Underway data from estuary transects in Coastal Gulf of Maine (Pleasant, Maine; St. John, New Brunswick) in May and October of 2018 and 2019

Website: https://www.bco-dmo.org/dataset/918590
Data Type: Other Field Results
Version: 1
Version Date: 2024-01-26

Project

» Collaborative Research: Organic Alkalinity: Impacts of the [OTHER] Alkalinity on Estuary and Coastal Ocean Chemistry (organic alkalinity)

Contributors	Affiliation	Role
Hunt, Christopher	University of New Hampshire (UNH)	Principal Investigator
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

This dataset contains underway data from four organic alkalinity estuary transects, in May and October of 2018 and 2019, completed in the Pleasant (Maine, USA) and St. John (New Brunswick, Canada) estuaries. See "Related Datasets" section for alkalinity data. Discrete samples were collected at intervals of salinity along each estuary. An underway measurements system was also operated during each transect. Discrete samples were analyzed via a number of methods described below. Underway measurements were collected using the procedures described in Hunt et al. (2013). Organic alkalinity is a poorly understood component of the estuarine and coastal ocean acid-base system. This lack of understanding makes assessment of ocean acidification vulnerability and inorganic carbon dynamics more difficult. However, the methods used to quantify organic alkalinity and its effects on the acid-base system are not standardized. In this work we examined several approaches for the measurement of organic alkalinity, and their application to inorganic carbon dynamics.

Table of Contents

Coverage

Location: Coastal Gulf of Maine: Pleasant (Maine, USA) and St. John (New Brunswick, CA)
Spatial Extent: **N**:45.941 **E**:-66.001 **S**:44.48 **W**:-67.764
Temporal Extent: 2018-05-15 - 2019-10-24

Dataset Description

This project was a collaboration between Dr. Christopher W. Hunt and Dr. Joseph Salisbury (of the University of New Hampshire) and Dr. Xuewu Liu and Dr. Robert H. Byrne (of the University of South Florida).

Methods & Sampling

Sampling was conducted during day trips on Pleasant (Maine, USA) and St. John (New Brunswick, CA) estuaries in May and October 2018 and 2019.

* See "Related Datasets" section for access to the related organic alkalinity data described below.

Sample Collection:

Four surveys were conducted of both the Pleasant and St. John estuaries, in May and October 2018, and again in May and October 2019 in order to assess potential differences in estuary conditions between spring and fall seasons. Estuary samples were collected during single-day surveys on small vessels in each system, departing from Addison Maine for Pleasant estuary surveys and from St. John, New Brunswick, for St. John surveys. Estuary water was continuously pumped to an underway measurement system, which recorded location, salinity(Seabird SBE-45), water temperature (Seabird SBE-45), and the partial pressure of carbon dioxide (pCO_2) among other parameters. Surveys were started on the incoming tide and lasted through high tide and into the ebb tide. At intervals determined from the underway salinity, surface water was captured for discrete sample collection. During the October 2017 and May 2018 surveys a Niskin bottle was lowered overboard by hand; during the later surveys a 10-liter high-density polyethylene (HDPE) carboy was rinsed and filled from the outflow of the underway system, then tightly capped until samples were drawn from a spout at the bottom of the carboy. River endmember samples were collected from above the final downstream dam on each river. For the Pleasant, this dam formed a physical tidal barrier, and the transition from river to estuary was immediate. For the St. John the closest site was in Fredericton New Brunswick, a location over 120 km from the estuary mouth along the river's course. For both endmember sites, a plastic bucket was lowered from the center of a bridge over the river, rinsed three times with river water, and samples were collected as described above. The temperature and conductivity of samples were measured directly from the bucket with a handheld meter (YSI, Yellow Springs, Ohio).

Water from the Niskin or carboy was transferred without bubbling into individual, previously-flushed borosilicate glass BOD bottles: 500 mL for alkalinity and pH_T analyses, and 300 mL for inorganic carbon (DIC) analysis. All bottles had greased stoppers and positive closure mechanisms, were filled to leave less than 1% headspace in the bottle, and were preserved with saturated mercuric chloride solution. Samples for silicate and phosphate analysis were filtered using a plastic syringe and 0.2 µm cartridge filter into acid-washed and previously-rinsed 50 mL HDPE vials and preserved with chloroform. Samples for DOC were filtered as was done for the nutrients into acid-washed and previously-rinsed 30 mL HDPE bottles. All samples were immediately placed on ice. Alkalinity, pH, and DIC samples were refrigerated until analysis; nutrient and DOC samples were frozen until analysis.

BCO-DMO Processing Description

* Underway data files were provided as SeaBASS format .sb files. These were loaded into matlab using the sbread.m file provided by the submitter (included in supplemental package on this dataset underway_data_sb_format.zip). Data were then converted to matlab table and exported as .csv format.

