Salinity, radium/thorium radionuclide, and nitrogen oxide concentration measurements from surface and porewater samples collected in coastal South Carolina from 2017 to 2019

Website: https://www.bco-dmo.org/dataset/869708
Data Type: Other Field Results
Version: 1
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Project
» A New Method for Assessing the Magnitude and Impact of Shallow Seawater/Pore water Exchange in Salt Marsh Systems (Salt Marsh Water Exchange)

Contributors	Affiliation	Role
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Abstract
Surface and porewater salinity, radium/thorium radionuclide measurements, and nitrogen oxide concentration measurements.

Table of Contents

Coverage

Spatial Extent: **N**:32.8963 **E**:-79.8965 **S**:32.6474 **W**:-79.968
Temporal Extent: 2017-05-31 - 2019-09-28

Methods & Sampling

Location:
Folly Island and Marsh, South Carolina, 32.68 N, 79.95 W
Daniel Island creek/marsh, South Carolina 32.89 N, 79.9 W

Sampling and analytical procedures:

Water samples were poured through PCV columns containing 15 grams of manganese impregnated fiber. The columns were returned to the lab (collection times were recorded to account for decay before counting) where the fiber was rinsed with deionized water and dried with compressed air to the point of no excess water expulsion. The samples were then weighed so that constant water content could be achieved between counting.

The RaDeCC counters had previously been flushed with air for a minimum of 15 minutes. Once the sample was attached, the system was flushed with helium and then closed trapping the helium. The samples were then counted three different times. The first count was directly after being rinsed and dried. The second count happened three days later. The third count happens approximately 3 weeks later, the sample is counted for 6 hours. The level of moisture is checked between each counting and adjusted by weight. The collection and counting method is adapted from Moore (2007) and Moore and Arnold (1996).

After the three counts on the RaDeCC the fibers are leached following an adapted method outlined by Moore et al (1985). In brief, the fibers are heated in a mixture of hydrochloric acid and hydroxylamine hydrochloride until pale. The fibers are then filtered and rinsed with hydrochloric acid and water. The leachate is then treated with barium nitrate (saturated) and 1 molar sodium hydrogen sulfate (or 1 molar sodium sulfate) and stirred to form a precipitate. After settling, the precipitate is centrifuged with excess liquid removed. The precipitate is then aged 2 weeks and counted using the WeGe.

For the determination of NOX, the method from Schnetger, Bernhard & Lehners, Carola. (2014) was used. In brief, the sample is collected in a glass vial and transported to the lab. To analyze nitrite a ratio of 10:1 sample to reagent (1:1 of NEED 0.004 M and Sulfanilamide 0.12 M) is incubated at 45C for 30 minutes or 60 minutes at room temperature. The absorbance is then measured at 540 nm. Total nitrogen oxide analysis is then performed using a 1:1.5 ratio of sample to reagent (5:1:1 of VCl_3 0.05 M: NEED 0.004 M: Sulfanilamide 0.12 M) where the sample is incubated for 60 minutes at 45C, then absorbance is measured at 540 nm. A correction is made to account for the amount of NO_2 lost by conversion to NO to obtain a final corrected value for NOX total nitrogen oxides.

Data Processing Description

Data from both the RaDeCC and WeGe are in text files. The relevant numbers from the raw data are transferred to Excel spreadsheets where calculations (including decay, coincidence counts, error) are performed to obtain final results.

Excel version: Microsoft® Excel® for Microsoft 365 MSO (Version 2111 Build 16.0.14701.20254) 64-bit .

BCO-DMO Data Manager Processing Notes:
* First sheet named "Water" imported from Excel file ALLDATA_ToSubmitWater.xlsx into the BCO-DMO data system.
* Parameters (column names) renamed to comply with BCO-DMO naming conventions. See https://www.bco-dmo.org/page/bco-dmo-data-processing-conventions
* Date format converted to ISO 8601 date format yyyy-mm-dd
* There were a few time formats that had extra seconds as :00, these were stripped of to match the time format hh:mm of the rest of the dataset.
* DateTime in UTC converted to ISO 8601 format yyyy-mm-ddTHH:MMZ
* Latitude and longitude rounded to five decimal places (from 8).
* Longitude made negative since West is negative in decimal degrees.
* The following columns rounded to two decimal places (guidance from submitter). exRa224_dpm_per_L, Ra223 dpm_per_L ,Th228 dpm_per_L , Ra226_dpm, Ra228_dpm, Ra226_dpm_L, Ra228_dpm_per_L
* column names NOX and NOX_Std_dev changed to Nitrate_and_Nitrite and Nitrate_and_Nitrite_std_dev for clarity Columns also rounded to one decimal place. (guidance from submitter).

