Inorganic and organic nutrient data from Niskin bottles from R/V Knorr cruise KN210-04 in the Western Atlantic Ocean between Uruguay and Barbados in 2013 (Deep Atlantic DOM project)

Website: https://www.bco-dmo.org/dataset/473296
Data Type: Cruise Results
Version: 1
Version Date: 2016-07-25

Project
» Dissolved Organic Matter Composition in the Deep Atlantic Ocean (Deep Atlantic DOM)

Programs
» Ocean Carbon and Biogeochemistry (OCB)
» Center for Chemical Currencies of a Microbial Planet (C-CoMP)

Contributors	Affiliation	Role
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Abstract
Inorganic and organic nutrient data from Niskin bottles from the KN210-04 cruise. Data include concentration of: phosphate, nitrate+nitrite, silicate, nitrite, ammonium, non-purgeable organic carbon, and total nitrogen.

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Coverage

Spatial Extent: **N**:9.700333 **E**:-24.000749 **S**:-38.0026 **W**:-55.299424
Temporal Extent: 2013-03-27 - 2013-05-06

Dataset Description

Inorganic and organic nutrient data from Niskin bottles from the KN210-04 cruise. Data include concentration of: phosphate, nitrate+nitrite, silicate, nitrite, ammonium, non-purgeable organic carbon, and total nitrogen.

Methods & Sampling

Samples for inorganic nutrient analysis were collected in HDPE bottles and frozen (-20ºC) immediately after sample collection. Samples were kept frozen until processing by Joe Jennings at Oregon State University. The analyses for phosphate (PO4), nitrate plus nitrite (NO3_NO2), nitrite (NO2), ammonium (NH4), and silicic acid (silicate) were performed using a hybrid Technicon AutoAnalyzerII and Alpkem RFA300 system following protocols modified from Gordon et al. (see below for reference). The estimated precision for each element was as follows: PO4, ± 0.008 µM; NO3_NO2, ± 0.15 µM; NO2, ± 0.01 µM; silicic acid, ± 0.3 µM.

To obtain the concentration of total organic carbon (TOC) and total nitrogen (TN), a 40 ml aliquot of whole seawater was acidified to pH~3 with concentrated hydrochloric acid (HCl) and stored in combusted glass vials at 4°C until analysis with a Shimadzu TOC-VCSH total organic carbon analyzer coupled to a TNM-1 analyzer. Blanks (MilliQ water) and standard curves with potassium hydrogen phthalate and potassium nitrate were interspersed into the sample runs. The coefficient of variability between replicate injections was <1%. Comparisons to standards provided by Prof. D. Hansell (University of Miami) were made daily.

References:
Gordon, L. I., J. C. Jennings, Jr., A. A. Ross, and J. M. Krest. 1994. A suggested protocol for continuous flow automated analysis of seawater nutrients (phosphate, nitrate, nitrite and silicic acid) in the WOCE Hydrographic Program and the Joint Global Ocean Fluxes Study. In WOCE operations manual. WOCE report no. 68/91, revision 1. WHP Office Report WHPO91-1. Woods Hole Oceanographic Institution, Woods Hole, Mass.

Data Processing Description

The data have been examined to identify outliers, and no samples were removed from the dataset. There are values in the inorganic nutrient data which are below zero, and these should be considered as below the detection limit for the instrument.

BCO-DMO Processing Notes:
- Parameter names were modified to conform with BCO-DMO naming conventions.
- lat_start and lon_start were added by joining the data to the event log and matching on the unique event number.
- Replaced 'NaN' with 'nd' to indicate 'no data'.
- Replaced questionable NPOC value for cast 18, niskin 21 with 'nd' per request of PI (change made on 25 July 2016).

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Data Files

File
nutrients.csv (Comma Separated Values (.csv), 28.94 KB) MD5:a405a75442a200e076af3512e2ce250e Primary data file for dataset ID 473296

