools and fluxes, plankton community structure, ecosystem productivity, and inherent optical properties of the water column. Continuity of these observations improves the value of the dataset for deciphering how low-frequency natural and anthropogenic climate signals influence ecosystem structure in the NPSG as well as providing up-to-date measurements to place current signals in the longer-term context. Such efforts will continue to aid on-going modeling efforts required for predicting how future habitat perturbations may influence ecosystem dynamics in the NPSG. All HOT program data are publicly available and are frequently used by researchers and policy makers around the world. HOT data provide reference baselines for essential ocean variables, allow for characterization of natural patterns of ocean system variability and associated links to regional climate indices, and support calibration/validation of autonomous in situ and remote (satellite, airborne) sensors.

Broader Impacts
The long-term, continuous HOT data are critical to assess variability on seasonal to decadal time-scales and thus are essential to determine the emergence of anthropogenic signals in the oligotrophic North Pacific. Further sustaining HOT measurements will strengthen our capacity to test hypotheses about poorly understood interactions between ocean dynamics, climate, and biogeochemistry and increase the value of HOT data for understanding the response of ocean ecosystems to both natural and anthropogenic climate perturbations. Over the next 5 years, we will continue to promote the value of HOT research through high quality, high visibility peer-reviewed journal and book articles, newspaper and newsletter articles, and community outreach. With partners BCO-DMO and OceanSITES we will also continue to strive for a FAIR data model (see data management plan) as metadata standards and conventions evolve in the community. We will

continue working with an Earthcube Research Coordination Network for Marine Ecological Time Series (METS) to support efforts that bring together different cross-sections of METS data producers, data users, data scientists, and data managers in large- and small-group formats to foster the necessary dialog to develop FAIR data solutions across multiple time-series. In addition, HOT is a community resource that helps support the research of numerous ocean scientists who rely on the program's infrastructure (ship time, staff, laboratories, equipment) to conduct their research, education, and outreach activities. Moreover, HOT PIs maintain a strong commitment to mentoring and training of undergraduate and graduate students, and will continue these activities as well as facilitates access to the sea by a number of ancillary students and scientists.

NSF Award Abstract:

Long-term observations of ocean physics, biology, and chemistry across decades provide a powerful lens for understanding the response of the oceans to environmental change. This award will continue the Hawaii Ocean Time-series (HOT) research program, which began in 1988, for an additional five years. Continuity of these observations will improve the value of the dataset for deciphering how natural and human-influenced climate signals affect ecosystem structure in the Pacific Ocean. All HOT program data are publicly available and are frequently used by researchers and policy makers around the world. HOT also serves as (1) a testbed for the development of new sensors and methodologies, (2) a calibration/validation site, (3) an invaluable training ground that attracts students and researchers from around the globe, and (4) a forum for international collaboration and capacity building.

The proposed research will rely on shipboard observations and experiments conducted on ten separate five-day expeditions per year along with near-continuous moored platform measurements of air-sea interactions, ocean mixing, and physical characteristics of the deep sea. Observations include biogeochemical and physical measurements required for continued assessment of dynamics in ocean carbon and nutrient pools and fluxes, plankton community structure, ecosystem productivity, and inherent optical properties of the water column. The major program goals and objectives over the next 5 years remain as in prior years and include: (1) sustain high quality, time-resolved oceanographic measurements on the interactions between ocean-climate and ecosystem variability in the North Pacific Subtropical Gyre (NPSG), (2) quantify time-varying (seasonal to decadal) changes in reservoirs and fluxes of carbon and associated bioelements (nitrogen, phosphorus, and silicon), (3) constrain processes controlling air-sea carbon exchange, rates of carbon transformation through the planktonic food web, and fluxes of carbon into the ocean?s interior, (4) extend to 40 years a climatology of hydrographic and biogeochemical dynamics from which to gauge anomalous or extreme changes to the NPSG habitat, forming a multi-decadal baseline from which to decipher natural and anthropogenic influences on the NPSG ecosystem, (5) continue to provide scientific and logistical support to ancillary programs that benefit from the temporal context, interdisciplinary science, and regular access to the open sea afforded by HOT program occupation of Station ALOHA, including projects implementing, testing, and validating new methodologies and transformative ocean sampling technologies, and (6) provide unique training and educational opportunities for the next generation of ocean scientists.

[table of contents | back to top]

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0926766
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260164
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756517

[table of contents | back to top]