Absorption spectra and DOC concentrations from the NOAA Ship Ronald H. Brown cruise RB-07-05, R/V Pelican cruises PE07-32, PEJun2000 in the Gulf of Mexico (GoMX - NACP-OCB project)

Website: https://www.bco-dmo.org/dataset/3296
Version: 21 June 2011
Version Date: 2011-06-21

Project
» Gulf of Mexico NACP-OCB Coastal Synthesis (GoMX - NACP-OCB)

Programs
» Ocean Carbon and Biogeochemistry (OCB)
» North American Carbon Program (NACP)
» NACP-OCB Coastal Synthesis (NACP-OCB Coastal)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

Geospatial Synthesis of Chromophoric (color-absorbing) Dissolved Organic Matter (CDOM) Distribution in the Gulf of Mexico

PI: Christopher Osburn, Dept. Marine, Earth, and Atmospheric Sciences, NC State University

Co-PIs: Thomas Bianchi, Texas A&M University, Bob Chen, University of Massachusetts-Boston; Paula Coble, University of South Florida; Eurico D'Sa, Louisiana State University

This dataset is affiliated with the North American Carbon Program (NACP). For additional information, please see the entry at the NACP site.

This data set will be a synthesis of bio-optical data on chromophoric or color-absorbing dissolved organic matter (CDOM) in the coastal regions the Gulf of Mexico - an immediate goal of the NACP and OCB programs. Absorption spectra and DOC concentrations from the Organic Matter Cycli project will be reported. In addition to in situ absorption spectra and DOC concentrations some study locations may also report fluorescence (estimate of chlorophyll a concentration), plus CTD and dissolved oxygen measurements

CDOM affects on water quality and water clarity are part of a high priority issue identified by the Gulf of Mexico Alliance (GOMA). Each of the PI's listed has historical CDOM data from coastal regions of the Gulf of Mexico, ranging from the Texas coast to West Florida Shelf.

The historic CDOM synthesis data set will provide a resource for validating remote sensing algorithms that predict water clarity properties in the coastal areas of the Gulf of Mexico. Each dataset to be shared by a PI is linked to specific research cruises. Thus the database has temporal and spatial coverage and associated metadata. In Years 1-2 of the project, data will be collated from each PI and transformed into a format amenable to data rescue by BCO-DMO. The structure of the resulting database will provide a mechanism by which future data sets may be integrated by members of the scientific community, through the project. In Year 2, as data comes online, it will be used to validate a coastal CDOM remote sensing algorithm for the Gulf of Mexico. Co-PI D'Sa has a decision support science website (http://gulf-coast.lsu.edu/index.html) that will provide water clarity data products based on CDOM algorithms.

The goal of the project is to have a functional database of CDOM information for two objectives. One objective is to provide coastal oceanographers with a clearinghouse for CDOM data that can be accessed and to which future cruise-related data acquisitions can be added. The second objective is to provide a resource for decision makers who require water clarity data on spatial and time scales for which satellite imagery may be used. For the second goal to be met, we have as an objective the validation of CDOM algorithms using the proposed database. Once the algorithm is validated, water clarity data products can be generated by users using the GCIS website, which will link to the CDOM database hosted by BCO-DMO.

The CDOM database will also provide pilot data for research proposals to NSF from our team. Part of our evolving project is to produce geospatial models of CDOM distributions in the Gulf of Mexico from the inflows of multiple rivers as well as the Loop Current. Functional models of CDOM distributions will further aid in remote sensing algorithm development and validation and in the general understanding of terrestrial C flux to the Gulf of Mexico.

Modification History:
September 2010: added processed Atchafalaya data from Chris Osburn
December 2010: raw/unprocessed Mississippi Plume absorption coefficients were added but then quickly removed
June 2011: added processed Mississippi Plume data from Bob Chen; a_lambda units corrected to "per meter" (had been incorrectly specified as "per nanometer" in earlier version)

Methods & Sampling

Samples were collected at the surface either in bucket grabs or from the Pelican's flow-through system, or by CTD. Samples were filtered through 0.2 micrometer polyethersulfone filters into baked (550 degrees Celsius; 5 hr. minimum) collection vials and stored at 4 degrees Celsius in the dark until return to the lab (about 3 days time). Absorbance was measured on a Shimadzu 1601UV spectrophotometer from 200 to 800 nm at 1 nm intervals versus air. All a(λ) values are blank corrected for Milli-Q water.

