Seawater properties and biogeochemical parameters of bottom boundary layer samples collected aboard the R/V Oceanus during ten cruises from 2017-2019 from the Oregon shelf and slope.

Website: https://www.bco-dmo.org/dataset/793115
Data Type: Cruise Results
Version: 1
Version Date: 2020-10-20

Project
» Benthic Biogeochemical Exchange Dynamics on the Oregon Shelf (BBEDOS)

Contributors	Affiliation	Role
Reimers, Clare E.	Oregon State University (OSU-CEOAS)	Principal Investigator
Haskins, Christina	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Seawater properties and biogeochemical parameters of bottom boundary layer samples from Oregon shelf and slope collected during ten cruises over three years. Most samples are from two repeat stations at ~30 m and 80 m water depth.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Related Publications
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Coverage

Spatial Extent: **N**:44.66379 **E**:-124.09713 **S**:43.92312 **W**:-125.14606
Temporal Extent: 2017-12-04 - 2019-07-11

Dataset Description

Seawater properties and biogeochemical parameters of bottom boundary layer samples from Oregon shelf and slope collected during ten cruises over three years. Most samples are from two repeat stations at ~30 m and 80 m water depth. This project is affiliated with the Coastal Endurance Array of the Ocean Observatories Initiative (OOI). https://www.bco-dmo.org/program/661079

Methods & Sampling

These data come from in situ sensor measurements or analyses of water samples collected during a series of cruises on the R/V Oceanus. The ship's SeaBird CTD system with a rosette of 12 10-L Niskin bottles was deployed for each reported event. Typically water samples were collected in the benthic boundary layer by tripping several Niskins within 4 m of the bottom. Compiled data include the water temperature, salinity and

dissolved oxygen (SBE-43 sensor) recorded at the time a bottle was closed. The Niskins were sampled back onboard for Winkler determinations of dissolved oxygen, TCO2/pCO2 samples poisoned, capped and stored in brown glass bottles, nutrient samples (stored frozen until analyses), and water that was filtered onboard onto pre-combusted GF/F filters for determinations of total suspended solids and the organic C and total N content of those solids. Methods details are oxygen concentrations were measured by whole bottle Winkler titration of 125 ml samples using an amperometric method for detecting the triiodide ion reaction endpoints. TCO2 and pCO2 are determined on the same sample by methods described in Hales et al. (2017) [Estuaries and Coasts, vol 40:173-186]. Nutrient samples were stored frozen in acid-washed Nalgene™ 60 ml HDPE bottles until thawed and analyzed using standard colorimetric methods as adapted for autoanalyzers. The POC/PN water samples were immediately filtered through precombusted (at 400°C for 4 h) 25 mm Whatman™ GF/F filters. These filters were frozen at sea then later exposed to acid fumes in the laboratory for 24 h to remove inorganic carbon. Dried filters were analyzed using an elemental analyzer.

Data Processing Description

BCO-DMO Data Manager Processing Notes: * added a conventional header with dataset name, PI name, version date * modified parameter names to conform with BCO-DMO naming conventions * blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system. * removed all spaces in headers and replaced with underscores * removed all units from headers * restructured excel sheet to eliminate merged cells for pipeline intake * removed a comment in row 80 for all nutrient samples that read "Nutrient bottle #1 spilled during analysis: lost" * created an ISO_DateTime_UTC column from the Date_UTC column * put the Date_PST column in ISO format * set Types for each data column * changed cruise ID OC1807B to OC1807A * rounded TSS and CTD_DO_2 to 2 digits

[table of contents | back to top]

Data Files

File
ctd_data.csv (Comma Separated Values (.csv), 48.39 KB) MD5:04d79740a093b32451b608d0e1d019ec Primary data file for dataset ID 793115

[table of contents | back to top]

Related Publications

Hales, B., Suhrbier, A., Waldbusser, G. G., Feely, R. A., & Newton, J. A. (2016). The Carbonate Chemistry of the “Fattening Line,” Willapa Bay, 2011–2014. Estuaries and Coasts, 40(1), 173–186. doi:10.1007/s12237-016-0136-7
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Cruise_Name	cruise designation; name	dimensionless
Event	cruise event	dimensionless
Latitude	latitude, in decimal degrees, North is positive, negative denotes South	decimal degrees
Longitude	longitude, in decimal degrees, East is positive, negative denotes West	decimal degrees
Niskin_bottle	Niskin sample bottle number	dimensionless
ISO_DateTime_UTC	UTC month, day and year, usually as a text string	YYYY-MM-DDTHH:MM:SS[.xx]Z
DateTime_PST	local month, day and year, usually as a text string (PST)	YYYY-MM-DDTHH:MM:SS[.xx][+/-TZ]
Depth	water depth	meters
Altitude	altitude above bottom	meters
CTD_Temp	temperature	degrees Celsius, ITS 90
CTD_Salinity	salinity from the CTD when water bottle tripped (Sal 00)	PSU
CTD_Cond	conductivity (C0S/m)	S/m
CTD_Density	density	kg/m^3
CTD_DO	dissolved oxygen concentration-CTD sensor	mL/L
CTD_DO_2	dissolved oxygen concentration-CTD sensor_alternate units	umol L-1
O2_Conc_Winkler	dissolved oxygen by Winkler titration	mL/L
O2_Conc_Winkler_2	dissolved oxygen by Winkler titration_alternate units	umol L-1
TCO2	total dissolved inorganic carbon	umol/kg
pco2_in_situ	partial pressure of Carbon dioxide	uatm
Volume_filtered	water volume filtered for particulates collection on filter	mL
TSS	total suspended solids	mg/L
TN	total particulate nitrogen	mg TN/L
OC	particulate organic carbon	mg OC/L
PO4	Orthophosphate (phosphate, reactive phosphorus)	umol/L
Nitrate_Nitrite	nitrate and nitrite	umol/L
Silicate	silicate	umol/L
NO2	nitrite	umol/L
NH4	ammunium	umol/L