[table of contents | back to top]

Data Files

File
water_exchange.csv(Comma Separated Values (.csv), 16.26 KB) MD5:2bc8d2352953f6875c2a5f5c79e1ac3f Primary data file for dataset ID 869708

[table of contents | back to top]

Related Publications

Moore, W. S. (2008). Fifteen years experience in measuring 224Ra and 223Ra by delayed-coincidence counting. Marine Chemistry, 109(3-4), 188–197. doi:10.1016/j.marchem.2007.06.015
Methods

Moore, W. S., & Arnold, R. (1996). Measurement of 223Ra and224Ra in coastal waters using a delayed coincidence counter. Journal of Geophysical Research: Oceans, 101(C1), 1321–1329. doi:10.1029/95jc03139
https://doi.org/10.1029/95JC03139
Methods

Moore, W. S., Key, R. M., & Sarmiento, J. L. (1985). Techniques for precise mapping of226Ra and228Ra in the ocean. Journal of Geophysical Research, 90(C4), 6983. https://doi.org/10.1029/jc090ic04p06983
https://doi.org/10.1029/JC090iC04p06983
Methods

Schnetger, B., & Lehners, C. (2014). Determination of nitrate plus nitrite in small volume marine water samples using vanadium(III)chloride as a reduction agent. Marine Chemistry, 160, 91–98. doi:10.1016/j.marchem.2014.01.010
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Sample_Name	Name of sample	unitless
Sample_Type	Surface or Pore Water	unitless
Year_Collected	Year sample was collected in format YYYY.	unitless
Collection_date	Date sample was collected in ISO 8601 format YYYY-MM-DD.	unitless
ISO_DateTime_UTC	Date and time of collection in ISO 8601 format YYYY-MM-DDThh:mmZ	Time UTC
Latitude	Latitude of sample location	decimal degrees
Longitude	Longitude of sample location (West is negative)	decimal degrees
Salinity	Salinity of water sample	Parts per trillion(ppt)
exRa224_dpm_per_L	Excess Radium224 measured	Decays per minute per liter (dpm/L)
Ra223_dpm_per_L	Radium223 measured	Decays per minute per liter (dpm/L)
Th228_dpm_per_L	Thorium228 measured	Decays per minute per liter (dpm/L)
Ra226_dpm	Radium 226 measured	Decays per minute (dpm)
Ra228_dpm	Radium 228 measured	Decays per minute (dpm)
Ra226_dpm_per_L	Radium 226 measured	Decays per minute per liter (dpm/L)
Ra228_dpm_per_L	Radium 228 measured	Decays per minute per liter (dpm/L)
Nitrate_and_Nitrite	Nitrogen oxides measured	Micromolar (uM)
Nitrate_and_Nitrite_std_dev	Nitrogen oxides measured standard deviation	Micromolar (uM)
Collection_time	Time (local EST/EDT) sample was collected in ISO 8601 format hh:mm.	

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Well Germanium Crystal Gamma Ray Detector (WeGe)
Generic Instrument Name	Gamma Ray Spectrometer
Dataset-specific Description	Well Germanium Crystal Gamma Ray Detector (WeGe), Manufactured by Canberra, used to measure 226Ra and 228Ra.
Generic Instrument Description	Instruments measuring the relative levels of electromagnetic radiation of different wavelengths in the gamma-ray waveband.

