CO2-system and auxiliary data from the Northern Gulf of Mexico from samples collected during R/V Pelican cruise PE18-09 in September of 2017

Website: https://www.bco-dmo.org/dataset/821117
Data Type: Cruise Results
Version: 1
Version Date: 2020-08-18

Project
» NSFOCE-BSF: Collaborative Research: The Role and Mechanisms of Nuclei-induced Calcium Carbonate Precipitation in the Coastal Carbon Cycle: A First In-depth Study (Nuclei CaCO3 Precip)

Contributors	Affiliation	Role
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Abstract
CO2-system and auxiliary data from the Northern Gulf of Mexico from samples collected during R/V Pelican cruise PE18-09 in September of 2017.

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Coverage

Spatial Extent: **N**:29.172 **E**:-89.262 **S**:28.059 **W**:-95.5236
Temporal Extent: 2017-09-10 - 2017-09-16

Dataset Description

CO2-system and auxiliary data from the Northern Gulf of Mexico from samples collected during R/V Pelican cruise PE18-09 in September of 2017.

Methods & Sampling

Discrete seawater samples and depth, temperature and salinity data were acquired using a SeaBird Electronics rosette, equipped with a CTD (Sea-Bird Electronics SBE 911 plus). Sampling for carbonate system parameters (TA, DIC and pH) commenced immediately after the recovery of the rosette to ship's deck and employed the standard procedures described by (Dickson et al., 2007), and was followed by sampling for nutrients (TON, SRP, Silica). Samples were kept at room temperature until their analysis. Nutrient samples were collected into

15 ml plastic vials, to which 100 µL of 0.1 M HCl were added.
Total alkalinity measurements were conducted at Wang's laboratory at WHOI by a modified Gran titration procedure (Cai et al., 2010; Huang et al., 2012). The titrations were conducted potentiometrically with an automated titrator (AS-ALK2; Apollo SciTech) using an open-cell configuration and a ROSSTM combination electrode (Thermo Fisher Scientific) at a controlled temperature. The titrant (HCl, 0.07 M) concentration was determined by titration of Certified Reference Material (CRM) provided by Dr. A.G. Dickson at the Scripps Institution of Oceanography. The precision and accuracy of total alkalinity measurements is better than ± 2 µmol kg-1.
The DIC concentrations were measured at Wang's laboratory at WHOI, using a NDIR-based DIC autoanalyzer (AS-C3, Apollo SciTech), calibrated with CRM. The NDIR-based DIC analyzer (AS-C3, Apollo SciTech) uses N2 to purge CO2 from a known volume of acidified seawater sample. The CO2 in the resulting gas stream is dried using a Nafion membrane trap, which is constantly flushed with a counter-flow of dried room air. Then, the CO2 content of the gas stream is quantified by a NDIR CO2 analyzer (LI-7000, LICOR). This instrument has a precision and accuracy of better than ±2.0 µmol kg−1.
Discrete pH samples were measured in Wang's lab at WHOI using 10 cm path-length optical cells and analyzed at 25°C within a few weeks after sampling. Discrete pH measurements were based on the conventional spectrophotometric procedure using purified m-cresol purple as an indicator and 10 cm path-length optical cells (Dickson et al., 2007; Liu et al., 2011) on a HP 8453 spectrophotometer, with a precision of ±0.0004 and an accuracy of 0.001-0.002 pH units.
Nutrient (Nitrate, soluble reactive phosphate and silicic acid) measurements were conducted at Lazar's laboratory at the Inter-University Institute for oceanography in Eilat, Israel. The analysis will be conducted colorimetrically, using a Flow Injection Analyzer (FIA, LACHAT Instruments Quik-Chem 8500) (Grasshoff et al., 2009). Accuracy was obtained by calibration against a commercial, high-concentration standard (Merck).

Instruments:
Discrete seawater samples and depth, temperature and salinity data were acquired using a SeaBird Electronics rosette, equipped with a CTD (Sea-Bird Electronics SBE 911 plus).

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* Data submitted in file MSP_BRA_Data20200729.xlsx in sheets "Mississippi" and "Brazos" extracted to csv format.
* column Plume added with values "Mississippi" and "Brazos." Data from both sheets combined into one table.
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions (spaces, +, and - changed to underscores). Units in parentheses removed and added to Parameter Description metadata section.
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.
* Added column ISO_DateTime_UTC in format yyyy-mm-ddTHH:MMZ using Time_UTC, Month, Day columns with year as 2017.
* Latitude and Longitude columns rounded to five decimal places
* Clarified parameter descriptions with submitter, "Silica" is Si(OH)4 and Salinity :Sal" are PSU.
* Submitter indicated the submitted file had an issue. The Na+ column should not have been divided by 1000 before submission to us. To resolve this, the data was exported from the Excel file without formatting so the full decimal values could be accessed (if exported with formatting Excel had, all Na+ values would have been 0.000). After Na+ multiplied by 1000, then the original formatting shown in the excel file was applied to the dataset for all columns.