Data Processing Description

Parameters reported will include:
a_lambda = absorption coefficient at each wavelength (250-750 nm), in m-1

DOC = dissolved organic carbon concentration (micromolar). For DOC, different techniques were used and are identified for each deployment.

Absorption coefficients (a) are calculated from absorbance (A) according to Equation 1: $a_{(\lambda)} = 2.303 A_{(\lambda)} / L$

where L is the pathlength in meters (0.1 m). The absorption coefficients were then modeled from 250 to 750 nm using Equation 2: $a_{(\lambda)} = a_{(\lambda_0)} e^{-S(\lambda_0 - \lambda)}$

Excitation-emission matrix (EEM) fluorescence spectra and 13C-DOC values were measured on most of these samples.

[table of contents | back to top]

Data Files

File
CDOM.csv (Comma Separated Values (.csv), 12.75 MB) MD5:54f9399a3bacdb473737daa6511c9a1e Primary data file for dataset ID 3296

[table of contents | back to top]

Parameters

Parameter	Description	Units
Location_ID	sampling location site identifier	dimensionless
Sta_name	station name	dimensionless
date	date of sampling in GMT	dimensionless
lat	latitude of sampling location (North is positive)	decimal degrees
lon	longitude of sampling location (West is negative)	decimal degrees
time	time of sampling in GMT	dimensionless
depth	depth calculated from pressure measured by the SeaBird CTD	meters
temp	surface water temperature (ITS-90 scale)	degrees Celsius
sal	surface water salinity	dimensionless
DOC	Dissolved Organic Carbon	micromolar
Wavelength	wavelength	nanometers
a_lambda	absorption coefficient	1/meter
DO	in situ dissolved oxygen	micromoles/kilogram
PI_name	last name of lead investigator who contributed the data	dimensionless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	bucket
Generic Instrument Name	bucket
Generic Instrument Description	A bucket used to collect surface sea water samples.

Dataset-specific Instrument Name	Cary 50 spectrophotometer
Generic Instrument Name	Cary 50 spectrophotometer
Dataset-specific Description	The Cary 50 spectrophotometer was used to measure absorbance (200-800 nm) and spectra were corrected for Milli-Q water as baseline.
Generic Instrument Description	A Cary 50 spectrophotometer measures absorbance (200-800 nm).

Dataset-specific Instrument Name	Conductivity, Temperature, Depth
Generic Instrument Name	CTD - profiler
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	DOC measured by wet chemical oxidation with high-amplification isotope ratio mass spectrometry (WCO-IRMS) using a WCO-modified OI Analytical Model 1010 TOC analyzer.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Shimadzu TOC-V Analyzer
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	The Shimadzu TOC-V Analyzer was used to measure DOC by high temperature combustion method.
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

Dataset-specific Instrument Name	towed undulating vehicle
Generic Instrument Name	towed undulating vehicle
Dataset-specific Description	The ECOShuttle is a towed undulating vehicle based on the Nu-Shuttle with CTD and dissolved oxygen sensor and is used to measure in-situ data including Temperature, Salinity and Depth.
Generic Instrument Description	A towed undulating vehicle is a generic class of instruments. See the data set specific information for a detailed description. These are often prototype instrument packages designed to make very specific measurements.

Dataset-specific Instrument Name	UV Spectrophotometer-Shimadzu
Generic Instrument Name	UV Spectrophotometer-Shimadzu
Dataset-specific Description	Absorbance was measured on a Shimadzu 1601UV spectrophotometer.
Generic Instrument Description	The Shimadzu UV Spectrophotometer is manufactured by Shimadzu Scientific Instruments (ssi.shimadzu.com). Shimadzu manufacturers several models of spectrophotometer; refer to dataset for make/model information.