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Parameters

Parameter	Description	Units
cast	Consecutive cast number for the instrument.	dimensionless
station	Identification number of the sampling station.	dimensionless

date_start_utc	Date (UTC) given as 4-digit year -- 2-digit month -- 2-digit day in YYYYmmdd format.	unitless
time_start_utc	Time (UTC) given as hour -- minute.	HHMM
event_start	The event number from the ELOG maintained during the cruise.	dimensionless
lat_start	Latitude at the time the event started (from the cruise event log).	decimal degrees
lon_start	Longitude at the time the event started (from the cruise event log).	decimal degrees
niskin	Niskin bottle number.	dimensionless
depth	Depth.	meters (m)
press	Pressure.	decibars (db)
bots	The full range of Niskin bottles used for the sample collection. For this particular dataset this is equal to the Niskin number.	dimensionless
PO4	Phosphate.	micromoles per liter (umol/L)
NO3_NO2	Nitrate + nitrite.	micromoles per liter (umol/L)
silicate	Silicate.	micromoles per liter (umol/L)
NO2	Nitrite.	micromoles per liter (umol/L)
NH4	Ammonium.	micromoles per liter (umol/L)
NPOC	Non-purgeable organic carbon.	micromolar (uM)
TN	Total nitrogen.	micromolar (uM)

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Instruments

Dataset-specific Instrument Name	Alpkem RFA300
Generic Instrument Name	Alpkem RFA300
Dataset-specific Description	The analyses for phosphate (PO4), nitrate plus nitrite (NO3_NO2), nitrite (NO2), ammonium (NH4), and silicic acid (silicate) were performed using a hybrid Technicon AutoAnalyzerII and Alpkem RFA300.
Generic Instrument Description	A rapid flow analyser (RFA) that may be used to measure nutrient concentrations in seawater. It is an air-segmented, continuous flow instrument comprising a sampler, a peristaltic pump which simultaneously pumps samples, reagents and air bubbles through the system, analytical cartridge, heating bath, colorimeter, data station, and printer. The RFA-300 was a precursor to the smaller Alpkem RFA/2 (also RFA II or RFA-2).

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.

Dataset-specific Instrument Name	Shimadzu TOC-V
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	The concentrations of total organic carbon (TOC) and total nitrogen (TN) were determined with a Shimadzu TOC-VCSH total organic carbon analyzer coupled to a TNM-1 analyzer.
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

Dataset-specific Instrument Name	Technicon AutoAnalyzerII
Generic Instrument Name	Technicon AutoAnalyzer II
Dataset-specific Description	The analyses for phosphate (PO4), nitrate plus nitrite (NO3_NO2), nitrite (NO2), ammonium (NH4), and silicic acid (silicate) were performed using a hybrid Technicon AutoAnalyzerII and Alpkem RFA300.
Generic Instrument Description	A rapid flow analyzer that may be used to measure nutrient concentrations in seawater. It is a continuous segmented flow instrument consisting of a sampler, peristaltic pump, analytical cartridge, heating bath, and colorimeter. See more information about this instrument from the manufacturer.

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Deployments

KN210-04

Website	https://www.bco-dmo.org/deployment/59057
Platform	R/V Knorr
Start Date	2013-03-25
End Date	2013-05-09
Description	Western Atlantic cruise started at Montevideo, Uruguay and ended at Bridgetown, Barbados. Science Objectives: 1. Characterize deep ocean dissolved organic matter in water masses of western Atlantic Ocean. 2. Characterize microbial community at selected stations and at selected depths. 3. Characterize metabolic capabilities of surface, mesopelagic and bathypelagic microbial consortia vis-a-vis the degradation of organic matter from each zone. 4. Examine metabolic and phylogenetic links between microbes in different marine zones (surface, meso-pelagic and bathypelagic depths). Science Activities: 1. Collection of discrete water samples by Niskin-bottles. 2. Collection of microbial communities from these water samples, by in-situ pumping, or by net-traps and net-tows. 3. Incubation experiments in lab and on deck. 4. Underway mass spectrometry and flow cytometry, from seawater intake. More information is available from the WHOI Cruise Planning Synopsis. Additional cruise information and original data are available from the NSF R2R Data Catalog.

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Project Information

Dissolved Organic Matter Composition in the Deep Atlantic Ocean (Deep Atlantic DOM)

Coverage: Western Atlantic Ocean

Transformations of dissolved organic matter (DOM) in the deep ocean have profound impacts on the global carbon cycle due to the sequestration of carbon dioxide (CO2) away from the atmosphere. Although research has been conducted on the high molecular weight component of this material, the same cannot be said for low molecular weight DOM because the needed analytical techniques have not been available to determine its composition and reactivity.

