Benthic chamber geochemical data obtained with an in situ benthic lander from the R/V Savannah at sampling stations across the Louisiana shelf and slope in the Northern Gulf of Mexico during four cruise between July 2021 and July 2022

Website: https://www.bco-dmo.org/dataset/959033
Data Type: Cruise Results
Version: 1
Version Date: 2025-09-03

Project
» Importance of Riverine Discharge on the Benthic Flux of Alkalinity to Continental Margins (NGoM Benthic Alk Flux)

Contributors	Affiliation	Role
Taillefert, Martial	Georgia Institute of Technology (GA Tech)	Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

This data set reports benthic flux measurements of dissolved inorganic carbon (DIC), orthophosphate (SPO43-), ammonium (NH4+), total alkalinity (TA), carbon isotopic fractionation of DIC (13-C-DIC), dissolved manganese (Mnd), dissolved calcium (Cad), nitrate (NO3-), and excess bromide (Br-) injected in the chamber as chemical tracer. In summer 2021, benthic flux data were obtained from benthic chamber deployments at eleven different stations on the Louisiana Shelf and slope in the Northern Gulf of Mexico during July 15-27, 2021 using two different benthic landers. These stations span two transects, one from the middle of the shelf offshore from Cocodrie, LA to the mouth of the Mississippi River North West Pass, and another from North West Pass of the Mississippi River mouth to the south, across the slope. A single station (St. 15) was also sampled on the eastern side of the second transect in the transition from the shelf break to the mid-slope. All benthic chamber samples were processed within an hour after collection. In fall 2021, benthic flux data were obtained from benthic chamber deployments at ten different stations on the Louisiana Shelf and slope in the Northern Gulf of Mexico between October 25 and November 10, 2021 using two different benthic landers. These stations span two transects, one from the middle of the shelf offshore from Cocodrie, LA to the mouth of the Mississippi River South West Pass, and another from South West Pass of the Mississippi River mouth to the south, across the slope. Two stations (St. 15 and St. 12) were also sampled on a second transect from the shelf break to the slope southeast of the Bird’s Foot. In spring 2022, benthic flux data were obtained from benthic chamber deployments at ten different stations on the Louisiana Shelf and slope in the Northern Gulf of Mexico during April 9-20, 2021 using two different benthic landers. These stations span two transects, one from the middle of the shelf offshore from Cocodrie, LA to the mouth of the Mississippi River South West Pass, and another from South West Pass of the Mississippi River mouth to the south, across the slope. Two stations (St. 15 and St. 12) were also sampled on a second transect from the shelf break to the slope southeast of the Bird’s Foot. In summer 2022, benthic flux data were obtained from benthic chamber deployments at eleven different stations on the Louisiana Shelf and slope in the Northern Gulf of Mexico in July 9 -23, 2022 using two different benthic landers. These stations span two transects, one from the middle of the shelf offshore from Cocodrie, LA to the mouth of the Mississippi River South West Pass, and another from South West Pass of the Mississippi River mouth to the south, across the slope. Two stations (St. 15 and St. 12) were also sampled on a second transect from the shelf break to the slope southeast of the Bird’s Foot. Samples were immediately filtered through 0.22-micrometer (µm) PSE syringe filters and either analyzed immediately onboard (SPO43-), preserved acidified with hydrochloric acid at 4 degrees Celsius (Cad, Mnd), frozen (NH4+, NO3-, Br-), or preserved at 4 degrees Celsius after addition of HgCl2 (TA) until analysis. In addition, samples for DIC, TA, and carbon isotopic analyses were preserved in glass bottles, whereas other samples were preserved in polypropylene containers. DIC and TA were analyzed by Gran titration (Gran, 1952) using temperature-controlled closed cells (Dickson et al. 2007), orthophosphate and ammonium by spectrophotometry (Murphy and Riley, 1962; Strickland and Parsons, 1972), the carbon isotopic signature by isotope ratio mass spectrometry (Wang et al, 2018), Mnd and Cad by ICP-MS (Magette et al., 2025 In review), and NO3- and Br- by high performance liquid chromatography (HPLC) (Beckler et al., 2014). In summer 2022, benthic chamber and pore water DIC and TA samples were analyzed by cavity ring-down spectrometry (CRDS, Picarro G2131-i) with an automatic CO2 extraction system (Apollo SciTech AS-D1) and open-cell potentiometric titrations, respectively (Ferreira et al., 2025).