* .csv form of the data were imported into BCO-DMO's data system and concatenated into one table. Additional column ISO_DateTime_UTC added. Data imported with missing data identifier designated as -9999
** Missing data values are displayed differently based on the file format you download. They are blank in csv files, "NaN" in MatLab files, etc.

* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

* sbread() loads and performs some reformatting of the data (for example, extraneous trailing .000000 on integers like year were removed).
* commands used to convert .sb to .csv

```
files = dir('*.sb') ; % you are in the folder where mat files are present
N = length(files) ;

for i = 1:N
```

```
[data,fields,units,header]=sbread(files(i).name)
T = array2table(data,'VariableNames',fields)

outfile = regexprep(files(i).name,'sb$','csv')
writetable(T,outfile);
end
```

Data Files

File
918590_v1_underway-data.csv   (Comma Separated Values (.csv), 17.01 MB)   MD5:810bf5ae706cce63c3c15dcab03bdb61   Primary data file for dataset ID 918590, version 1.   See "BCO-DMO Data Processing" section for more information about how this table was created from source files contained in underway_data_sb_format.zip

---

Supplemental Files

File
Underway data system files (.sb) [Alternate data format]   filename: underway_data_sb_format.zip   (ZIP Archive (ZIP), 4.74 MB)   MD5:de8e991c6ee08051a2a6f83456516f0b   Underway data system file for each estuary survey in SeaBASS (.sb) format which includes header lines and comment lines preceding the data.   files named: FLO_L3_yyyymmdd_yyyy_2sec.sb = underway data system file for each estuary survey.   Matlab m-file (sbread.m) is also contained in this package which reads data and metadata from the .sb files and performs reformatting (for example trailing decimal .000000 values stripped from integers like year).   function [data,fields,units,header]=sbread(sbfile);   % [data,fields,units,header,fieldwvln]=sbread(sbfile);   % Reads in data from SeaBASS files and assigns field names to 'fields', units   % to 'units', data to 'data', and header parameters to 'header'. List of   % header parameters is in 'header.parameters' and all of the header text is in   % 'header.all'. Time in the format hh:mm:ss is reformated to decimal hours and   % inserted in place of the orignal. Uses function NEAREST.M   The primary data table for this dataset was produced by loading .sb files using sbread(), converting to table type, and exporting as csv files. All subtables were concatenated into one table. See "BCO-DMO Processing Notes" section.

Related Publications

Cai, W.-J., Wang, Y., & Hodson, R. E. (1998). Acid-Base Properties of Dissolved Organic Matter in the Estuarine Waters of Georgia, USA. Geochimica et Cosmochimica Acta, 62(3), 473–483. doi:10.1016/s0016-7037(97)00363-3 https://doi.org/10.1016/S0016-7037(97)00363-3
Methods

Hinckley, Jessica A., "The Non-Conservative Behavior of Organic Alkalinity in Simulated Gulf of Maine Estuary Mixing" (2021). Master's Theses and Capstones. 1512. https://scholars.unh.edu/thesis/1512
Results

Hunt, C. W., Salisbury, J. E., & Vandemark, D. (2013). CO_2 Input Dynamics and Air–Sea Exchange in a Large New England Estuary. Estuaries and Coasts, 37(5), 1078–1091. https://doi.org/10.1007/s12237-013-9749-2
Methods

Hunt, C.W., Salisbury, J.E., Liu, X., and R.H. Byrne. 2023. Estuary Organic Alkalinity Distributions,

Characteristics, and Application to Carbonate System Calculations (in prep).
Results

Hunt, Christopher, "Alkalinity and Buffering in Estuarine, Coastal and Shelf Waters" (2021). Doctoral Dissertations. 2623. https://scholars.unh.edu/dissertation/2623
Results

Kerr, D. E., Turner, C., Grey, A., Keogh, J., Brown, P. J., & Kelleher, B. P. (2023). OrgAlkCalc: Estimation of organic alkalinity quantities and acid-base properties with proof of concept in Dublin Bay. Marine Chemistry, 251, 104234. https://doi.org/10.1016/j.marchem.2023.104234
Methods

Song, S., Wang, Z. A., Gonneea, M. E., Kroeger, K. D., Chu, S. N., Li, D., & Liang, H. (2020). An Important Biogeochemical Link between Organic and Inorganic Carbon Cycling: Effects of Organic Alkalinity on Carbonate Chemistry in Coastal Waters Influenced by Intertidal Salt Marshes. Geochimica et Cosmochimica Acta. doi:10.1016/j.gca.2020.02.013
Results

[table of contents | back to top]

Related Datasets

IsRelatedTo

Hunt, C. (2024) **Organic alkalinity data from estuary transects in Coastal Gulf of Maine (Pleasant, Maine; St. John, New Brunswick) in May and October of 2018 and 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-01-25 doi:10.26008/1912/bco-dmo.918545.1 [view at BCO-DMO]
Relationship Description: Data collected from the same estuary transects, in May and October of 2018 and 2019, completed in the Pleasant (Maine, USA) and St. John (New Brunswick, Canada) estuaries.