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus 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 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus 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

Dataset-specific Instrument Name	ThermoQuest NC2500
Generic Instrument Name	Elemental Analyzer
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
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

[table of contents | back to top]

Deployments

OC1712A

Website	https://www.bco-dmo.org/deployment/793132
Platform	R/V Oceanus
Start Date	2017-12-04
End Date	2017-12-07

OC1801A

Website	https://www.bco-dmo.org/deployment/793151
Platform	R/V Oceanus
Start Date	2018-01-28
End Date	2018-01-31

OC1802B

Website	https://www.bco-dmo.org/deployment/793218
Platform	R/V Oceanus
Start Date	2018-02-26
End Date	2018-03-01

OC1805B

Website	https://www.bco-dmo.org/deployment/793242
Platform	R/V Oceanus
Start Date	2018-05-07
End Date	2018-05-11

OC1807A

Website	https://www.bco-dmo.org/deployment/793307
Platform	R/V Oceanus
Start Date	2018-07-03
End Date	2018-07-05

OC1808A

Website	https://www.bco-dmo.org/deployment/793244
Platform	R/V Oceanus
Start Date	2018-08-02
End Date	2018-08-03

OC1810A

Website	https://www.bco-dmo.org/deployment/793260
Platform	R/V Oceanus
Start Date	2018-10-04
End Date	2018-10-08

OC1901A

Website	https://www.bco-dmo.org/deployment/827118
Platform	R/V Oceanus
Start Date	2019-01-11
End Date	2019-01-15
Description	Cruise DOI: https://doi.org/10.7284/908627 Endurance opportunity glider recovery by Oceanus martech.

OC1904A

Website	https://www.bco-dmo.org/deployment/827167
Platform	R/V Oceanus
Start Date	2019-04-22
End Date	2019-04-26
Description	Cruise DOI: 10.7284/908631

OC1907A

Website	https://www.bco-dmo.org/deployment/827213
Platform	R/V Oceanus
Start Date	2019-07-07
End Date	2019-07-11
Description	Cruise DOI: 10.7284/908636

[table of contents | back to top]

Project Information

Benthic Biogeochemical Exchange Dynamics on the Oregon Shelf (BBEDOS)

Coverage: Oregon Shelf 44.6N 124 W

NSF Award Abstract:

The longstanding theory regarding the formation of low oxygen zones in coastal shelf regions at the eastern boundaries of the oceans has pointed to the upwelling of oxygen-depleted waters from off of the shelf. In other words, dense water from beyond the shelf break that is depleted in dissolved oxygen is drawn along the seafloor upwards onto the shelf, mixing with the oxygenated water there, and creating low oxygen (hypoxic) zones. This is a paradigm that the researcher in this project seeks to shift by analyzing the added effects of respiration in shelf sediments. The investigator hypothesizes that changes in the biological activity of sediments due to seasonal changes in organic matter input from overlying waters are a major factor in the changes in

dissolved oxygen content of deep shelf water, perhaps being the leading variable in the creation of hypoxic zones. Though the field analysis will be confined to the Oregon margin, there is a great deal of applicability for this research in other coastal regions where hypoxic zones form. In addition to the potential for unraveling complex local feedbacks between physical and biogeochemical processes, the researcher plans to work with a small business called Analytical Instrument Systems to build a new oxygen sensor, called a rotating disc microelectrode (RDME), that does not intrude on the environment it is testing and that can be deployed for much longer periods of time than currently popular sensors, micro-optodes. Her RDME will be deployed with micro-optodes for comparison and to validate the necessity for the RDME in the study of coastal ecosystems. This project will provide a unique experience for a postdoctoral researcher as well as a graduate and three undergraduate students. A public database will be created which will greatly help with accessibility and archiving of data for anyone who is interested in similar research. The database will be connected with a variety of other ocean observing data products, which will allow the research community and the public to make connections outside of this particular field of study. This investigator has a strong track record of including Research Experiences for Undergraduates (REU) students in her research, and she will continue to do so in this project.

The researcher aims to challenge the paradigm that hypoxic zones on the Oregon shelf are created by upwelling of offshelf oxygen-depleted water and that most of the local primary productivity is exported off the shelf during downwelling periods. Preliminary data suggests the possibility that seasonal benthic respiration may be a major factor in hypoxic water formation on the shelf. With the use of eddy covariance measurements, sediment core incubations, and near seabed particulate organic matter (POM) collections, the biogeochemical fluxes of the Oregon margin will be characterized for every season. This work is ambitious on its own, but the investigator also plans to incorporate the development of a new oxygen sensor called a rotating disc microelectrode (RDME) that will be compared to currently popular micro-optodes when making eddy covariance measurements. The RDME will be small enough as not to interfere with the physical properties being measured in situ; it will be insensitive to flow and deployable for longer periods of time. Not only does this project contain the possibility of completely overturning the current best theory of hypoxic zone formation on shelf margins, but the use of eddy covariance is new to the study of dynamic coastal ecosystems and will yield great insights into the biogeochemical processes of shelf benthos.

This project is affiliated with the Coastal Endurance Array of the Ocean Observatories Initiative (OOI).
https://www.bco-dmo.org/program/661079

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1634319

[table of contents | back to top]