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Coverage

Location: Louisiana Shelf, Northern Gulf of Mexico
Spatial Extent: **N**:28.94785 **E**:-88.60532 **S**:28.19917 **W**:-91.33712
Temporal Extent: 2021-07-15 - 2022-07-23

Methods & Sampling

Benthic chamber samples were collected using two in situ benthic landers configured similarly, one tethered to the surface for shelf measurements (< 100 meters (m)) adapted from a previously developed platform (Tercier-Waeber and Taillefert, 2008; Meiggs et al., 2011), the other is a modified version of the free Benthic Experiment Chamber Instrument (BECI) developed for deep-sea measurements (Jahnke and Christensen, 1989). Both landers are autonomous and programmed before deployment. They carry a single benthic chamber, two sampling racks holding 50-milliliter (ml) polypropylene syringes for the injection of a chemical tracer and the sampling of up to 18 samples (Jahnke and Christensen, 1989). The shelf lander chamber is gently mixed using a SBEST Seabird pump, whereas the deep-sea chamber is mixed mechanically at slow speed (5-10 rpm). The benthic chambers are closed using hydraulically-controlled actuators after a settling period of 20 minutes on the seafloor. A chemical tracer is injected 10 minutes after the lid is closed, and the first sample is collected 2 minutes after tracer injection to determine the volume of the overlying waters in the benthic chamber (Rao and Jahnke, 2004). Samples are then collected with different frequencies depending on the time of deployment (ranging from 60 minutes on the shelf to 115 minutes for deep-sea measurements). Both landers were recovered within an hour after the last benthic chamber sample was collected. The benthic water samples were then filtered within an hour after lander recovery onto 0.22-micrometer (µm) Whatman 25-millimeter (mm) Acrodisc syringe filters (PES membrane) and either preserved until analysis or analyzed immediately onboard ship. Samples were preserved at 4 degrees Celsius (C) after acidification (Ca_d, Mn_d) or addition of $HgCl_2$ (δ^{13}C-DIC, TA), preserved at -20 degrees C (NH_4^+, NO_3^-, Br^-), or dispensed directly into reagents for analysis (SPO_4^{3-}). Sealed borosilicate glass vials were used for TA, DIC, and δ^{13}C-DIC as recommended (Dickson et al., 2007; Wang et al., 2018).

NH_4^+ was measured spectrophotometrically by the indophenol blue method (Strickland and Parsons, 1972), SPO_4^{3-} was measured spectrophotometrically using the molybdate-blue method after natural color correction to avoid interferences from dissolved silica and sulfides (Murphy and Riley, 1962). DIC and TA were measured by acid titration in a closed cell with continuous pH measurements (Dickson et al., 2007; Rassmann et al., 2016), except in July 2022 when DIC and TA were measured by cavity ring-down spectrometry (CRDS, Picarro G2131-i) with an automatic CO_2 extraction system (Apollo SciTech AS-D1) and open-cell potentiometric titrations, respectively (Ferreira et al., 2025). δ^{13}C-DIC was measured using an isotope ratio mass spectrometer with a high-performance liquid chromatography preparation module for gas samples (Brandes, 2009; Wang et al., 2018). NO_3^- and Br^- were measured by high-performance liquid chromatography (HPLC) using a matrix elimination method developed for seawater samples without dilution (Beckler et al., 2014). Finally, Ca_d and Mn_d were measured by ICP-MS with collision cell to prevent argon interferences.

Internal standards were used to correct for the drift of the instrument, and quality control blanks, standard checks, and certified seawater references were run several times during each run to control accuracy and reproducibility. All calibrations were conducted with at least five standards prepared in a 0.54 M NaCl matrix before each series of measurements. Blanks and quality control checks were run routinely during each analysis. Finally, calibration sensitivities were compared routinely to ensure the accuracy of the methods. For DIC analyses, Dickson DIC-certified seawater samples were run routinely during analyses to validate the accuracy of the method. Errors of all reported concentrations represent the analytical error propagated from calibration curves, dilution, and instrumental drift.

