CTD Profiles from R/V Knorr cruise KN207-03 in the North Atlantic (transect from Ponta Delgada, Azores to Reykjavik, Iceland) in 2012 (NA-VICE project)

Website: https://www.bco-dmo.org/dataset/3875
Version: 08 Feb 2013
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Project
» Lipid lubrication of oceanic carbon and sulfur biogeochemistry via a host-virus chemical arms race (NA-VICE)

Program
» Ocean Carbon and Biogeochemistry (OCB)

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Dataset Description

CTD data from a SeaBird 911+ collected during the KN207-03 cruise for the project 'Lipid lubrication of oceanic carbon and sulfur biogeochemistry via a host-virus chemical arms race'.

Methods & Sampling

See the CTD Configuration Report (PDF) and instrument calibration sheets (PDF).

Note regarding the SUNA nitrate sensor: The SUNA was set to output volts on a 0-5V scale. The range was set to 0-20 uM (0V=0uM, 5V=20uM) for casts 1-17. On cast 18, the range was changed to 0-40 uM and stayed that way for the remainder of the cruise.

Data Processing Description

Raw data was processed using Seasave software version 7.21e. BCO-DMO retrieved the processed downcast data files on 18 Feb 2013 and made the following modifications:
- Changed parameter names to conform to BCO-DMO conventions;
- Converted latitude and longitude from degrees and decimal minutes to decimal degrees;
- Added cast, date, time_start, lat_start, lon_start from the CTD file headers (time rounded to nearest minute);
- Removed a duplicate depth parameter (second column named 'DepSM') and the flag column (all values were 0).

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Data Files

File
KN207-03_ctd.csv (Comma Separated Values (.csv), 6.61 MB) MD5:f43b03674d435b08cf2f755f169e61ce Primary data file for dataset ID 3875

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Parameters

Parameter	Description	Units
cast	CTD cast number.	dimensionless
date	Date (GMT) of the CTD cast in YYYYmmdd format.	dimensionless
time_start	Time (GMT) at start of the CTD cast in HHMMSS format (rounded to the nearest minute).	HHMMSS
lat_start	Latitude in decimal degrees at start of CTD cast; negative = South.	decimal degrees
lon_start	Longitude in decimal degrees at start of CTD cast; negative = West.	decimal degrees
press	Water pressure, in decibars (db). (Originally named 'PrDM'.)	decibars
depth	Sample depth. (Originally named 'DepSM'.)	meters
temp	Temperature in degrees Celsius. (Originally named 'T090C'.)	degrees C
temp2	Temperature (in degrees Celsius) measured by secondary sensor. (Originally named 'T190C'.)	degrees C
cond	Conductivity measured in Siemens per meter. (Originally named 'C0S/m'.)	S/m

cond2	Conductivity (in Siemens per meter) measured by secondary sensor. (Originally named 'C1S/m'.)	S/m
sal	Salinity in practical salinity units, PSU. (Originally named 'Sal00'.)	PSU
sal2	Salinity in PSU measured by the secondary sensor. (Originally named 'Sal11'.)	PSU
O2_v	Raw oxygen reading in volts from SBE43 sensor. (Originally named 'Sbeox0V'.)	volts
O2	Oxygen measured in milliLiters per Liter from SBE43 sensor. (Originally named 'Sbeox0ML/L'.)	mL/L
trans	Beam transmission, as a percentage; from WET Labs CStar transmissometer. (Originally named 'Xmiss'.)	%
beam_c	Beam attenuation; from WET Labs CStar transmissometer. (Originally named 'Bat'.)	1/m
fluor	Fluorescence (in mg per cubic meter). (Originally named 'FlECO-AFL'.)	mg/m^3
turbidity	Turbidity measured using a Wet Labs FLNTURTD combination fluorometer and tubidity sensor. (Originally named 'Upoly0'.)	NTU
par	Irradiance (µmol photons m-2 s-1) measured by Biospherical Instruments PAR sensor.	umol photons per meter^2 per second
spar	Surface Irradiance (µmol photons m-2 s-1).	umol photons per meter^2 per second
sigma_0	Density (sigma-theta). (Originally named 'Sigma-e00'.)	kg/m^3
sigma_0_2	Density (sigma-theta) from secondary sensor. (Originally named 'Sigma-e11'.)	kg/m^3
potemp	Potential temperature in degrees Celsius; ITS-90. (Originally named 'Potemp090C'.)	degrees C
potemp2	Potential temperature in degrees Celsius; ITS-90 from secondary sensor. (Originally named 'Potemp190C'.)	degrees C
sal_diff	Practical salinity difference; sal2 - sal. (Originally named 'SecS-priS'.)	PSU

temp_diff	Temperature difference; temp2 - temp. (Originally named 'T2-T190C'.)	degrees C
cond_diff	Conductivity difference; cond2 - cond. (Originally named 'C2-C1S/m'.)	S/m
O2sat	Oxygen saturation in milliLiters per Liter; calculated using Garcia & Gordon method. (Originally named 'OxsolML/L'.)	mL/L
sound_vel	Sound velocity measured in meters per second. (Originally named 'SvWM'.)	m/s
geopot_anom	Geopotential anomaly measured in joules per kilogram. (Originally named 'Gpa'.)	J/kg
nitrate_SUNA	Output from SUNA Nitrate sensor. The sensor output is delivered to the CTD by 0 to +5V analog voltage to a dedicated port on the SBE9. The range was set to 0-20 uM (0V=0uM, 5V=20uM) for casts 1-17. On cast 18 the range was changed to 0-40 uM and stayed that way for the remainder of the cruise.(Originally named 'V6'.)	volts
ISO_DateTime_UTC	Starting date and time of cast formatted to ISO8601 standard. T indicates start of time string; Z indicates UTC.	YYYY-mm-ddTHH:MM:SS.ss

