Depth profiles of temperature, conductivity, dissolved oxygen, pH, chlorophyll fluorescence, etc., collected with a SeaBird SBE 25plus CTD in Lake Michigan during 2017

Website: https://www.bco-dmo.org/dataset/737534

Data Type: Cruise Results

Version: 1

Version Date: 2018-05-25

Project

» Collaborative Research: Regulation of plankton and nutrient dynamics by hydrodynamics and profundal filter feeders (Filter Feeders Physics and Phosphorus)

Contributors	Affiliation	Role
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Abstract

Depth profiles of temperature, conductivity, dissolved oxygen, pH, chlorophyll fluorescence, etc., collected with a SeaBird SBE 25plus CTD in Lake Michigan during 2017.

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Coverage

Spatial Extent: **N**:43.097983 **E**:-87.7187 **S**:43.09503 **W**:-87.861117

Temporal Extent: 2017-05-11 - 2017-11-13

Dataset Description

CTD data collected in 2017 from Lake Michigan, depth = 55-75 m, approximately 12-16 km northeast of Milwaukee Harbor.

Acquisition Description

Data were collected using a SeaBird SBEplus 25 CTD, calibrated annually by SeaBird.

Data are processed using the "SBE Data Processing" software package provided by Sea-Bird Scientific. The processing modules used were as follows:

Data Conversion. Potential temperature anomaly set to 0. Tau correction is applied to dissolved oxygen measurements, with a 2-second window.

Filter. Low pass filter A time constant = 0.1 seconds. Low pass filter B time constant = 0.5 seconds.

Align CTD. An advance value of 0.1 seconds was applied to conductance measurements, and an advance value of 5 seconds was applied to dissolved oxygen measurements.

Loop Edit. Minimum CTD velocity set to 0.1 meters per second. Scans marked bad are excluded.

Bin Average. Bin type = Depth. Bin size = 0.25 meters. Both the upcast and the downcast were processed.

Processing Description

BCO-DMO Processing:
- converted date/time to ISO 8601 format;
- modified parameter names to conform with BCO-DMO naming conventions;
- replaced blanks (missing data), -9.99E-29, 9.99E-29, and #VALUE! with "nd" (no data).

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Parameters

Parameter	Description	Units
Deployment	Deployment name/date.	unitless
Year	4-digit year	unitless
Lat	Latitude. Locations south of equator are negative.	Decimal degrees

Long	Longitude. Locations west of prime meridian are negative.	Decimal degrees
ISO_DateTime_UTC	UTC Date and time. Local time + 5 hours between March 12, 2:00 a.m. and November 5, 2:00 a.m. Local time + 6 hours between November 5, 2:00 a.m. and March 12, 2:00 a.m. Formatted to ISO 8601 standard (yyyy-mm-ddTHH:MM).	unitless
Depth	Depth below lake surface; resolution = 0.01; accuracy = 0.15	meters (m)
Temp	Water Temperature; resoultion = 0.0003; accuracy = 0.001	Degrees celsius (°C)
Cond	Water conductance; resoultion = 0.4 uS/cm; accuracy = 3 uS/cm	microsiemens per cm (uS/cm)
SpCond	Water Specific Conductance (conductance normalized to a temperature of 25 degrees celcius). Resolution = 0.4 uS/cm; accuracy = 3 uS/cm.	microsiemens per cm (uS/cm)
flECO_AFL	Chlorophyll a fluorescence.	Fluorescence units that are calibrated to approximate chlorophyll concentration in units of microgram per liter (ug/L)
PAR	Photosyntheticall active radiation (within the range of approximately 400 to 700 nm wavelength). Accuracy = 3%	micromoles of photons per square meter per second
pH	pH is a measure of the concentration of free hydrogen ions. Resolution = 0.01 ; accuracy = 0.1	pH = -log10 [H+], where [H+] = moles per liter of the hydrogen ion.
DO	Dissolved oxygen concentration; resolution = 0.01 ; accuracy = 2%.	milligrams per liter (mg/L)
prdM	Pressure; resolution = 0.01; accuracy = 0.15	decibars (dbar)

DOSat_pcnt	Dissolved oxygen concentration as % saturation at in situ temperature and a pressure of 1.0 atmospheres. Calculated as: DOSat% = DO(mg/L)*100/(-0.00007*T^3+0.0075*T^2-0.3976*T+14.602. T = water temperature (oC). Resolution = 0.1; accuracy = 2%	percent (%) saturation
BeamAtt	Beam attenuation over 25 cm path length; accuracy = 0.02%	inverse meters (m-1)
Beam_pcnt	Beam % transmission over 25 cm path length; accuracy = 0.02%	percent (%)