[table of contents | back to top]

Deployments

RB-07-05

Website	https://www.bco-dmo.org/deployment/58036
Platform	NOAA Ship Ronald H. Brown
Report	http://data.bco-dmo.org/NACP-OCB_CoSyn/Gulf_Mexico/RB-07-05_CruiseReportFinal.pdf
Start Date	2007-07-10
End Date	2007-08-04
Description	The final GOMECC cruise report was downloaded on 31 January 2010 from NOAA AOML: PDF format GOMECC cruise Web site from AOML: http://www.aoml.noaa.gov/ocd/gcc/GOMECC/ GOMECC Cruise Track: as a PDF file Note that this cruise was added to the BCO-DMO database in late January 2010 in expectation that data from the cruise will be contributed as part of the NACP-OCB Coastal Synthesis: Gulf of Mexico project. Cruise Report Summary: The first North American Carbon Program (NACP) Gulf of Mexico and East Coast Carbon (GOMECC) Cruise (RB-07-05) on board the R/V Ronald H. Brown conducted sampling in the coastal waters between Galveston in the northern Gulf of Mexico to Boston on the East coast of the United States. The cruise was designed to obtain a snapshot of concentrations and fluxes of key carbon, physical, and biogeochemical parameters in the coastal realm. The program is in support of the North American Carbon Program (NACP) that has as overriding goal to constrain fluxes of carbon over North America and adjacent seas. Full scale repeat occupations are planned every two years to complement mooring time series and other regional activities. The cruise included a series of 9 transects approximately orthogonal to the Gulf of Mexico and Atlantic Coast and a comprehensive set of underway measurements along the entire transect (Figure 1). Full water column CTD/rosette stations were occupied at 90 specified locations. A total of 29 scientists from AOML and other government agencies and universities participated on the 26-day cruise which departed from the Galveston, Texas on 10 July, and arrived on schedule in Boston, Massachusetts on 4 August. Water samples were collected from the 24-bottle rosette at each station and analyzed for salinity, oxygen, nutrients, dissolved inorganic carbon, total alkalinity, pCO2, dissolved organic matter, colored dissolved organic matter, particulate organic carbon, halocarbons, alkyl nitrates, CO and phytoplankton pigments. Underway systems were in operation for measuring atmospheric CO2 and near-surface water pCO2, DIC, halocarbons, pH, NH3, CO and bio-optical properties. An in situ spectrophotometric pH profiler was used with the CTD to measure pH profiles to a depth of 1000m. Air-sea fluxes of CO2 and ozone were also measured using eddy correlation methods. In the midst of a CTD cast along the New Jersey transect, the ship encountered generator cooling problem and needed to go into Boston harbor for emergency repairs. As a result, only two stations of the 10 scheduled stations along the New Jersey transect were occupied. After repair of the ship's generator, science operations resumed July 30 starting at the northern most stations and working backwards through Gulf of Maine and MVCO stations as far as time would allow. All major cruise objectives were achieved.

PE07-32

Website	https://www.bco-dmo.org/deployment/58038
Platform	R/V Pelican
Start Date	2007-05-07
End Date	2007-05-10
Description	Organic Matter Cycli project cruise aboard R/V Pelican in May 2007 no cruise information contributed yet - dates are from Chief Scientist (contributed Aug 2010), and cruise ID confirmed. **Methods & Sampling** DOC concentration was measured on an OI Analytical 1010 wet chemical oxidation carbon analyzer using modifications for seawater per Osburn and St-Jean (2007). Modifications included the use of wet chemical oxidation with high-amplification isotope ratio mass spectrometry (WCO-IRMS) to measure stable isotope values of dissolved organic carbon in seawater. The analytical obstacles associated with low amounts of DOC in seawater samples, are overcome by use of concentrated persulfate in a wet chemical oxidation organic carbon analyzer coupled to an isotope ratio mass spectrometry (WCO-IRMS). One key aspect of this method is reducing the persulfate blank and increasing the IRMS signal with larger amplifier gain resistors. After these simple modifications, a 2 mL sample provides enough signal to make precise measurements of DOC concentration. DOC methods are described in: Osburn, CL and G. St-Jean (2007) "The use of wet chemical oxidation with high-amplification isotope ratio mass spectrometry (WCO-IRMS) to measure stable isotope values of dissolved organic carbon in seawater" Limnology and Oceanography: Methods, 5: pp. 296-308.

