Isotope data from USCGC Healy cruise HLY1202 from the Arctic, North of Alaska in 2012 (OA - Canada Basin project)

Website: https://www.bco-dmo.org/dataset/527905
Version: 09 September 2014
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Project
» Ocean Acidification in the Canada Basin: Roles of Sea Ice (OA - Canada Basin)

Program
» Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Contributors	Affiliation	Role
Onac, Bogdan	University of South Florida (USF)	Principal Investigator
Wynn, Jonathan	University of South Florida (USF)	Principal Investigator
Robbins, Lisa	United States Geological Survey (USGS)	Co-Principal Investigator, Contact
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Dataset Description

USGS Arctic Ocean Carbon Cruise 2012: Stable isotope Data
Stable isotope data for seawater samples from the HLY 2012 cruise

For aditional information see:
HLY1202 Cruise Report, Appendix E
U.S. Geological Survey Data Series 862 - Methods
USFSI Stable Isotope Lab

Methods & Sampling

Isotope Analyses

Seawater samples were collected for stable isotopic analysis by rinsing, then filling 125-mL bottles such that no headspace remained. Samples were fixed with 50 microliters (µL) of saturated mercuric chloride, and sealed with Teflon crimp caps containing a thin coating of Apiezon grease. Samples were refrigerated during storage prior to analysis. Analyses were completed at the University of South Florida Department of Geology Stable Isotope Laboratory using a Thermo-Finnigan Delta V 3 kiloelectron (keV) Isotope Ratio Mass Spectrometer coupled to a GasBench II preparation device. Analyses of d18O of H2O was completed by equilibrating 200

µL of sample with approximately 12 mL headspace of H2 in septum-capped vials. After equlibration, the isotopic composition of the headspace gas was measured (methods following Epstein and Mayeda, 1953; Prosser and Scrimgeour, 1995). Analyses of δ13C of dissolved inorganic carbon (DIC) was completed by injecting 1 mL of sample into an approximately 12-mL vial that was pre-flushed with He and pre-filled with 1 mL of 85 percent H3PO4 (methods following Assayag and others, 2006). The CO2 produced by this acid-stripping of the DIC was then measured after 24 h of equilibration. All stable isotope data are expressed in the conventional delta (d) notation:

Δ = [(Rsample-Rstandard)/Rstandard] × 1000‰

where Rsample and Rstandard is the 18O/16O ratio of the sample and standard, respectively, for d18O. The standard used as a reference for the d scale is VSMOW for H2O. Internal standards were used in the calibration to the VSMOW scale (VEEN and HTAMP waters with d18O = -13.17 per mil (‰) and +15.05‰) and PDB scale Carrara Marble and NBS-18 calcite). Analytical precision on these standards was better than 0.15‰ for d18O and 0.2‰ for d13C.

For aditional information see:
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Data Processing Description

Isotope Analyses

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The QA/QC process compared analysis results with calibrated reference standards

For aditional information see:
HLY1202 Cruise Report, Appendix E
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BCO-DMO Processing Notes
- Generated from original file: "HLY1202_Isotopes.csv" contributed by Lisa Robbins
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
- Date reformatted from MM/DD/YYYY to YYYYMMDD
- Time reformatted from HH:MM to HHMM
- "nd" (no data) inserted into blank fields

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Data Files

File
Isotopes.csv (Comma Separated Values (.csv), 17.80 KB) MD5:327d2a565fc24821e11871deb0443ec0 Primary data file for dataset ID 527905

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Parameters

Parameter	Description	Units
Sample_ID	Sample identification number. Duplicate samples identified by additional letter qualifier.	text
Bottle_ID	Used to identify rosette bottles from CTD station casts. Deepest bottle is 1. Shallowest bottle is 24.	dimensionless
Latitude	Latitude (South is negative); WGS 84	decimal degrees
Longitude	Longitude (West is negative); WGS 84	decimal degrees
Depth	Depth at which sample was taken. Zero (0) indicates surface sample	meters
d18O	Ratio of Oxygen-18 to Oxygen-16 as compared to VSMOW standard in per mil (parts per thousand).	Per mil (parts per thousand)
d13C	Ratio of Carbon-13 to Carbon-12 as compared to VPDB standard in per mil (parts per thousand).	Per mil (parts per thousand)

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Instruments

Dataset-specific Instrument Name	CTD SBE 911plus
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Discrete samples from vertical profile casts were collected at 4 locations. A 24-bottle Niskin rosette (12-L bottle volume) with an electronic trigger was fitted with a Sea-Bird SBE 911plus CTD and altimeter.
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	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Discrete samples from vertical profile casts were collected at 4 locations. A 24-bottle Niskin rosette (12-L bottle volume) with an electronic trigger was fitted with a Sea-Bird SBE 911plus CTD and altimeter.
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	pump-ship intake
Generic Instrument Name	Pump - Surface Underway Ship Intake
Dataset-specific Description	Samples were numbered incrementally throughout the duration cruises. A "surface" prefix indicates a sample taken from the ship's flow-through system.
Generic Instrument Description	The 'Pump-underway ship intake' system indicates that samples are from the ship's clean water intake pump. This is essentially a surface water sample from a source of uncontaminated near-surface (commonly 3 to 7 m) seawater that can be pumped continuously to shipboard laboratories on research vessels. There is typically a temperature sensor near the intake (known as the hull temperature) to provide measurements that are as close as possible to the ambient water temperature. The flow from the supply is typically directed through continuously logged sensors such as a thermosalinograph and a fluorometer. Water samples are often collected from the underway supply that may also be referred to as the non-toxic supply. Ideally the data contributor has specified the depth in the ship's hull at which the pump is mounted.