Data Processing Description

Spectrophotometric measurements were recorded on paper forms specifically designed for each analysis and digitized to process the data. DIC, TA, δ^{13}C-DIC, HPLC, and ICP-MS data were acquired by computers. DIC and TA concentrations were determined by non-linear least squares fitting of the DIC and total alkalinity equations in seawater to the titration data (Magette et al., 2025). NO_3^-, and Br^- chromatographic data were integrated using a Matlab-based software developed in-house (Bristow and Taillefert, 2008). TA, δ^{13}C-DIC, and ICP-MS data were processed through Excel macro spreadsheet routines developed for each of these analyses.

BCO-DMO Processing Description

- Imported the four original files into the BCO-DMO system (original file names: GOM_Summer2021_BenthicChamberData_BCO-DMO.xlsx, GOM_Fall2021_BenthicChamberData_BCO-DMO.xlsx, GOM_Spring2022_BenthicChamberData_BCO-DMO.xlsx, GOM_Summer2022_BenthicChamberData_BCO-DMO.xlsx)
- Flagged "nd", "#N/A", and "--" as missing data values; missing data are empty/blank in the final CSV file.
- Concatenated the four data files into a single data file.
- Added column for the cruise ID.
- Created Date field in YYYY-MM-DD format.
- Renamed fields to comply with BCO-DMO naming conventions.
- Rounded the Time_h column to 2 decimal places.
- Saved the final file as "959033_v1_nGoM_benthic_chamber_2021-2022.csv".

Problem Description

Missing data are typically due to pore water volumes being too small to be able to conduct all analyses in the same sample. All data provided have been analytically validated via the procedures described above.

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Data Files

File	
959033_v1_nGoM_benthic_chamber_2021-2022.csv Primary data file for dataset ID 959033, version 1	(Comma Separated Values (.csv), 102.37 KB) MD5:862f14123b001fc50e06cff4ae1cd30f

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Related Publications

Beckler, J. S., Nuzzio, D. B., & Taillefert, M. (2014). Development of single-step liquid chromatography methods with ultraviolet detection for the measurement of inorganic anions in marine waters. Limnology and Oceanography: Methods, 12(8), 563–576. doi:10.4319/lom.2014.12.563
Methods

Brandes, J. A. (2009). Rapid and precise δ13C measurement of dissolved inorganic carbon in natural waters using liquid chromatography coupled to an isotope-ratio mass spectrometer. Limnology and Oceanography: Methods, 7(11), 730–739. Portico. https://doi.org/10.4319/lom.2009.7.730
Methods

Bristow, G., & Taillefert, M. (2008). VOLTINT: A Matlab®-based program for semi-automated processing of geochemical data acquired by voltammetry. Computers & Geosciences, 34(2), 153–162. doi:10.1016/j.cageo.2007.01.005
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 https://isbnsearch.org/isbn/1-897176-07-4
Methods

Ferreira, E., Lansard, B., Monvoisin, G., Magette, E., Boever, A., Bridgham, H., Bombled, B., Beckler, J. S., Taillefert, M., & Rabouille, C. (2025). Benthic biogeochemical processes and fluxes in the hypoxic and acidified northern Gulf of Mexico (nGoM), part I: Carbonate dissolution from in situ microprofiles. Marine Chemistry, 270, 104515. https://doi.org/10.1016/j.marchem.2025.104515
Results

Ferreira, E., Lansard, B., Monvoisin, G., Magette, E., Boever, A., Bridgham, H., Bombled, B., Beckler, J., Taillefert, M., & Rabouille, C. (2024). Benthic Biogeochemical Reactions and Fluxes in the Hypoxic and Acidified Northern Gulf of Mexico (Ngom), Part I: Carbonate Dissolution from in Situ Microprofiles. https://doi.org/10.2139/ssrn.5020184
Results

Jahnke, R. A., & Christiansen, M. B. (1989). A free-vehicle benthic chamber instrument for sea floor studies. Deep Sea Research Part A. Oceanographic Research Papers, 36(4), 625–637. https://doi.org/10.1016/0198-0149(89)90011-3
Methods

Meiggs, D., & Taillefert, M. (2011). The effect of riverine discharge on biogeochemical processes in estuarine sediments. Limnology and Oceanography, 56(5), 1797–1810. Portico. https://doi.org/10.4319/lo.2011.56.5.1797
Methods

Murphy, J., & Riley, J. P. (1962). A modified single solution method for the determination of phosphate in natural waters. Analytica Chimica Acta, 27, 31–36. doi:10.1016/s0003-2670(00)88444-5
Methods

