Alongtrack data collected continuously by the ship's underway acquisition system 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/3743
Version: 05 Oct 2012
Version Date: 2012-10-05

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

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Dataset Description

This alongtrack data was recorded by the R/V Knorr's data logging system, Calliope, during the KN207-03 cruise from 06/15/12 to 07/14/12. **The data are preliminary; no QC has been done.**

Methods & Sampling

A .csv file was generated for each day of the cruise.

Known data acquisition problems:
On both **22 June 2012 from 11:20am (UTC) through 12:34pm (UTC)** and on **01 July 2012 from 09:36am (UTC) through 11:13pm (UTC)**: Underway Fluorometer and SBE45 sensors were flushed with fresh water and Fluorometer cell cleaned as data showed 'greens growing' behavior, ie fluorometer data steadily rising. Data columns affected are: **flr, sal_ss_SBE, temp_ss5_2, sal_ss, cond_mS**. Data from these items should be considered faulty from 11:20am UTC until 12:35pm UTC on 22 June 2012 and from 09:36am UTC until 11:14pm UTC on 01 July 2012, while waterflow was secured to these instruments for cleaning.

Data Processing Description

BCO-DMO retrieved the .csv files from the WHOI's Data Library and Archives (DLA) and the following edits were made:

- Blank values were replaced with 'nd' to indicate 'no data';
- Parameter names were changed to conform to BCO-DMO conventions;
- time_gmt was converted from HH:MM:SS format to HHMM.mm (hours, minutes, decimal minutes);
- temp_ss5_2 values for 01 July 2012 from 1136.37 to 1211.37 (time_gmt) were corrupt, containing undecipherable symbols. Those have been replaced with 'nd';
- The following parameters were removed from display:
  Depth35 (3.5 kHz depth) - all values were 0 or nd.
  HdChkSum61 - no data; column used for QC only.
  SBE45C - duplication of cond_mS; both are sea surface conductivity from the primary source (SBE45).
  SBE48T - duplication of temp_ss; both are sea surface temp from the primary sensor (SBE48).
  WXTS_Ta (air temp starboard) - values are identical to temp_air.
  WXTS_Pa (press_bar starboard) - values are identical to press_bar.
  WXTP_Ua (humidity port) - values are identical to humidity.

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Data Files

File
KN207-03_alongtrack.csv(Comma Separated Values (.csv), 10.69 MB) MD5:55294a250d8cf17162cd554553afe56a Primary data file for dataset ID 3743

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Parameters

Parameter	Description	Units
day_gmt	2-digit day of month (GMT).	dd (01 to 31)
month_gmt	2-digit month of year (GMT).	mm (01 to 12)
year_gmt	4-digit year (GMT).	YYYY
time_gmt	Time in GMT format; 24-hour clock.	HHMM.mm
date	Date (GMT).	YYYY/mm/dd
lat	Latitude; negative = South.	decimal degrees
lon	Longitude; negative = West.	decimal degrees
cond_mS	Sea surface conductivity from the primary source (SBE45). Originally named 'SSCND'.	mS/cm
temp_ss5	Sea surface temperature from primary sensor (SBE48) located in the bow chamber 5 meters below water level. Originally named 'SSTMP'.	degrees Celsius
sal_ss	Sea surface salinity calculated from the temperature and conductivity values measured by the SBE45 (temp_ss5_2 and cond_mS). Calculations made in accordance with UNESCO 44. Originally named 'Salinity'.	PSU
sal_ss_SBE	Surface salinity from SBE45 located in main lab. This value is provided by the instrument rather than being calculated from the temperature and conductivity values. (For calculated salinity see sal_ss.) Originally named 'SBE45S'.	PSU
depth_w_12	12 kHz depth from sea surface obtained from Knudsen bathymetry system. Originally named 'Depth12'.	meters
temp_air	Air temperature. Originally named 'AT'.	degrees Celsius