PEJun2000

Website	https://www.bco-dmo.org/deployment/58161
Platform	R/V Pelican
Start Date	2000-06-21
End Date	2000-06-28
Description	The purpose of this cruise aboard the R/V Pelican in June 2000 was to study Chromophoric dissolved organic matter (CDOM) in the Mississippi River Plume. The science party did not know the cruise ID but referred to this cruise as 'Deployment 2000'. **Methods & Sampling** Data from this deployment include: fluorescence, absorbance and DOC measurements of water samples; in-situ CTD data and dissolved oxygen measurements. Dissolved organic carbon was measured by high temperature catalytic oxidation. Briefly, 50 microliter injections of sparged, acidified seawater were combusted at 800 °C and the resultant CO2 was purified and measured with a nondispersive infrared detector (Chen et al. 2004). In-situ data (Temperature, Salinity, Depth) were collected using towed undulating vehicle, the ECOShuttle, based on the Nu-Shuttle with CTD and dissolved oxygen sensor. Absorbance (200-800 nm) measurements were made with a Cary 50 spectrophotometer and spectra were corrected for Milli-Q water as baseline. DOC was measured by high temperature combustion method using a Shimadzu TOC-V Analyzer. For sampling and analytical methodology, please refer to: Chen, R. F., Gardner, G. B., 2004. High-resolution measurements of chromophoric dissolved organic matter in the Mississippi and Atchafalaya River plume regions. Marine Chemistry 89, 103-125. Chen, R. F., Bissett, P., Coble, P., Conmy, R., Gardner, G. B., Moran, M. A., Wang, X.-C., Wells, M. L., Whelan, P. and Zepp, R. G., 2004. Chromophoric dissolved organic matter (CDOM) source characterization in the Louisiana Bight. Marine Chemistry 89, 257-272.

[table of contents | back to top]

Project Information

Gulf of Mexico NACP-OCB Coastal Synthesis (GoMX - NACP-OCB)

Website: http://coastalcarbon.pbwiki.com/

Coverage: global coastal zones

NACP-OCB Coastal Synthesis: Gulf of Mexico region

The objective of the NACP coastal synthesis activities is to stimulate the synthesis and publication of recent observational and modeling results on carbon cycle fluxes and processes along the North American continental margin, a critical unknown in the North American carbon budget. NACP/OCB researchers have identified the Gulf of Mexico as being one of the regions of special interest for this coastal synthesis activity.

Phase 1. Regional Carbon Budgets

The first phase of the coastal synthesis will be to develop a carbon budget for each region based on a compilation of existing data, which will require literature searches, web searches of databases, etc. Although full community participation is welcome and encouraged, Paula Coble volunteered to lead the Gulf of Mexico Phase 1 synthesis efforts.

Some key elements of the database synthesis are:

- Climatology
- pCO2
- riverine delivery, inc losses and inputs on the way
- rates of processes
- ocean color data and products
- export out of coastal regions
- DIC, PIC, DOC, POC
- Nutrients
- Other fluxes
- model output

plus uncertainty analysis and quality control related to those observations

Phase 2. Community Modeling and Database Development

The second phase of the coastal synthesis will involve community modeling activity to refine the regional carbon budgets.

[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.

North American Carbon Program (NACP)

Website: http://www.nacarbon.org/nacp/

Coverage: North America

The North American Carbon Program (NACP) is a multidisciplinary research program to obtain scientific understanding of North America's carbon sources and sinks and of changes in carbon stocks needed to meet societal concerns and to provide tools for decision makers. Successful execution of the NACP will require an unprecedented level of coordination among observational, experimental, and modeling efforts regarding terrestrial, oceanic, atmospheric, and human components. The NACP is supported by a number of different federal agencies through a variety of intramural and extramural funding mechanisms and award instruments. NACP will rely upon a rich and diverse array of existing observational networks, monitoring sites, and experimental field studies in North America and its adjacent oceans. Integrating these different program activities and maximizing synergy amongst them, will require expert guidance beyond the norm for large field programs in Earth system science and global climate change.