[table of contents | back to top]

Parameters

Parameter	Description	Units
year	Sample year (yyyy)	unitless
month	Sample month (mm)	unitless
day	Sample day (dd)	unitless
hour	Sample hour (HH)	unitless
minute	Sample minute (MM)	unitless
second	Sample second (SS)	unitless
ISO_DateTime_UTC	Sample datetime (UTC) in ISO 8601 format	unitless

Julian_Day	Days since January 1	unitless
secDay	Cumulative seconds of the day since 00:00:00 GMT	sssss
lat	Latitude	decimal degrees
lon	Longitude	decimal degrees
heading	Heading of vessel	degrees
speed	Speed of Vessel	meters per second (m/s)
Wt	Water temperature	degreesC
cond	Water conductivity	millimho per centimeter (mmho/cm)
sal	Water salinity	Practical Salinity Units (PSU)
stimfCDOM	Stimulated fluorescence of chromophoric dissolved organic matter	parts per billion (ppb)
stimf	Stimulated fluorescence of chlorophyll	milligrams per meter cubed (mg/m^3)
c660	Bean transmittance at 600 nm	per meter (1/m)
SBE43_oxygen	Dissolved oxygen concentration	micromoles per liter (umol/L)
SBE43_oxygen_percent_sat	Dissolved oxygen saturation	percent (%)
pressure_atm	Atmospheric pressure	hectopascal (hPa)
L1_pCO2	In-water partial pressure of carbon dioxide	microatmospheres. (uatm)
L1_fCO2	In-water fugacity of carbon dioxide	microatmospheres. (uatm)
L2_pCO2	In-air partial pressure of carbon dioxide	microatmospheres. (uatm)
L2_fCO2	In-air fugacity of carbon dioxide	microatmospheres. (uatm)

bottom_flag	Data from surface (1) or bottom water (2)	unitless
source_data_file	Filename of input data file	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 45 MicroTSG Thermosalinograph
Dataset-specific Description	. Estuary water was continuously pumped to an underway measurement system, which recorded location, salinity(Seabird SBE-45), water temperature (Seabird SBE-45), and the partial pressure of carbon dioxide (pCO2) among other parameters.
Generic Instrument Description	A small externally powered, high-accuracy instrument, designed for shipboard determination of sea surface (pumped-water) conductivity and temperature. It is constructed of plastic and titanium to ensure long life with minimum maintenance. It may optionally be interfaced to an external SBE 38 hull temperature sensor. Sea Bird SBE 45 MicroTSG (Thermosalinograph)

[table of contents | back to top]

Project Information

Collaborative Research: Organic Alkalinity: Impacts of the [OTHER] Alkalinity on Estuary and Coastal Ocean Chemistry (organic alkalinity)

Coverage: Laboratory Research and Florida, New Hampshire, Maine

NSF Award Abstact:

Estuaries are bodies of water formed where rivers meet the ocean, and are important ecosystems that provide protected environments and abundant food for fish and shellfish to reproduce. Many estuary systems are under pressure by changing atmospheric and oceanic conditions, as well as impacts on the rivers that empty into them. Scientists from the University of New Hampshire and the University of South Florida propose that the total alkalinity of some coastal systems, influenced by river runoff, may contain a large fraction of organic acids that have been previously ignored and may play a role in the acid-base chemistry of the estuary. This project would focus on understanding the organic and inorganic acid-base chemistry in estuaries. The project will support a PhD student and several undergraduate students, as well as high school interns from minority communities, broadening participation in the ocean sciences. Also, the monitoring and outreach capacity of a regional wild fishery conservation group will be enhanced, allowing the public to be more fully informed on the effect of ongoing estuarine changes on fisheries.

This project will be a comparison study of two estuary-plume systems to examine the exact buffering impact of organic alkalinity on the acid-base properties of coastal systems. The Pleasant (Maine) and St. John (Canada) estuaries represent extremes of river acid-base systems, where the Pleasant is comprised mostly of organic alkalinity and the St. John has a small organic alkalinity fraction. It is hypothesized by these scientists that some coastal regions may experience organic alkalinity as the dominant alkalinity factor in the total alkalinity distribution. This would mean that organic alkalinity would be the dominant factor affecting system pH, pCO2

(partial pressure of carbon dioxide), and the saturation index of aragonite. By doing this river endmember study into organic alkalinity of these two systems, these scientists will provide the tools for the entire oceanographic community to assess the buffering capability of organic alkalinity in other coastal systems and how the systems are likely to respond to acidification.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1658321
NSF Division of Ocean Sciences (NSF OCE)	OCE-1658377