Noble gas concentrations and saturations from Marsh Pond in Massachusetts, USA from 2014.

Website: https://www.bco-dmo.org/dataset/670694
Data Type: experimental
Version: 1
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Project
» Eutrophication Effects on Sediment Metabolism and Benthic Algal-bacterial Coupling: An Application of Novel Techniques in a LTER Estuary (Benthic_PP_at_TIDE)

Contributors	Affiliation	Role
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Abstract

Noble gas concentrations and saturations from Marsh Pond in Massachusetts, USA from 2014.

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Coverage

Spatial Extent: **Lat**:42.741097 **Lon**:-70.831269
Temporal Extent: 2014-07-29 - 2014-08-26

Dataset Description

Marsh Pond noble gas concentrations and saturations.

Methods & Sampling

Noble gas concentrations were sampled using copper tube sampling (~13g samples) with a handheld pump, and extracted and analyzed at the WHOI Isotope Geochemistry Facility using peak height manometry and isotope dilution mass spectrometry techniques. Uncertainties are calculated from replicate precision and are similar to expected analytical uncertainties reported by WHOI IGF. Noble gas saturation concentrations are calculated using the unpublished solubility functions of Dempsey Lott III and William Jenkins (WHOI Isotope Geochemistry Facility (http://www.whoi.edu/IGF)), derived for all five gases from the same instrument over conditions near one atmosphere and atmospheric partial pressures of the noble gases. Saturation concentrations were calculated using a Monte Carlo approach in which temperature and salinity (the dominant sources of uncertainty in the saturation concentration) were allowed to randomly vary within the standard

deviation bounds for the environmental variability (1 degree Celsius, 0.5 on PSS-78) with 3000 iterations, and the mean variance of all iterations converted to a one standard deviation uncertainty for the saturation concentration based on the measured temperature and salinity at the sonde location. The same approach was used to combine measurement uncertainties with saturation concentration uncertainties and determine the one standard deviation uncertainty of the gas saturation states. These uncertainties were simultaneously determined for all gases at each timepoint, so that the full suite of noble gases vary with respect to each other. Variations of temperature and salinity around the pond were not random with respect to time (i.e. a location with high temperature relative to the sonde at 10am generally had higher temperature at noon and 2pm as well). Therefore the saturation state of any given noble gas varies systematically across each time series; the difference between concentrations at consecutive timepoints is conserved because the random uncertainty associated with the individual measurements is an order of magnitude lower than the systematic uncertainty associated with shifts in temperature and salinity compared to that expected from the sonde.

Because of the sampling method (smaller than usual copper tube samples, relatively slow and uneven flow from hand pumping compared to Niskin sampling), it is possible that atmospheric He was not adequately flushed from the copper tube and contaminated the samples for that gas only—we urge caution in the interpretation of the He results, and do not use these measurements in the associated manuscript (Howard et al., submitted to Limnol. Oceanog. Letters). There was no evidence that this issue would affect the other gases in a detectable manner, because of their higher solubility. One noble gas sample was flagged as having a pattern of saturation states consistent with contamination by a bubble during sampling. He, Ne, and Ar concentrations and saturation states from this sample are likely too large, but Kr and Xe are insensitive to bubble processes and any effect of sample contamination in minor on these more soluble gases.

Data Processing Description

No recalibration or post processing of sonde data was found to be necessary. Noble gas saturation state is calculated as ([C]/[C]sat-1)*100%, meaning 0% is at atmospheric equilibrium, values >0 are supersaturated, and values <0 are undersaturated with respect to atmospheric equilibrium. All noble gas saturation concentrations are adjusted for local atmospheric pressure using data from a nearby marshtop meteorological tower, with that data available at the link (http://www.whoi.edu/IGF/) described in the analytical methods section.

BCO-DMO Data Processing Notes:

-reformatted column names to comply with BCO-DMO standards
-separated DateTime column into two columns (date and time)
-reformatted date to "yyyy-mm-dd"
-filled in blank cells with "nd"
-added ISO_DateTime_UTC column

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Data Files

File
noble_gases.csv (Comma Separated Values (.csv), 4.90 KB) MD5:2a1c3d3b30cea8d43fa82a577cfac5b4
Primary data file for dataset ID 670694

