Characterization of dissolved organic carbon (DOC) in estuarine waters near Sapelo Island, GA, using ultrahigh-resolution mass spectrometry and stable carbon isotope analyses.

Website: https://www.bco-dmo.org/dataset/661880
Data Type: Other Field Results
Version:
Version Date: 2016-10-26

Project
» High Resolution Linkages Between DOC Turnover and Bacterioplankton in a Coastal Ocean (SIMCO)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

Field collected DOC from estuarine waters near Sapelo Island, GA in 2012 and 2013 was analyzed for chemical composition. Analysis of the dissolved organic matter pool retrieved by solid phase extraction (PPL resin) was analyzed to determine delta-13C ratios and carbon concentration.

Methods & Sampling

DOM was collected in Doboy Sound off the southeastern U.S. in November 2012, May 2013 and September 2013. At least 3 replicates were collected for each sample. Immediately after collection, samples were filtered (using 0.7 μm Whatman GF/F filters pre-combusted at 450°C for 5 h and pre-washed 0.2 μm Pall Supor membrane filters), and aliquots were stored frozen for DOC analysis. Filtrates were acidified to pH 2, and DOM was isolated using solid phase extraction (SPE) cartridges (Agilent Bond Elut PPL) as in Dittmar et al. (2008).

DOC concentrations from water samples and extracts (i.e., dried and resuspended in ultrapure water) were measured with a Shimadzu TOC-VCPH analyzer. SPE efficiency across all samples was 75±7% of the DOC.

Bulk delta-13C ratios of extracted DOC (SPE-DOC) were measured with a Finnigan MAT 251 isotope ratio mass spectrometer after complete drying. Precision and accuracy was better than 1 ppt, and procedural blanks did not yield detectable amounts of carbon isotopes. The molecular composition of the DOM extracts (15 mg C L-1 in 1:1 methanol/water) was analyzed using a 15T Fourier transform ion cyclotron resonance mass spectrometer (FT-ICR MS; Bruker Daltonics) with electrospray ionization (negative mode) as in Seidel et al. (2014).

Data Processing Description

References:

Dittmar, T., Boris Koch, Norbert Hertkorn, and Gerhard Kattner. 2008. A simple and efficient method for the solid-phase extraction of dissolved organic matter (SPE-DOM) from seawaterLimnol. Oceanogr.: Methods 6, 2008, 230-235

Medeiros, P. M., M. Seidel, T. Dittmar, W. B. Whitman, and M. A. Moran (2015), Drought-induced variability in dissolved organic matter composition in a marshdominated estuary, Geophys. Res. Lett., 42, 6446–6453, doi:10.1002/ 2015GL064653.

Seidel, M., Melanie Beck, Thomas Riedel, Hannelore Waska, I G.N.A. Suryaputra, d, Bernhard Schnetger, Jutta Niggemann, Meinhard Simonc, Thorsten Dittmar. 2014. Biogeochemistry of dissolved organic matter in an anoxic intertidal creek bank. Geochimica et Cosmochimica Acta 140:418-434. http://dx.doi.org/10.1016/j.gca.2014.05.038

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date
- column names reformatted to comply with BCO-DMO standards
- replaced spaces with underscores

[table of contents | back to top]

Data Files

File
carbon_salinity.csv(Comma Separated Values (.csv), 372 bytes)   MD5:dd9ac19491c0896189c4f702ab230784   Primary data file for dataset ID 661880

[table of contents | back to top]

Parameters

Parameter	Description	Units
sample	sample identification composed of date and replicate	unitless
date	sampling date	year-month
replicate	replicate identification	unitless
DOC	dissolved organic carbon concentration	microMolar
delta13C	carbon 13 to carbon 12 ratio of total carbon	parts per thousand (ppt)
sal	salinity	PSU?

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	FT-ICR MS (Bruker Daltonics)
Generic Instrument Name	Fourier Transform Ion Cyclotron Resonance Mass Spectrometer
Dataset-specific Description	The molecular composition of the DOM extracts were analyzed
Generic Instrument Description	In Fourier Transform Ion Cyclotron Resonance Mass Spectrometry, the mass-to-charge ratio (m/z) of an ion is experimentally determined by measuring the frequency at which the ion processes in a magnetic field. These frequencies, which are typically in the 100 KHz to MHz regime, can be measured with modern electronics making it possible to determine the mass of an ion to within +/- 0.000005 amu or 5 ppm.

Dataset-specific Instrument Name	Finnigan MAT 251 isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Bulk delta-13C ratios of extracted DOC (SPE-DOC) were measured
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Shimadzu TOC-VCPH analyzer
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	DOC concentrations measured
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

[table of contents | back to top]

Deployments

Moran_Sapelo_2012-14

Website	https://www.bco-dmo.org/deployment/661864
Platform	Univ_Georgia
Start Date	2012-09-01
End Date	2014-10-31
Description	Microbial 'omics studies

[table of contents | back to top]

Project Information

High Resolution Linkages Between DOC Turnover and Bacterioplankton in a Coastal Ocean (SIMCO)

Coverage: Southeastern U.S. coastal ocean, 31.4° N Lat, 81.3° W Lon

Description from NSF award abstract:
Long-standing questions regarding the fate of dissolved organic carbon (DOC) in coastal oceans require a better understanding of the network that links bacterioplankton metabolism with carbon transformation. These questions address uncertainties about the composition of the bioreactive DOC components transformed in ocean margins, and the role of bacterial taxonomic and genetic composition in determining the fate of DOC.

This project will infuse a new type of data into coastal carbon cycle research based on high-resolution chemical analysis coupled with bacterial gene expression measures. It will extend DOC process studies down to the single-compound level and bacterial activity studies down to the single-gene level, and integrate this information into existing bioinformatic resources for biogeochemical and modeling applications.

The specific goals of this project are:
1) To reconstruct major components of the network linking DOC composition, DOC turnover, and bacterial heterotrophy in the coastal ocean (the composition of the DOC pool, the major bioreactive components, the bacterioplankton taxa mediating transformations, and the bacterial genes and pathways responsible).

2) To test hypothesized network links for selected DOC compounds using a simplified system that queries individual DOC compounds against a complex natural microbial community.

3) To test hypothesized network links for marine bacteria using a simplified system that queries a single generalist heterotrophic bacteria against a complex natural DOC pool.

4) To verify predicted DOC-gene linkages that are most informative about heterotrophic activities of bacterioplankton.

This research addresses fundamental questions on bacterial mediation of organic carbon fate in the ocean and atmosphere. As such, these investigations linking the chemical changes in dissolved organic carbon with patterns of gene expression in coastal bacterioplankton communities will be of interest to scientists across several disciplines.

Note: The project acronym, SIMCO, means "Sapelo Island Microbial Carbon Observatory".

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1356010

[table of contents | back to top]