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Instruments

Dataset-specific Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	ISUS Nitrate sensor
Generic Instrument Name	ISUS Nitrate sensor
Dataset-specific Description	A SUNA nitrate sensor rated to 500-m depth was used (reported in the 'nitrate_SUNA' column). See the SUNA Manual (PDF).
Generic Instrument Description	The Satlantic ISUS nitrate sensor is an in-situ UV absorption sensor which calculates nitrate concentration from the seawater spectrum. The ISUS V2 has a 1cm path length, a 200-400 nm wavelength range., and is depth rated to 1000 m. Satlantic's ISUS V3 nitrate sensor uses advanced UV absorption technology to measure nitrate concentration in real-time.

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Deployments

KN207-03

Website	https://www.bco-dmo.org/deployment/58868
Platform	R/V Knorr
Start Date	2012-06-15
End Date	2012-07-14
Description	Description from the WHOI Cruise Synopsis: The 30 day "NA-VICE" (North Atlantic Virus Infection of Coccolithophores Expedition) cruise in June-July 2012 aboard the R/V Knorr followed a transect from Ponta Delgada, Azores to Reykjavik, Iceland. The goal for this cruise was to transect the region of the NEA spring bloom and to extensively sample the bloom when it is encountered. The cruise track was modeled after a recent study in this area that documented intense coccolithophore (and other haptophyte) blooms across Rockall Hatton Plateau to the Iceland Basin (55-63°N latitude) and coincided with elevated POC and TEP. The science plan calls for sampling of 12 water depths at 20 station locations. In addition, three stations were occupied for several days to allow opportunities for extended experiments and sinking particulate carbon collection and flux determination. Given that the timing of the bloom is difficult to predict exactly, the precise cruise track was determined by remote sensing data (satellite and autonomous glider from Rutgers) analyzed by the PIs a few days before and during the cruise. The cruise was supported by NSF award OCE-1061883. Additional cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Lipid lubrication of oceanic carbon and sulfur biogeochemistry via a host-virus chemical arms race (NA-VICE)

Coverage: North Atlantic; Azores to Iceland

This project is also called "**NA-VICE**" (North Atlantic Virus Infection of Coccolithophores Expedition).

Project description from NSF award abstract:
Despite the critical importance of viruses in shaping marine microbial ecosystems, very little is known about the

molecular mechanisms mediating phytoplankton-virus interactions. As a consequence, we currently lack biomarkers to quantify active viral infection in the oceans, significantly hindering our understanding of its ecological and biogeochemical impacts.

The coccolithophore *Emiliania huxleyi* (Prymnesiophyceae, Haptophyte) is a cosmopolitan unicellular photoautotroph whose calcite skeletons account for about a third of the total marine CaCO3 production. *E. huxleyi* forms massive annual spring blooms in the North Atlantic that are infected and terminated by lytic, giant double-stranded DNA containing coccolithoviruses. Findings that lytic viral infection of *E. huxleyi* recruits the hosts programmed cell death (PCD) machinery demonstrate that viruses employ a sophisticated, co-evolutionary “arms race” in mediating host-virus interactions. The investigators recently demonstrated that viral glycosphingolipids (vGSLs), derived from unexpected cluster of sphingolipid biosynthetic genes, a pathway never before described in a viral genome, play a crucial functional role in facilitating infection of *E. huxleyi*. The observations of vGSLs in the North Atlantic and Norwegian fjords further suggest that they may be novel, diagnostic biomarkers for viral infection of coccolithophore populations. At the same time, the discovery of vGSLs and a distinct, protective 802 lipid argues that a host-virus, co-evolutionary chemical arms race plays a pivotal role in regulating viral infection and in lubricating upper ocean biogeochemical fluxes of carbon and sulfur.

The focus of this collaborative research project is to elucidate the molecular, ecological, and biogeochemical links between vGSLs (and other polar lipids) and the global cycles of carbon and sulfur.

The team of investigators proposes a multi-pronged approach combing a suite of lab-based, mechanistic studies using several haptophyte-virus model systems along with observational studies and manipulative field-based experiments the Northeast Atlantic. Using these diagnostic markers, they will document active viral infection of natural coccolithophore populations and couple it with a suite of oceanographic measurements in order to quantify how viral infection (via vGSLs) influences cell fate, the dissolved organic carbon (DOC) pool, vertical export of particular organic (POC) and inorganic carbon (PIC; as calcium carbonate, CaCO3) (along with associated alkenone lipid biomarkers and genetic signatures of viruses and their hosts) and the upper ocean sulfur cycle (via the cycling of dimethylsulfide [DMS] and other biogenic sulfur compounds). Furthermore, given they are unique to viruses, the investigators propose that vGSLs can be used to trace the flow of virally-derived carbon and provide quantitative insights into a “viral shunt” that diverts fixed carbon from higher trophic levels and the deep sea.

The overarching hypothesis for this study is that vGSLs are cornerstone molecules in the upper ocean, which facilitate viral infection on massive scales and thereby mechanistically "lubricate" the biogeochemical fluxes of C and S in the 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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061883

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