Rao, A. M. F., & Jahnke, R. A. (2004). Quantifying porewater exchange across the sediment-water interface in the deep sea with in situ tracer studies. Limnology and Oceanography: Methods, 2(3), 75–90. Portico. https://doi.org/10.4319/lom.2004.2.75
Methods

Rassmann, J., Lansard, B., Pozzato, L., & Rabouille, C. (2016). Carbonate chemistry in sediment porewaters of the Rhone River delta driven by early diagenesis (northwestern Mediterranean). Biogeosciences, 13(18), 5379–5394. doi:10.5194/bg-13-5379-2016
Methods

Strickland, J. D. H., & Parsons, T. R. (1972). A Practical Handbook of Seawater Analysis, 2nd edition. Fisheries Research Board of Canada. https://doi.org/10.25607/OBP-1791
Methods

Tercier-Waeber, M.-L., & Taillefert, M. (2008). Remote in situ voltammetric techniques to characterize the biogeochemical cycling of trace metals in aquatic systems. J. Environ. Monit., 10(1), 30–54. https://doi.org/10.1039/b714439n https://doi.org/10.1039/B714439N
Methods

Wang, H., Hu, X., Rabalais, N. N., & Brandes, J. (2018). Drivers of Oxygen Consumption in the Northern Gulf of Mexico Hypoxic Waters—A Stable Carbon Isotope Perspective. Geophysical Research Letters, 45(19). Portico. https://doi.org/10.1029/2018gl078571 https://doi.org/10.1029/2018GL078571
Methods

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Parameters

Parameter	Description	Units
Date	Date of sample collection	unitless
Year	Year of sample collection	unitless
Month	Month of sample collection	unitless
Day	Day of sample collection	unitless
Cruise_ID	Cruise ID	unitless
Collection_Type	Description of sample	unitless
Station	Station ID	unitless
Lon	Longitude of sample collection; negative values = West	decimal degrees
Lat	Latitude of sample collection	decimal degrees
sample_ID	sample_ID	unitless
Time_h	Incubation time in hours	hours (h)
DIC_mM	Dissolved inorganic carbon (DIC)	millimolar (mM)
sdDIC_mM	Standard deviation of Dissolved inorganic carbon (DIC)	millimolar (mM)
PO4_uM	Orthophosphate (PO4)	micromolar (uM)
sdPO4_uM	Standard deviation of Orthophosphate (PO4)	micromolar (uM)
NH4_uM	Ammonium (NH4)	micromolar (uM)
sdNH4_uM	Standard deviation of Ammonium (NH4)	micromolar (uM)
TA_mM	Total alkalinity (TA)	millimolar (mM)
sdTA_mM	Standard deviation of Total alkalinity (TA)	millimolar (mM)

d13C_DIC_permille	Carbon isotopic fractionation of DIC	per mille
sdd13C_DIC_permille	Standard deviation of Carbon isotopic fractionation of DIC	per mille
Mnd_uM	Dissolved manganese (Mnd)	micromolar (uM)
sdMnd_uM	Standard deviation of dissolved manganese (Mnd)	micromolar (uM)
Cad_mM	Dissolved calcium (Cad)	millimolar (mM)
sdCad_mM	Standard deviation of dissolved calcium (Cad)	millimolar (mM)
NO3_uM	Nitrate (NO3)	micromolar (uM)
sdNO3_uM	Standard deviation of nitrate (NO3)	micromolar (uM)
ExBr_mM	Excess bromide (ExBr)	millimolar (mM)
sdExBr_mM	Standard deviation of excess bromide (ExBr)	millimolar (mM)

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Instruments

Dataset-specific Instrument Name	benthic chamber
Generic Instrument Name	benthic incubation chamber
Dataset-specific Description	Benthic chamber samples were collected with a benthic lander and sampling racks designed and fabricated at Georgia Tech.
Generic Instrument Description	A device that isolates a portion of seabed plus overlying water from its surroundings. Either returns the entire system to the surface or incorporates sampling devices and/or in-situ sensors.