In recent years, a research team at Woods Hole Oceanographic Institution has acquired the necessary analytical capability. As such, in this project, they will carry out the first systematic survey of deep ocean DOM in the western Atlantic Ocean to characterize the low molecular weight fraction of DOM in southward flowing North Atlantic Deep Water (NADW), northward flowing Antarctic Bottom Water (AABW), and Antarctic Intermediate Water (AAIW). Using ultrahigh resolution mass spectrometry and multi-stage fragmentation coupled to liquid chromatography, the scientists will determine the spatial variability in the composition of DOM along the flow path of the water masses, as well as assess the source water, transport, and surface processes that contribute to temporal changes in DOM composition. These results will be augmented with structural elucidation and quantitative assays of unique marker compounds for each water mass. Results will provide important insights into the biogeochemical reactions that govern DOM dynamics in the deep ocean.

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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.

Center for Chemical Currencies of a Microbial Planet (C-CoMP)

Website: https://ccomp-stc.org/

Coverage: North Atlantic, BATS, global/other

Functions carried out by microscopic inhabitants of the surface ocean affect every aspect of life on our planet, regardless of distance from the coast. Ocean phytoplankton are responsible for half of the photosynthesis on Earth, the first step in a complex system that annually withdraws 50 billion metric tons of carbon from the atmosphere to sustain their growth. Of this, 25 billion metric tons participate in a rapid cycle in which biologically reactive material is released into seawater and converted back into carbon dioxide by marine bacteria within hours to days. The chemical-microbe network at the heart of this fast cycle remains poorly constrained; consequently, its primary currencies and controls remain elusive; its sensitivities to changing ocean conditions are unknown; and its responses to future climate scenarios are not predictable. The Center for Chemical Currencies of a Microbial Planet (C-CoMP) integrates research, education and knowledge transfer activities to develop a mechanistic understanding of surface ocean carbon flux within the context of a changing ocean and through increased participation in ocean sciences. C-CoMP supports science teams that merge biology, chemistry, modeling, and informatics to close long-standing knowledge gaps in the identities and dynamics of organic molecules that serve as the currencies of elemental transfer between the ocean and atmosphere. C-CoMP fosters education, outreach, and knowledge transfer activities that engage students of all ages, broaden participation in the next generation of ocean scientists, and extend novel open-science approaches into complementary academic and industrial communities. The Center framework is critical to this mission, uniquely facilitating an open exchange of experimental and computational science, methodological and conceptual challenges, and collaborations that establish integrated science and education partnerships. With expanded participation in ocean science research and ocean literacy across the US society, the next generation of ocean scientists will better reflect the diverse US population.

Climate-carbon feedbacks on the marine carbon reservoir are major uncertainties for future climate

projections, and the trajectory and rate of ocean changes depend directly on microbial responses to temperature increases, ocean acidification, and other perturbations driven by climate change. C-CoMP research closes an urgent knowledge gap in the mechanisms driving carbon flow between ocean and atmosphere, with global implications for predictive climate models. The Center supports interdisciplinary science teams following open and reproducible science practices to address: (1) the chemical currencies of surface ocean carbon flux; (2) the structure and regulation of the chemical-microbe network that mediates this flux; and (3) sensitivity of the network and its feedbacks on climate. C-CoMP leverages emerging tools and technologies to tackle critical challenges in these themes, in synergy with existing ocean programs and consistent with NSF's Big Ideas. C-CoMP education and outreach activities seek to overcome barriers to ocean literacy and diversify participation in ocean research. The Center is developing (1) initiatives to expand ocean literacy in K-12 and the broader public, (2) ocean sciences undergraduate curricula and research opportunities that provide multiple entry points into research experiences, (3) post-baccalaureate programs to transition undergraduates into graduate education and careers in ocean science, and (4) interdisciplinary graduate student and postdoctoral programs that prepare the next generation of ocean scientists. The C-CoMP team includes education faculty who evaluate the impacts of education and outreach activities and export successful STEM initiatives to the education community. C-CoMP is revolutionizing the technologies for studying chemical transformations in microbial systems to build understanding of the outsized impact of microbes on elemental cycles. Open science, cross-disciplinary collaborations, community engagement, and inclusive practices foster strategic advances in critical science problems and STEM initiatives. C-CoMP science, education, and knowledge-transfer themes are efficiently addressed through a sustained network of scientists addressing critical research challenges while broadening the workforce that will tackle multi-disciplinary problems with academic, industrial and policy partners.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

The Program's Data Management Plan (DMP) is available as a PDF document.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1154320

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