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Parameters

Parameter	Description	Units
date	Sampling date; yyyy-mm-dd	unitless

time	Sampling time; HH:MM	unitless
lat	Latitude; N is positive	decimal degrees
lon	Longitude; E is positive	decimal degrees
He	Helium (He) concentration	micromoles per kilogram (umol/Kg)
He_stdev	Standard deviation of He concentration	umol/Kg
He_sat	Saturated He concentration	umol/Kg
He_sat_stdev	Standard deviation of saturated He concentration	umol/Kg
dHe	dHe concentration	percent
dHe_stdev	Standard deviation of dHe concentration	percent
He_flag	He concentration flag	unitless
Ne	Neon (Ne) concentration	umol/Kg
Ne_stdev	Standard deviation of Ne concentration	umol/Kg
Ne_sat	Saturated Ne concentration	umol/Kg
Ne_sat_stdev	Standard deviation of saturated Ne concentration	umol/Kg
dNe	dNe concentration	percent
dNe_stdev	Standard deviation of dNe concetration	percent
Ne_flag	Ne concentration flag	unitless
Ar	Argon (Ar) concentration	umol/Kg

Ar_stdev	Standard deviation of Ar concentration	umol/Kg
Ar_sat	Saturated Ar concentration	umol/Kg
Ar_sat_stdev	Standard deviation of saturated Ar concentration	umol/Kg
dAr	dAr concentration	percent
dAr_stdev	Standard deviation of dAr concentration	percent
Ar_flag	Ar concentration flag	unitless
Kr	Krypton (Kr) concentration	umol/Kg
Kr_stdev	Standard deviation of Kr concentration	umol/Kg
Kr_sat	Saturated Kr concentration	umol/Kg
Kr_sat_stdev	Standard deviation of saturated Kr concentration	umol/Kg
dKr	dKr concentration	percent
dKr_stdev	Standard deviation of dKr concentration	percent
Kr_flag	Kr concentration flag	unitless
Xe	Xenon (Xe) concentration	umol/Kg
Xe_stdev	Standard deviation of Xe concentration	umol/Kg
Xe_sat	Saturated Xe concentration	umol/Kg
Xe_sat_stdev	Standard deviation of saturated Xe concentration	umol/Kg
dXe	dXe concentration	percent
dXe_stdev	Standard deviation of dXe concentration	percent

Xe_flag	Xe concentration flag	unitless
notes	Notes	unitless
ISO_DateTime_UTC	Date/Time (UTC) ISO formatted	unitless

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Instruments

Dataset-specific Instrument Name	Isotope mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Extracted and analyzed noble gas concentrations
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	Handheld pump
Generic Instrument Name	Pump
Dataset-specific Description	Used with copper tube for noble gas sampling
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

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Deployments

Plum_Island

Website	https://www.bco-dmo.org/deployment/669365
Platform	shoreside Massachusetts
Start Date	2012-07-27
End Date	2012-08-15
Description	Plum Island, MA; LTER sites

Project Information

Eutrophication Effects on Sediment Metabolism and Benthic Algal-bacterial Coupling: An Application of Novel Techniques in a LTER Estuary (Benthic_PP_at_TIDE)

Coverage: Plum Island Estuary, Rowley Massachusetts

Extracted from the NSF award abstract:
This project will address how rates of benthic microalgal production respond to eutrophication and geomorphological changes in human-impacted tidal creeks. Excess nutrient loading increases benthic algal biomass and likely stimulates production rates but the magnitude of nutrient and geomorphological effects on rates of production is unknown. Will changes in benthic algal productivity affect algal-bacterial coupling? Furthermore, how is algal-bacterial coupling affected by geomorphological changes, which may be exacerbated by excess nutrient loading but can also occur in pristine marshes?

This project will take advantage of the infrastructure of the TIDE project, a long-term saltmarsh eutrophication experiment at the Plum Island Ecosystem - Long Term Ecological Research site in Northeastern Massachusetts. Specifically, the PIs will measure benthic metabolism and examine algal- bacterial coupling in fertilized and ambient nutrient tidal creeks in the first field season. The following field season, they will compare sediment metabolism and carbon dynamics on slumped tidal creek walls (i.e. areas where low marsh has collapsed into the tidal creek) to that on the bottom of tidal creeks. In both years, gross and net production will be determined using an innovative triple oxygen isotope technique and traditional dissolved oxygen and inorganic carbon flux measurements. Comparisons between these methods will be useful in informing studies of sediment metabolism. Lipid biomarkers will be used to characterize the sources of organic matter to creek sediments, and stable isotope analysis of bacterial specific biomarkers to identify the sources of organic carbon utilized by sediment bacteria. The biomarkers will reveal whether sediment bacteria use organic matter substrates, such as benthic microalgal carbon, selectively or in proportion to availability. Overall, results from the proposed study will provide important information about how sediment carbon dynamics in shallow tidal creeks respond to long term eutrophication. Furthermore, findings will enhance understanding of the role of tidal creeks in coastal biogeochemistry.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1233678