Dataset-specific Instrument Name	benthic lander
Generic Instrument Name	benthic lander
Dataset-specific Description	Benthic chamber samples were collected with a benthic lander and sampling racks designed and fabricated at Georgia Tech. Electronic equipment controlling the autonomous benthic lander sample collection was designed and developed by Analytical Instrument Systems, Inc. in collaboration with the Georgia Tech group. The shelf lander included a SBEST Seabird pump to mix the overlying waters, whereas the deep-sea lander carried a mechanical stirrer designed and fabricated by Georgia Tech.
Generic Instrument Description	A benthic lander is an autonomous research platform used in marine research to take measurements directly on the seafloor. Benthic landers are carrier systems to which different measuring and sampling devices can be attached. They transport these devices to the seafloor and back up again. Autonomous means that the lander is not connected to the ship via a cable. It can thus work independently on the seafloor for a long period of time.

Dataset-specific Instrument Name	cavity ring-down spectrometry
Generic Instrument Name	Cavity enhanced absorption spectrometers
Dataset-specific Description	DIC was measured by cavity ring-down spectrometry with a Picarro G2131-i and an Apollo SciTech AS-D1 automatic CO2 extraction system.
Generic Instrument Description	Instruments that illuminate a sample inside an optical cavity, typically using laser light, and measure the concentration or amount of a species in gas phase by absorption spectroscopy. Techniques include cavity ring-down spectroscopy (CRDS) and integrated cavity output spectroscopy (ICOS).

Dataset-specific Instrument Name	HPLC
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	HPLC measurements were conducted with a Waters 1525 binary pump with degasser, coupled to a Waters 2487 dual absorbance detector, and Waters 2707 Autosampler.
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

Dataset-specific Instrument Name	Agilent 7900e ICP-MS
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	Cad and Mnd measurements were conducted with an Agilent 7900e ICP-MS with SPS4 Autosampler.
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

Dataset-specific Instrument Name	Thermo Electron SurveyorLite autosampler
Generic Instrument Name	Laboratory Autosampler
Dataset-specific Description	δ13C-DIC measurements were conducted with a Thermo Electron SurveyorLite autosampler, a Surveyor MS HPLC pump, and an LC Isolink interface coupled to a Thermo Scientific Delta V plus stable isotope mass spectrometer.
Generic Instrument Description	Laboratory apparatus that automatically introduces one or more samples with a predetermined volume or mass into an analytical instrument.

Dataset-specific Instrument Name	Waters 2707 Autosampler
Generic Instrument Name	Laboratory Autosampler
Dataset-specific Description	HPLC measurements were conducted with a Waters 1525 binary pump with degasser, coupled to a Waters 2487 dual absorbance detector, and Waters 2707 Autosampler.
Generic Instrument Description	Laboratory apparatus that automatically introduces one or more samples with a predetermined volume or mass into an analytical instrument.

Dataset-specific Instrument Name	SPS4 Autosampler.
Generic Instrument Name	Laboratory Autosampler
Dataset-specific Description	Cad and Mnd measurements were conducted with an Agilent 7900e ICP-MS with SPS4 Autosampler.
Generic Instrument Description	Laboratory apparatus that automatically introduces one or more samples with a predetermined volume or mass into an analytical instrument.

Dataset-specific Instrument Name	Beckman Coulter DU 720 UV-vis
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	All spectrophotometric measurements were conducted with a Beckman Coulter DU 720 UV-vis spectrophotometer.
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.

Dataset-specific Instrument Name	Thermo Scientific Delta V plus
Generic Instrument Name	Thermo Fisher Scientific DELTA V Plus isotope ratio mass spectrometer
Dataset-specific Description	δ13C-DIC measurements were conducted with a Thermo Electron SurveyorLite autosampler, a Surveyor MS HPLC pump, and an LC Isolink interface coupled to a Thermo Scientific Delta V plus stable isotope mass spectrometer.
Generic Instrument Description	The Thermo Scientific DELTA V Plus is an isotope ratio mass spectrometer designed to measure isotopic, elemental and molecular ratios of organic and inorganic compounds. The DELTA V Plus is an enhanced model of the DELTA V series of isotope ratio mass spectrometers, which can be upgraded from the DELTA V Advantage. The DELTA V Plus can be operated in Continuous Flow or Dual Inlet mode and can accommodate up to 10 collectors, ensuring flexibility to cover many applications. The DELTA V Plus is controlled by an automated, integrated Isodat software suite. A magnet, whose pole faces determine the free flight space for the ions, eliminates the traditional flight tube. The magnet is designed for fast mass switching which is further supported by a fast jump control between consecutive measurements of multiple gases within one run. The sample gas is introduced at ground potential, eliminating the need for insulation of the flow path, ensuring 100 percent transfer into the ion source. The amplifiers register ion beams up to 50 V. The DELTA V Plus has refined optics, enabling greater ion transmission than the DELTA V Advantage. It has a sensitivity of 800 molecules per ion (M/I) in Dual Inlet mode and 1100 M/I in Continuous Flow mode. It has a system stability of < 10 ppm and an effective magnetic detection radius of 191 nm. It has a mass range of 1 - 96 Dalton at 3 kV.