Dataset-specific Instrument Name	Thermo-Finnigan Delta V 3 kiloelectron (keV) Isotope Ratio Mass Spectrometer
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Analyses were completed at the University of South Florida Department of Geology Stable Isotope Laboratory using a Thermo-Finnigan Delta V 3 kiloelectron (keV) Isotope Ratio Mass Spectrometer coupled to a GasBench II preparation device
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

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Deployments

HLY1202

Website	https://www.bco-dmo.org/deployment/523780
Platform	USCGC Healy
Report	http://dmoserv3.whoi.edu/data_docs/OA_Canada_Basin/HEALY1202_FINAL_CRUISE_REPORT-3.pdf
Start Date	2012-08-26
End Date	2012-09-24
Description	Original cruise data are available from the NSF R2R data catalog USCGC Healy Science-Technical Support Summary From August 25 to September 27, 2012, the United States Coast Guard Cutter (USCGC) Healy was part of an Extended Continental Shelf Project to determine the limits of the extended continental shelf in the Arctic. On a non-interference basis, a USGS ocean acidification team participated on the cruise to collect baseline water data in the Arctic. The collection of data extended from coastal waters near Barrow, Alaska, to 83°2'N., -175°36'W., and southward back to coastal waters near Barrow and on to Dutch Harbor, Alaska. As a consequence, a number of hypotheses were tested and questions asked associated with ocean acidification, including: - What is the saturation state for different parts of the basin? - What factors drive the saturation state in the different parts of the basin? - How does saturation state compare to other regions? - How do the carbon fluxes compare in the different parts of the basin? - What is the buffering capacity of the water (Revelle factor)? - What kind of variability does carbon demonstrate in the Arctic (near shore versus offshore and diurnal)? During the cruise, underway continuous and discrete water samples were collected, and discrete water samples were collected at stations to document the carbonate chemistry of the Arctic waters and quantify the saturation state of seawater with respect to calcium carbonate. These data are critical for providing baseline information in areas where no data have existed prior and will also be used to test existing models and predict future trends.

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Project Information

Ocean Acidification in the Canada Basin: Roles of Sea Ice (OA - Canada Basin)

Website: http://coastal.er.usgs.gov/ocean-acidification/polar.html

Coverage: Beaufort Sea, Canada Basin

Extracted from the NSF award abstract:

The proposed research aims to identify mechanisms of ocean acidification and carbonate undersaturation in the Canada Basin of the Arctic Ocean. The investigators will use a 3-year dataset to address the role of two specific mechanisms involving sea-ice processes: (1) surface water freshening and undersaturation resulting from recent enhanced melting of multi-year sea-ice, and (2) surface water undersaturation resulting from a "carbon-pumping" mechanism driven by brine rejection and carbonate mineral precipitation during increasingly cyclical seasonal sea ice growth and decay. The proposed work would expand understanding of the inorganic carbon cycle, air-sea CO2 exchange rates and acidification in the Arctic Ocean. Understanding baselines and how they are changing is important for setting realistic parameters for process studies on the effects of ocean acidification on flora and fauna.

Models project the Arctic Ocean will become undersaturated with respect to carbonate minerals in the next decade. Recent field results indicate parts may already be undersaturated in late summer months when ice melt is at its greatest extent. However, few comprehensive datasets of carbonate system parameters in the Arctic Ocean exist. Researchers from the U.S. Geological Survey (USGS) and University of South Florida (USF) collected high-resolution measurements of pCO2, pH, total dissolved inorganic carbon (DIC), total alkalinity (TA), and carbonate (CO3-2) from the Canada Basin that fill critical information gaps concerning Arctic carbon variability. A Multiparameter Inorganic Carbon Analyzer (MICA) was used to collect approximately 1,800 measurements of pH and DIC along an 11,965-km trackline in August and September 2012. In addition, over

500 discrete surface water samples were taken. These data are being used to characterize and model regional pCO2, pH, and carbonate mineral saturation state. A high-resolution, three-dimensional map of these results will be presented.

Data collected on the August 2012 Arctic Cruise will be used to create regional maps of seawater carbonate parameters, including pCO2 flux/change maps, and derivative maps on saturation state. Maps depicting pCO2 and carbonate saturation states over large latitudinal and nearshore to offshore gradients are needed for the Arctic, where significant decline of carbonate ecosystems, habitats, and calcifying organisms are predicted over the next decade. The data will allow the USGS to map variations in ocean chemistry along designated tracks and will be used in models to predict future Arctic Ocean saturation states.

Note: Jonathan Wynn is a former Pricipal Investigator for this project

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Program Information

Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Website: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477

Coverage: global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

Solicitations issued under this program:
NSF 10-530, FY 2010-FY2011
NSF 12-500, FY 2012
NSF 12-600, FY 2013
NSF 13-586, FY 2014
NSF 13-586 was the final solicitation that will be released for this program.

PI Meetings:
1st U.S. Ocean Acidification PI Meeting(March 22-24, 2011, Woods Hole, MA)
2nd U.S. Ocean Acidification PI Meeting(Sept. 18-20, 2013, Washington, DC)
3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA – Tentative)

NSF media releases for the Ocean Acidification Program:

Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification

Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?

Discovery nsf.gov - National Science Foundation (NSF) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation (NSF)

Press Release 12-179 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation (NSF)

Press Release 13-102 World Oceans Month Brings Mixed News for Oysters

Press Release 13-108 nsf.gov - National Science Foundation (NSF) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation (NSF)

Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants

Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation (NSF)

Press Release 14-010 nsf.gov - National Science Foundation (NSF) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation (NSF)

Press Release 14-116 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: NSF awards $11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation (NSF)

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Funding

Funding Source	Award
NSF Arctic Sciences (NSF ARC)	PLR-1220032

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