press_bar	Primary barometric pressure reading; corrected for 15.5 meter mast height (0.1185 millibars/m). Originally named 'BPR'.	millibars
humidity	Relative humidity (%) from best source. Sensor is mounted on the forward mast (15.5 meters above waterline). Originally named 'HRH'.	%
flr	Fluorescence measured by WetLabs Wet-Star fluorometer located in the Hydro Lab clean seawater piping. Measured in volts dc converted to MetraByte serial (count) data. 1 volt dc = +0100.00 counts.	counts
SPAR	Surface irradiance (or surface PAR) measured by QSR-2240A sensor. Surface irradiance values were calculated by dividing the net voltage reading by the calibration scale factor of 6.0452 V/(uE/cm^2/sec).	uE/cm^2/sec
precip_port	Rain accumulation obtained from the Vaisala WXT520 mounted on the forward mast port-side (15.5 m above waterline). The accumulation value is reset only when the sensor power is reset. Originally named 'WXTP_Rc'.	millimeters
precip_stbd	Rain accumulation obtained from the Vaisala WXT520 mounted on the forward mast stbd-side (15.5 m above waterline). The accumulation value is reset only when the sensor power is reset. Originally named 'WXTS_Rc'.	millimeters
precip_rate_port	Rain intensity obtained from the Vaisala WXT520 mounted on the forward mast port-side (15.5 m above waterline). Calculated over 10 second intervals. Originally named 'WXTP_Ri'.	mm
precip_rate_stbd	Rain intensity obtained from the Vaisala WXT520 mounted on the forward mast stbd-side (15.5 m above waterline). Calculated over 10 second intervals. Originally named 'WXTS_Ri'.	mm
wind_dir_r_port	Relative wind direction from port-side Vaisala WXT520. Data has not been corrected for sensor mounting alignment error. A 0-degree wind comes over the bow; 90-degree wind comes over the stbd side. Originally named 'WXTP_Dm'.	degrees
wind_dir_r_stbd	Relative wind direction from stbd-side Vaisala WXT520. Data has not been corrected for sensor mounting alignment error. A 0-degree wind comes over the bow; 90-degree wind comes over the stbd side. Originally named 'WXTS_Dm'.	degrees
wind_dir_c_port	True port-side wind direction. Calculated from the Vaisala WXT520. Raw data corrected for sensor alignment error and combined with gyro heading and sog and cog values. Originally named 'WXTP_TD'.	degrees
wind_dir_c_stbd	True stbd-side wind direction. Calculated from the Vaisala WXT520. Raw data corrected for sensor alignment error and combined with gyro heading and sog and cog values. Originally named 'WXTS_TD'.	degrees
wind_dir_c	True wind direction from the primary sensor (IMET). Calculations use heading and sog and cog data values. Originally named 'Wnd_TD'.	degrees
wind_speed_r_port	Relative port-side wind speed from the Vaisala WXT520. Wind sampling done at 2 Hz and averaged over 10 seconds. Originally named 'WXTP_Sm'.	meters/second
wind_speed_r_stbd	Relative stbd-side wind speed obtained from Vaisala WXT520. Wind sampling done at 2 Hz and averaged over 10 seconds. Originally named 'WXTS_Sm'.	meters/second
wind_speed_c_port	True port-side wind speed. Values calculated from the Vaisala WXT520. Raw data corrected for sensor alignment error and combined with the ship's heading and sog and cog values. Originally named 'WXTP_TS'.	meters/second
wind_speed_c_stbd	True stbd-side wind speed. Values calculated from the Vaisala WXT520. Raw data corrected for sensor alignment error and combined with the ship's heading and sog and cog values. Originally named 'WXTS_TS'.	meters/second

wind_speed_c	True wind speed from primary wind sensor (IMET). Calculations use heading and sog and cog values. Originally named 'Wnd_TS'.	meters/second
sound_vel	Sea surface sound velocity calculated from salinity and temp values (sal_ss and temp_ss5). Originally named 'SSV'.	meters/second
temp_ss5_2	Sea surface temperature measured by SBE45 sensor located in main lab plumbed into the uncontaminated salt water system. Intake located 5 meters below water level. Originally named 'SBE45T'.	degrees Celsius
temp_air_port	Air temperature obtained from the Vaisala WXT520 sensor mounted on forward mast port-side (15.5 m above waterline). Originally named 'WXTP_Ta'.	degrees Celsius
press_bar_port	Barometric pressure obtained from Vaisala WXT520. Data has been corrected for 15.5 meter mast height (0.1185 millibars per meter). Originally named 'WXTP_Pa'.	millibars
humidity_stbd	Relative humidity (%) obtained from Vaisala WXT520 mounted on forward mast stbd-side (15.5 m above waterline). Originally named 'WXTS_Ua'.	%
sog	Primary speed-over-ground obtained from the GPS.	knots
cog	Primary course-over-ground (true) obtained from the GPS.	degrees
speedlog	Ship's speed through the water from the Furuno Speedlog. Originally named 'SPD'.	knots
head	The ship's primary heading data. Originally named 'HDT'.	degrees true
ISO_DateTime_UTC	Date and time (UTC) formatted to ISO8601 standard.	YYYY-mm-ddTHH:MM:SS.ss

Instruments

Dataset-specific Instrument Name	Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	Wetlabs Wet-Star fluorometer located in the Hydro Lab clean seawater piping. A MetraByte A/D converter is used to convert the 0 - 5 volt dc fluorometer output to serial (count) data. Output: 0 - 5 VDC; 0 - 4095 counts.
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	Global Positioning System Receiver
Generic Instrument Name	Global Positioning System Receiver
Dataset-specific Description	Simrad MX512 GPS receiver.
Generic Instrument Description	The Global Positioning System (GPS) is a U.S. space-based radionavigation system that provides reliable positioning, navigation, and timing services to civilian users on a continuous worldwide basis. The U.S. Air Force develops, maintains, and operates the space and control segments of the NAVSTAR GPS transmitter system. Ships use a variety of receivers (e.g. Trimble and Ashtech) to interpret the GPS signal and determine accurate latitude and longitude.