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Data Files

File
co2.csv(Comma Separated Values (.csv), 13.24 KB) MD5:6cf08e037e2e9c0e2bc6eafd33c0f1e0 Primary data file for dataset ID 821117

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Related Publications

Cai, W.-J., Hu, X., Huang, W.-J., Jiang, L.-Q., Wang, Y., Peng, T.-H., & Zhang, X. (2010). Alkalinity distribution in the western North Atlantic Ocean margins. Journal of Geophysical Research, 115(C8). doi:10.1029/2009jc005482 https://doi.org/10.1029/2009JC005482
Methods

Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to best practices for ocean CO2 measurements. PICES Special Publication 3, 191 pp. ISBN: 1-897176-07-4. URL: https://www.nodc.noaa.gov/ocads/oceans/Handbook_2007.html https://hdl.handle.net/11329/249
Methods

Grasshoff, K., Kremling, K., & Ehrhardt, M. (Eds.). (2009). Methods of seawater analysis. John Wiley & Sons. https://isbnsearch.org/isbn/978-3-527-61399-1
Methods

Huang, W.-J., Wang, Y., & Cai, W.-J. (2012). Assessment of sample storage techniques for total alkalinity and dissolved inorganic carbon in seawater. Limnology and Oceanography: Methods, 10(9), 711–717. doi:10.4319/lom.2012.10.711
Methods

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Parameters

Parameter	Description	Units
Plume	River plume sampled	unitless
Month	Month	unitless
Day	Day	unitless
Time_UTC	Date (UTC) in format yyyy-mm-dd	unitless
ISO_DateTime_UTC	Datetime (UTC) in ISO 8601:2004 format yyyy-mm-ddTHH:MMZ	unitless
Latitude	degrees	decimal degrees
Longitude	degrees	decimal degrees
Depth	water depth	meters (m)
Temp	water temperature	degrees Celsius
Sal	water salinity	Practical Salinity Units (PSU)
TA	Total Alkalinity	micromoles per kilogram (umol/kg)
DIC	Dissolved Inorganic Carbon	micromoles per kilogram (umol/kg)
pH	pH	total scale
TON	Total oxideized nitrogen	micromoles per kilogram (umol/kg)
SRP	Soluble reactive phosphate	micromoles per kilogram (umol/kg)
Silica	dissolved Si(OH)4	micromoles per kilogram (umol/kg)
Ca_2plus	dissolved Ca2+	moles per kilogram (mol/kg)
Na_plus	dissolved Na+	moles per kilogram (mol/kg)

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Discrete seawater samples and depth, temperature and salinity data were acquired using a SeaBird Electronics rosette, equipped with a CTD (Sea-Bird Electronics SBE 911 plus).
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

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Deployments

PE18-09

Website	https://www.bco-dmo.org/deployment/821124
Platform	R/V Pelican
Start Date	2017-09-09
End Date	2017-09-15

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Project Information

NSFOCE-BSF: Collaborative Research: The Role and Mechanisms of Nuclei-induced Calcium Carbonate Precipitation in the Coastal Carbon Cycle: A First In-depth Study (Nuclei CaCO3 Precip)

Coverage: Northern Red Sea (Eilat, Israel), Mississippi / Sabine/ Brazos River plumes and Galveston Bay in the northern Gulf of Mexico

NSF Abstract:

The formation of calcium carbonate (CaCO3) in seawater is a fundamental pathway in the marine carbon cycle. Calcium carbonate formation may occur through biological production (calcification by organisms building shells or skeletal material) or through non-biological (abiotic, or chemical) processes. Although most surface seawater in both open and coastal waters is supersaturated in calcium carbonate, several factors inhibit the abiotic production of calcium carbonate. Therefore the current paradigm is that most calcium carbonate formation in seawater is biological. However, laboratory experiments have demonstrated that addition of solid-phase particles to supersaturated seawater promotes nuclei-induced $CaCO_3$ precipitation (NICP) by providing "seeds" for precipitation. NICP has been demonstrated in the Little Bahama Banks during events of re-suspension of $CaCO_3$-rich sediments. Until very recently, essentially no evidence has shown that NICP occurs in typical marine systems where suspended particles have relatively low $CaCO_3$ content. A recent study by the Israeli partners in this project provides evidence that NICP may play a significant role in the carbon budget in the Red Sea, as a result of an influx of particulate material caused by flash floods and potentially airborne dusts. Such a finding suggests that NICP may be an important $CaCO_3$ formation pathway that has been mostly ignored in the ocean carbon cycle. The goal of this project is to conduct the first comprehensive, in-depth study to evaluate the significance of NICP in the oceans. The project is an international collaboration between U.S. and Israeli scientists, jointly funded by NSF and the U.S.-Israel Binational Science Foundation. A postdoctoral researcher whose Ph.D. work forms the foundation for this study will be supported through this project. An Israeli masters-level student and one U.S. minority undergraduate intern will be advised and trained in this project.

The project will use an integrated approach to assess different mechanisms that may result in NICP, including riverine sediment input, land-derived particle influx via flash floods, bottom sediment resuspension, and atmospheric dust input. Field investigations will be done in a suite of coastal environments: the northern Red Sea, the Mississippi and Sabine River plumes and Galveston Bay in the northern Gulf of Mexico, each of which receive significant quantities of non-carbonate rich sediments. The investigators will also conduct controlled laboratory experiments to verify and extend field observations. If NICP is shown to be significant, this finding could promote a reexamination of important parts of the carbon cycle and the response of the ocean carbon system to ongoing perturbations.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1635388

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