Time-binned CTD casts from R/V Pelican PE17-02 in the Louisiana Shelf, Gulf of Mexico from July to August 2016 (Methane cycling in OMZs project)

Website: https://www.bco-dmo.org/dataset/682613
Data Type: Cruise Results
Version: 1
Version Date: 2017-02-16

Project
» Microbial processes of pelagic anaerobic methane cycling in oxygen minimum zones (Methane cycling in OMZs)

Contributors	Affiliation	Role
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Abstract
Time-binned CTD casts from R/V Pelican PE17-02 in the Louisiana Shelf, Gulf of Mexico from July to August 2016.

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Coverage

Spatial Extent: **N**:29.30136 **E**:-89.5967 **S**:27.68898 **W**:-92.8012
Temporal Extent: 2016-07-23 - 2016-08-02

Processing Description

Using the SeaBird data processing software, with the following steps applied:
- Filter: applied to the pressure data only (low pass 0.15s)
- Alignment: applied to the oxygen data only (using a value of 3)
- Loop edit: to mark and remove scans when the CTD is moving less than minimum velocity (set

at 0.2 m/s)
- Binned: into 1m depth bins (Bd) and by time (Bt)

BCO-DMO Processing Notes:

Data were received as one-meter bin averaged Seabird CTD .cnv files. For station 1, the fluorometer data were bad and the sensor was replaced for the remaining stations, which recorded PAR and fluorescence. The fluor field was flagged with "nd" for bad data for station 1. Extraneous parameters used for acquisition purposes were hidden.

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Parameters

Parameter	Description	Units
cast	number of cast	dimensionless
cruise_id	cruise identifier	dimensionless
year	year reported as yyyy	dimensionless
lat	latitude	decimal degrees
lon	longitude	decimal degrees
mon	month reported as mm	dimensionless
day	day reported as dd	dimensionless
time	start time of cast reported as hhmm	dimensionless
ISO_DateTime_UTC	UTC date and time ISO formatted	YYYY-MM-DDTHH:MM:SS[.xx]Z
yrday_utc	UTC day and decimal time	dimensionless
time_elapsed	time elapsed	seconds
scan	scan count	unitless
depth	sampling depth	meters
press	sampling pressure	decibars
temp	temperature	degrees Celsius
sal	salinity	PSU
potemp	potential temperature	degrees Celsius
sigma_0	density; sigma-theta	kilograms/cubic meter (kg/m^3)
O2_sat_pcnt	oxygen concentration	percent
O2_umol_kg	oxygen concentration	micromoles/kg
lat_sample	latitude of record; north is positive	decimal degrees
lon_sample	longitude of record; east is positive	decimal degrees
PAR	Photosynthetically Available Radiation	uE/m^2/sec
fluor	fluorescence	milligrams/meter^3

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Instruments

Dataset-specific Instrument Name	PAR/Irradiance
Generic Instrument Name	LI-COR Biospherical PAR Sensor
Dataset-specific Description	The LI-COR Biospherical PAR Sensor is used to measure Photosynthetically Available Radiation (PAR) and irradiance (SPAR) in the water column.
Generic Instrument Description	The LI-COR Biospherical PAR Sensor is used to measure Photosynthetically Available Radiation (PAR) in the water column. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	WET Labs ECO CDOM Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	A CTD-fluorometer is an instrument package designed to measure hydrographic information (pressure, temperature and conductivity) and chlorophyll fluorescence.
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	SBE43 Oxygen Sensor
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Seabird CTD
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics, no specific unit identified. This instrument designation is used when specific make and model are not known. See also other SeaBird instruments listed under CTD. More information from Sea-Bird Electronics.
Generic Instrument Description	The Sea-Bird SBE 911plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9plus and SBE 11plus is called a SBE 911plus. The SBE 9plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3plus and SBE 4). The SBE 9plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

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Deployments

PE17-02

Website	https://www.bco-dmo.org/deployment/675038
Platform	R/V Pelican
Start Date	2016-07-23
End Date	2016-08-03
Description	East-west transect through the hypoxic zone on the Louisiana Shelf (~28-29°N, 89-94° W). Objective: CTD/rosette surveys and multi-coring (MC-800) to study microbial nitrogen and sulfur cycling in the Louisiana Shelf hypoxic zone.

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Project Information

Microbial processes of pelagic anaerobic methane cycling in oxygen minimum zones (Methane cycling in OMZs)

Website: http://omz.biology.gatech.edu/

Coverage: Eastern Tropical North Pacific oxygen minimum zone; off Colima, Mexico; ~19-24°N, 106-116°W Gulf of Mexico; Louisiana Shelf hypoxic zone; ~28-29°N, 89-94° W

Exerpt from the NSF Award Abstract: The overarching goal of this research is to understand how bacteria

in marine oxygen minimum zones (OMZs) control interactions between the ocean methane and nitrogen cycles. OMZs constitute the largest pool of methane in the ocean water column, and also serve as sites where anaerobic microbes convert the essential element nitrogen from a form that can be used by organisms to a gaseous form (N2) that can be lost from the ocean. Recent studies, predominantly in freshwater environments, have discovered novel bacteria that link methane consumption to pathways of nitrogen loss. These researchers have recently shown that such bacteria also occur in OMZs. However, the contributions of these bacteria to ocean methane and nitrogen flux remain unknown. Here, the researchers will use a combination of genomics and biochemical measurements to characterize the metabolic potential and diversity of these bacteria in OMZs and to quantify their contribution to methane and nitrogen transformations. Meeting this goal is critical for constraining bulk fluxes of these chemicals in the open ocean and for predictive models of climate change, notably given the importance of methane as a potent greenhouse gas and the prediction that OMZs will expand with global warming.

This research focuses specifically on bacteria conducting nitrite-dependent anaerobic methane oxidation (n-damo). This process has been described in bacteria of the NC10 division, in which a dismutation reaction generates both N2 and O2 gas, with the O2 used for intra-aerobic methane oxidation. Although NC10 bacteria have been described primarily from nitrite-rich freshwater and marine sediments, recent evidence indicates that NC10 are also present in anoxic OMZs. Given that OMZs contain substantial pools of the n-damo substrates nitrite and methane, it is hypothesized that OMZs harbor an anaerobic methane cycle coupled to nitrogen loss, and that this coupling is mediated by n-damo NC10 bacteria that occur as ubiquitous components in diverse OMZs. To test this hypothesis, the researchers will 1) quantify the contribution of n-damo to OMZ methane oxidation, N2 production, and oxygen production rates, 2) characterize the diversity and ecophysiology of OMZ NC10 isolates through enrichments and single-cell genomics, and 3) survey the abundance, diversity, and activity of NC10 bacteria across distinct OMZ systems.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1558916

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