Processed eddy covariance measurements from three lander deployments during R/V Oceanus cruises OC1802B and OC1901A along the Oregon shelf in 2018 and 2019.

Website: https://www.bco-dmo.org/dataset/827116
Data Type: Cruise Results
Version: 1
Version Date: 2020-10-30

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

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

Abstract
Processed eddy covariance measurements from benthic lander deployments on the central Oregon shelf collected during R/V Oceanus cruises OC1802B and OC1901A in 2018 and 2019.

Table of Contents

Coverage

Spatial Extent: **N**:44.6519 **E**:-124.0998 **S**:44.6418 **W**:-124.3085
Temporal Extent: 2018-02-26 - 2019-01-15

Dataset Description

This dataset is comprised of individual files of eddy covariance time series data identified by the cruise id and an event number corresponding to the lander deployment. Eddy covariance fluxes and other parameters derived from these data are presented in a manuscript submitted to JGR-Oceans (Reimers and Fogaren).

This dataset will be updated in the future to include additional processed eddy covariance measurements from additional cruises. The future version of this dataset will combine data from ten repeat R/V Oceanus cruises on the central Oregon shelf that spanned December 2017 through July 2019.

Acquisition Description

All data acquired with sensors mounted on a bottom lander ~30 cm above the seafloor unless noted otherwise.

Problems/Issues:
The temperature data were collected at lower frequencies and in the OC1901 Ev51 case processed with a 15 min moving average to interpolate to 8 Hz.

Instrument summary:

Nortek Vector ADV (yielded u, v, w, P, BSI).

Pyroscience fiber-optic oxygen sensors (OXB430) (yielded O2). The fiber-optic sensors were activated through PyroScience FireStingO2-Subport modules enclosed in Delrin housings with 12V to 5V power converter circuits produced and integrated by Rockland Scientific (Victoria, BC, Canada).

A new fiber-optic sensor was installed for each EC experiment, and it was calibrated in seawater solutions at 0 and 100% air saturation using FirestingO2 software, before and after each deployment. When processing EC data records the specific Firesting "pre" and "post" calibration parameters were applied with time-series inputs of temperature, salinity and pressure to convert the sensor measurements to two parallel O2 time-series in units of mmol L-1. Because it was observed that the fiber-optic sensor calibrations shifted gradually over time, independent reference measurements (from OOI data products or ship-based casts) were used to derive corrected fiber-optic time-series based on the fractions of pre- and post-calibration series needed to align with the reference measurements. For each deployment, four reference points were assigned, with calibration proportions extrapolated in between each reference point. Not surprisingly, these fractions shifted from mostly dependent on the "pre" calibration to dominantly the "post" calibration over the course of each deployment. Adjustments in mean concentration were generally about 10%.

Temperature records were extracted from the neighboring OOI Benthic Experimental Package CTD when at the 80 m station. Temperature records were measured with a recording CTD (SBE 37) during deployments at 30 m.

Processing Description

In most cases temperature data were collected at lower frequencies and processed with a moving average to interpolate to 8 Hz.

Velocity and oxygen time-series were filtered to remove spikes (extreme data outliers) using a phase-space method adapted from *Goring and Nikora* [2002] whereby spikes are replaced with points based on a spline fit to adjacent data. These "cleaned" time series, together with coincident pressure measurements (P) made by the ADV were then reduced from 64 to 8 Hz by computing sequential eight-point averages.

BCO-DMO Data Manager Processing Notes (Data version 1):
* Combined submitted files into one data table adding columns for cruise_id and event from information in the file names.
* added site latitude and longitude for each event in the dataset(information submitted by email).
* Added ISO_DateTime_PT and ISO_DateTime_UTC in ISO 8601 format using the matlab DateNumber provided. Verified by checking the conversion in MATLAB using datestr().
* rounded decimals to five decimal places after confirming the precision with the data submitter.