Dataset-specific Instrument Name	Metrohm 877 Titrino Plus
Generic Instrument Name	Titrator
Dataset-specific Description	DIC and TA measurements were obtained with a computer-controlled Metrohm 877 Titrino Plus.
Generic Instrument Description	Titrators are instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

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Deployments

SAV-21-24

Website	https://www.bco-dmo.org/deployment/959040
Platform	R/V Savannah
Start Date	2021-10-18
End Date	2021-11-19
Description	See more information at R2R: https://www.rvdata.us/search/cruise/SAV-21-24

SAV-21-15

Website	https://www.bco-dmo.org/deployment/959038
Platform	R/V Savannah
Start Date	2021-07-02
End Date	2021-07-30
Description	See more information at R2R: https://www.rvdata.us/search/cruise/SAV-21-15

SAV-22-06

Website	https://www.bco-dmo.org/deployment/959044
Platform	R/V Savannah
Start Date	2022-04-01
End Date	2022-05-01
Description	See more information at R2R: https://www.rvdata.us/search/cruise/SAV-22-06

SAV-22-11

Website	https://www.bco-dmo.org/deployment/959047
Platform	R/V Savannah
Start Date	2022-07-01
End Date	2022-07-29
Description	See more information at R2R https://www.rvdata.us/search/cruise/SAV-22-11

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Project Information

Importance of Riverine Discharge on the Benthic Flux of Alkalinity to Continental Margins (NGoM Benthic Alk Flux)

NSF Award Abstract

Ocean acidification is the process that lowers the pH of the ocean over time due to uptake of atmospheric carbon dioxide. This project investigates how chemical reactions in marine sediments exposed to high riverine sediment loads influence ocean acidification in coastal waters. Although we know that ocean acidification affects marine life and commercial fisheries in coastal waters, little is known about how acidification processes in the water column are influenced by reactions occurring in sediments on the sea floor. The role of large sediment deposits from rivers in these processes has also never been investigated. This study will be conducted in the Mississippi River and Gulf of Mexico. The Mississippi River transports a high sediment load to the continental shelf in the Gulf of Mexico and plays an important role in the economy of the southern coast of the United States. Results from this study will be useful to the oceanographic community for increasing understanding of ocean acidification processes in delta and shelf environments. It will also benefit decision makers interested in predicting the role of sediments on the nutrient -rich Louisiana shelf for discharge control purposes. This project also has an important educational component by training undergraduate, graduate, and postdoctoral students, providing experiences at sea for undergraduates, and conducting outreach activities with K-12 students.

The geochemical and microbiological processes responsible for the transformation of particles deposited on the seafloor will be characterized near the Mississippi River mouth and along the nearby continental slope. The release of acids (CO2) and bases (alkalinity) from the sediment will be quantified using autonomous instruments deployed on the seafloor to determine whether sediments contribute to the acidity of the surrounding water column or instead provide bases to buffer the water column from atmospheric CO2 inputs. As the Mississippi River discharge during the later Winter and Spring provides much more sediment to the coastal zone compared to the rest of the year, research cruises will be taken twice a year to determine how seasonal variations in riverine discharge affect the release of acids and bases into the water column. Mathematical models will then be used to predict the effect of seasonal variations on acids or bases release to the water column. This study will therefore provide a quantitative understanding of the role of large sediment depositions to the seafloor on sediment geochemical and microbiological processes and their feedback to the overlying waters. Simultaneously, a large data set will be generated and used to calibrate mathematical models and better characterize benthic-pelagic interactions. Such efforts are needed to predict how continental margins respond to constantly increasing stress from anthropogenic activities.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1948914

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