Central Objective

The central objective of the North American Carbon Program is to measure and understand the sources and sinks of Carbon Dioxide (CO_2), Methane (CH_4), and Carbon Monoxide (CO) in North America and in adjacent ocean regions.

Goals

- Develop quantitative scientific knowledge, robust observations, and models to determine the emissions and uptake of CO_2, CH_4, and CO, changes in carbon stocks, and the factors regulating these processes for North America and adjacent ocean basins.
- Develop the scientific basis to implement full carbon accounting on regional and continental scales. This is the knowledge base needed to design monitoring programs for natural and managed CO_2 sinks and emissions of CH_4.
- Support long-term quantitative measurements of fluxes, sources, and sinks of atmospheric CO_2 and CH_4, and develop forecasts for future trends.

Science Questions

- What is the carbon balance of North America and adjacent oceans? What are the geographic patterns of fluxes of CO_2, CH_4, and CO? How is the balance changing over time?
- What processes control the sources and sinks of CO_2, CH_4, and CO, and how do the controls change with time?
- Are there potential surprises where sources increase or sinks disappear?

- How can we enhance and manage long-lived carbon sinks, and provide resources to support decision makers?

The NACP Science Steering Group (SSG) provides scientific leadership for the NACP. (NACP SSG)

Program Data: The data from most projects associated with the NACP program are not managed by BCO-DMO. Information about most projects and their results are available from the Program and Data site URLs shown above. However, some exceptions are the NACP/OCB coastal synthesis projects listed below when the project section is expanded.

NACP-OCB Coastal Synthesis (NACP-OCB Coastal)

Website: http://www.nacarbon.org/cgi-nacp/working_groups/wg.pl?synthesis=1#coastal

Coverage: global coastal zones

In late June 2008, the OCB Project Office sent out a call for participation in the Coastal Synthesis Activity as part of the North American Carbon Program (NACP) Interim Synthesis Activities. The objective of this activity is to stimulate the synthesis and publication of recent observational and modeling results on carbon cycle fluxes and processes along the North American continental margin. The current state of knowledge of the magnitude, spatial distribution, and inter-annual variability of carbon sources and sinks in coastal waters is incomplete. Thus, the goal of this activity is to synthesize individual, small-scale studies across broader spatial and temporal scales to improve quantitative assessments of the North American coastal carbon cycle. Because the coastal oceans have important and complex linkages with terrestrial, atmospheric, and open ocean biogeochemical cycles, we encourage the participation of researchers focused on both organic and inorganic carbon, as well as nitrogen and phosphorous cycle topics related to carbon balance and related issues such as hypoxia impacts on continental margins.

Planning for the coastal synthesis activity was initiated during a breakout session at the 2008 OCB Summer Science Workshop. The proposed coastal synthesis activity is initially broken into five U.S. geographical sub-regions (Atlantic Coast, Pacific Coast, Gulf Coast, Arctic Coast, and Laurentian Great Lakes), with leads identified for each region. Researchers were encouraged to consider ongoing projects and think about how those projects might relate to one or more of the regional syntheses. Additional information available at the NACP Web site (http://www.nacarbon.org/cgi-bin/working_groups/wg.pl) includes a list of active NACP Interim Synthesis activities and working groups.

The majority of data sets uploaded for this project will be synthesis data sets, representing an integration of previously compiled data from the various sub-regions.

Related Links:

NACP Coastal Synthesis Web Site (includes regional links)

[table of contents | back to top]

Funding

Funding Source	Award
United States Naval Research Laboratory (Navy/NRL)	unknown GoMX NACP-OCB Navy/NRL
Office of Naval Research (ONR)	N00014-00-10325
National Aeronautics & Space Administration (NASA)	unknown GoMX NACP-OCB NASA

[table of contents | back to top]