Dataset-specific Instrument Name	Improved Meteorological Recorder
Generic Instrument Name	Improved Meteorological Recorder
Dataset-specific Description	humidity, air_temp, press_bar, true wind speed (wind_speed_c), and true wind direction (wind_dir_c) are obtained from the IMET sensors, mounted on the forward mast 15.5 meters about the waterline.
Generic Instrument Description	An IMET Recorder is an instrument package that can be mounted on a ship or buoy to record mean weather data including air and sea-surface temperature, incoming short and long-wave radiation, precipitation, humidity, wind velocity and barometric pressure. Each sensor in the system communicates digitally and returns calibrated values to a central data recorder.

Dataset-specific Instrument Name	Knudsen 320 BR deepwater echosounder
Generic Instrument Name	Knudsen 320 BR deepwater echosounder
Dataset-specific Description	Knudsen 320B/R with digital data logging and EPC graphic recorder. Array of twelve 3.5 kHz transducers located 5 meters below the surface.
Generic Instrument Description	The Knudsen 320 B/R deepwater echosounder is a digital data logging system used to measure water depth (e.g. depth of the seafloor). The system is configured to work with different frequency transducers. For example, the Edo 323 B is a 12 kHz High Frequency (HF) transducer or it can be configured to work with an array of 3.5 kHz Low Frequency (LF) transducers mounted in the hull of a vessel.

Dataset-specific Instrument Name	MicroTSG Thermosalinograph
Generic Instrument Name	MicroTSG Thermosalinograph
Dataset-specific Description	The SBE45 Thermosalinograph is mounted in the main lab and connected to the clean seawater system. The intake for the system in in the bow dome ~5 meters below water level. More information on this instrument is available on its spec sheet.
Generic Instrument Description	An externally powered, high-accuracy instrument, designed for shipboard determination of sea surface (pumped-water) conductivity and temperature. Salinity and sound velocity can also be computed.

Dataset-specific Instrument Name	Photosynthetically Available Radiation Sensor
Generic Instrument Name	Photosynthetically Available Radiation Sensor
Dataset-specific Description	Surface irradiance (or surface PAR) measured by Biospherical Instruments Inc. Model QSR-2240A.
Generic Instrument Description	A PAR sensor measures photosynthetically available (or active) radiation. The sensor measures photon flux density (photons per second per square meter) within the visible wavelength range (typically 400 to 700 nanometers). PAR gives an indication of the total energy available to plants for photosynthesis. This instrument name is used when specific type, make and model are not known.

Dataset-specific Instrument Name	SBE 48 Hull Temperature Sensor
Generic Instrument Name	Sea-Bird SBE 48 Hull Temperature Sensor
Dataset-specific Description	Hull Temperature Sensor; magnetically coupled SBE48 to measure sea surface temperature through the hull. Sensor is located in the bow chamber outboard of the UCSW pump, a few feet aft of the UCSW intake. Sensor housing is contained in an insulation jacket to limit the effect of ambient bow chamber air.
Generic Instrument Description	The SBE 48 is a high-accuracy temperature recorder with non-volatile memory, designed for shipboard determination of sea surface temperature. Installed with magnets just below the water line, the SBE 48's temperature sensor is in contact with the inside of the ship's hull. For more information, see the SBE48 Manual.

Dataset-specific Instrument Name	Speedlog
Generic Instrument Name	Speedlog
Dataset-specific Description	Model: Furuno DS-50 Doppler. The DS50 measures and displays the ship's over-the-ground or through-the-water speed based on the Doppler effect.
Generic Instrument Description	Measures Doppler near surface vessel speed through the water.

Dataset-specific Instrument Name	Weather Transmitter
Generic Instrument Name	Weather Transmitter
Dataset-specific Description	Vaisala WXT520 MET sensors mounted on both port and starborad side of the forward mast 15.5 meters above the water line.
Generic Instrument Description	The ship-mounted Vaisala Weather Transmitter WXT520 measures: Wind speed and direction; Liquid precipitation: rainfall, duration, intensity; Barometric pressure; Air temperature and Relative humidity. (for more information see http://www.vaisala.com/en/products/multiweathersensors/Pages/WXT520.aspx)

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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.

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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