[table of contents | back to top]

Related Publications

Goring, D. G., & Nikora, V. I. (2002). Despiking Acoustic Doppler Velocimeter Data. Journal of Hydraulic Engineering, 128(1), 117–126. doi:10.1061/(asce)0733-9429(2002)128:1(117)

https://doi.org/10.1061/(ASCE)0733-9429(2002)128:1(117)
Methods

Reimers, CE and Fogaren, KE. (2020) Bottom boundary layer oxygen fluxes during winter on the Oregon shelf. Journal of Geophysical Research: Oceans. Manuscript submitted for publication.
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
matlab_DateNumber	Date/Time of measurement in local time (U.S. Pacific); resolution 8 Hz. Matlab DateNumber. Numerical number representing calendar days (e.g., January 1, 2019 12:00PM = 737426.500000000)	unitless
u	Horizontal velocity in direction of the X probe of ADV	cm s-1
v	Horizontal velocity in Y direction	cm s-1
w	Vertical velocity in Z direction	cm s-1
O2	Oxygen concentration	micromoles per L (umol L-1)
P	Pressure	m
temp	Temperature	degrees Celsius (C)
BSI	Backscatter Intensity	unitless
cruise_id	Cruise identifier	unitless
event	Event name	unitless
lat	Site latitude	decimal degrees
lon	Site longitude	decimal degrees
ISO_DateTime_PT	Date and time (local Pacific Time) in ISO 8601 format YYYY-MM-DDThh:mm:ss.SSS.	unitless
ISO_DateTime_UTC	Date and time (UTC) in ISO 8601 format YYYY-MM-DDThh:mm:ss.SSSZ.	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	unknown
Dataset-specific Description	A new fiber-optic sensor was installed for each EC experiment, and it was calibrated in seawater solutions at 0 and 100% air saturation using FirestingO2 software, before and after each deployment. When processing EC data records the specific Firesting "pre" and "post" calibration parameters were applied with time-series inputs of temperature, salinity and pressure to convert the sensor measurements to two parallel O2 time-series in units of mmol L-1. Because it was observed that the fiber-optic sensor calibrations shifted gradually over time, independent reference measurements (from OOI data products or ship-based casts) were used to derive corrected fiber-optic time-series based on the fractions of pre- and post- calibration series needed to align with the reference measurements. For each deployment, four reference points were assigned, with calibration proportions extrapolated in between each reference point. Not surprisingly, these fractions shifted from mostly dependent on the "pre" calibration to dominantly the "post" calibration over the course of each deployment. Adjustments in mean concentration were generally about 10%.
Generic Instrument Description	No relevant match in BCO-DMO instrument vocabulary.

Dataset-specific Instrument Name	
Generic Instrument Name	Water Temperature Sensor
Dataset-specific Description	Temperature records were extracted from the neighboring OOI Benthic Experimental Package CTD when at the 80 m station. Temperature records were measured with a recording CTD (SBE 37) during deployments at 30 m.
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

Dataset-specific Instrument Name	Pyroscience fiber-optic oxygen sensors (OXB430)
Generic Instrument Name	Dissolved Oxygen Sensor
Dataset-specific Description	Pyroscience fiber-optic oxygen sensors (OXB430) (yielded O2).The fiber-optic sensors were activated through PyroScience FireStingO2-Subport modules enclosed in Delrin housings with 12V to 5V power converter circuits produced and integrated by Rockland Scientific (Victoria, BC, Canada).
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O2) in the gas or liquid being analyzed

Dataset-specific Instrument Name	Nortek Vector ADV
Generic Instrument Name	Acoustic Doppler Velocimeter
Dataset-specific Description	Nortek Vector ADV (yielded u, v, w, P, BSI).
Generic Instrument Description	ADV is the acronym for acoustic doppler velocimeter. The ADV is a remote-sensing, three-dimensional velocity sensor. Its operation is based on the Doppler shift effect. The sensor can be deployed either as a moored instrument or attached to a still structure near the seabed. Reference: G. Voulgaris and J. H. Trowbridge, 1998. Evaluation of the Acoustic Doppler Velocimeter (ADV) for Turbulence Measurements. J. Atmos. Oceanic Technol., 15, 272–289. doi: http://dx.doi.org/10.1175/1520-0426(1998)0152.0.CO;2

[table of contents | back to top]

Deployments

OC1802B

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

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.

[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]