Dataset-specific Instrument Name	Radium Delayed Coincidence Counter
Generic Instrument Name	Radium Delayed Coincidence Counter
Dataset-specific Description	Radium Delayed Coincidence Counter, Manufactured by Scientific Computer Instruments. Used to measure 220Rn and 219Rn which allows for the quantification of 224Ra, 223Ra, and 228Th.
Generic Instrument Description	The RaDeCC is an alpha scintillation counter that distinguishes decay events of short-lived radium daughter products based on their contrasting half-lives. This system was pioneered by Giffin et al. (1963) and adapted for radium measurements by Moore and Arnold (1996). References: Giffin, C., A. Kaufman, W.S. Broecker (1963). Delayed coincidence counter for the assay of actinon and thoron. J. Geophys. Res., 68, pp. 1749-1757. Moore, W.S., R. Arnold (1996). Measurement of 223Ra and 224Ra in coastal waters using a delayed coincidence counter. J. Geophys. Res., 101 (1996), pp. 1321-1329. Charette, Matthew A.; Dulaiova, Henrieta; Gonneea, Meagan E.; Henderson, Paul B.; Moore, Willard S.; Scholten, Jan C.; Pham, M. K. (2012). GEOTRACES radium isotopes interlaboratory comparison experiment. Limnology and Oceanography - Methods, vol 10, pg 451.

Dataset-specific Instrument Name	YSI Model 30
Generic Instrument Name	Salinity Sensor
Dataset-specific Description	YSI Model 30 Salinity Conductivity Temperature, Model 30/50 FT, Manufactured by YSI Incorporated, used for salinity and temperature measurements
Generic Instrument Description	Category of instrument that simultaneously measures electrical conductivity and temperature in the water column to provide temperature and salinity data.

Dataset-specific Instrument Name	PushPoint sippers
Generic Instrument Name	Sediment Porewater Sampler
Dataset-specific Description	PushPoint sippers, Manufactured by M.H.E Products, use to collect pore water samples.
Generic Instrument Description	A device that collects samples of pore water from various horizons below the seabed.

Dataset-specific Instrument Name	YSI Model 30
Generic Instrument Name	Temperature Logger
Dataset-specific Description	YSI Model 30 Salinity Conductivity Temperature, Model 30/50 FT, Manufactured by YSI Incorporated, used for salinity and temperature measurements.
Generic Instrument Description	Records temperature data over a period of time.

[table of contents | back to top]

Project Information

A New Method for Assessing the Magnitude and Impact of Shallow Seawater/Pore water Exchange in Salt Marsh Systems (Salt Marsh Water Exchange)

NSF Award Abstract:
Tidal marshes are critical junctions between marine and terrestrial chemical processes. The chemical and physical processes that tidal marsh sediments undergo determine the nature of the transformation and accumulation of particulate organic carbon (POC) at the marine to terrestrial interface. Physical transport of pore water through marsh sediments greatly influences the availability of carbon and nutrients that can undergo transformative reactions at the marine to terrestrial interface. Past studies have shown that there is a discrepancy between predicted rates of pore water flow and calculated estimates from tracer studies. Because this flow is crucial to the chemistry of sediment at the terrestrial to marine interface, which is the first junction of the chemical species exported to the ocean, it is important to explain the discrepancy between expected rates of flow and observed rates. This study will use a known tracer method based on natural isotopic ratios (224Radon/228Thorium) and will develop a new method (223Radon/ 227Actinium) to evaluate the export of POC due to pore water flow in tidal marsh sediments, which will have much broader impacts to the overall marine carbon budget. Results from this work will also be integrated into workshops that will educate students and teachers from outside of oceanography about oceanographic carbon and climate research. Presentations will also be developed in collaboration with the South Carolina State Museum as part of the Science Café series. Additionally, one graduate student and one undergraduate student will be supported by this funding.

Predicted advection rates of pore water in very fine-grained tidal marsh sediments have been shown to significantly differ from rates calculated using tracer studies. Because tidal marshes are a crucial chemical link at the marine terrestrial interface, and advection has a significant impact on the availability of chemical species to undergo diagenetic reactions at this interface, it is of significant importance to evaluate this discrepancy. Export of particulate organic carbon (POC) and dissolved organic carbon (DIC), in particular, are of interest, due to the impact on microbial communities within sediments. This research aims to validate the method of 224Ra/228Th disequilibrium to calculate pore water exchange rates. Previous studies using this method have provided evidence for more rapid pore water exchange than would generally be expected in such fine-grained sediments, which are less permeable than coarser grained sediment. Additionally, this research will attempt to develop the disequilibrium method for 223Ra/227Ac. The researchers will evaluate the impact of advection rates on the export of chemical species in salt marshes.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1559274

[table of contents | back to top]