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Instruments

Dataset-specific Instrument Name	SeaBird SBEplus 25 CTD
Generic Instrument Name	CTD Sea-Bird 25
Generic Instrument Description	The Sea-Bird SBE 25 SEALOGGER CTD is battery powered and is typically used to record data in memory, eliminating the need for a large vessel, electrical sea cable, and on-board computer. All SBE 25s can also operate in real-time, transmitting data via an opto-isolated RS-232 serial port. Temperature and conductivity are measured by the SBE 3F Temperature sensor and SBE 4 Conductivity sensor (same as those used on the premium SBE 9plus CTD). The SBE 25 also includes the SBE 5P (plastic) or 5T (titanium) Submersible Pump and TC Duct. The pump-controlled, TC-ducted flow configuration significantly reduces salinity spiking caused by ship heave, and in calm waters allows slower descent rates for improved resolution of water column features. Pressure is measured by the modular SBE 29 Temperature Compensated Strain-Gauge Pressure sensor (available in eight depth ranges to suit the operating depth requirement). The SBE 25's modular design makes it easy to configure in the field for a wide range of auxiliary sensors, including optional dissolved oxygen (SBE 43), pH (SBE 18 or SBE 27), fluorescence, transmissivity, PAR, and optical backscatter sensors. more information from Sea-Bird Electronics

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Deployments

Neeskay_Cruise_1

Website	https://www.bco-dmo.org/deployment/730830
Platform	R/V Neeskay
Start Date	2017-08-01
End Date	2017-08-16
Description	Multiple deployments of the research vessel, R/V Neeskay, in Lake Michigan, Depth = 55 m, approximately 12 km northeast of Milwaukee Harbor. Ship returned to port at end of each day. Dates: August 1, 2017 to August 16, 2017.

Osprey_Lake_Michigan_2017

Website	https://www.bco-dmo.org/deployment/737338
Platform	R/V Osprey
Start Date	2017-05-11
End Date	2017-11-13
Description	Multiple deployments of the small research vessel, R/V Osprey, in Lake Michigan at three locations northeast of Milwaukee Harbor, with bottom depths of 15 m (43.09577 N, 87.8611 W), 45 m (43.097983 N, 87.784033 W), and 75 m (43.097917 N, 87.7187 W). The vessel returned to port at end of each day. 2017 Dates: May 11, 26, June 1, 8, 13, 23, 30, July 11, 18, 25, Aug. 1, 2, 9, 10, 16, 29, Sep. 12, Oct. 5, 9, 23, Nov. 13.

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Project Information

Collaborative Research: Regulation of plankton and nutrient dynamics by hydrodynamics and profundal filter feeders (Filter Feeders Physics and Phosphorus)

Coverage: Lake Michigan

Overview: While benthic filter feeders are known to influence plankton and nutrient dynamics in shallow marine and freshwater systems, their role is generally considered to be minor in large, deep systems. However, recent evidence indicates that profundal quagga mussels (Dreissena rostriformis bugensis) have dramatically altered energy flow and nutrient cycling in the Laurentian Great Lakes and other larges aquatic systems, so that conventional nutrient-plankton paradigms no longer apply. Observed rates of phosphorus grazing by profundal quagga mussels in Lake Michigan exceed the passive settling rates by nearly an order of magnitude, even under stably stratified conditions. We hypothesize that the apparently enhanced particle deliver rate to the lake bottom results from high filtration capacity combined with vertical mixing processes that advect phytoplankton from the euphotic zone to the near-bottom layer. However, the role of hydrodynamics is unclear, because these processes are poorly characterized both within the hypolimnion as a whole and within the near-bottom layer. In addition, the implications for phytoplankton and nutrient dynamics are unclear, as mussels are also important nutrient recyclers. In the proposed interdisciplinary research project, state-of-the-art instruments and analytical tools will be deployed in Lake Michigan to quantify these critical dynamic processes, including boundary layer turbulence, mussel grazing, excretion and egestion, and benthic fluxes of carbon and phosphorus. Empirical data will be used to calibrate a 3D hydrodynamic-biogeochemical model to test our hypotheses. Intellectual Merit: This collaborative biophysical project is structured around two primary questions: 1) What role do profundal dreissenid mussels play in large lake carbon and nutrient cycles? 2) How are mussel grazing and the fate of nutrients recycled by mussels modulated by hydrodynamics at scales ranging from mm (benthic boundary layer) to meters (entire water column)? The project will improve the ability to model nutrient and carbon dynamics in coastal and lacustrine waters where benthic filter-feeders are a significant portion of the biota. By so doing, it will address the overarching question of how plankton and nutrient dynamics in large, deep lakes with abundant profundal filter feeders differ from the conventional paradigm described by previous models. Additionally, the project will quantify and characterize boundary layer turbulence for benthic boundary layers in large, deep lakes, including near-bed turbulence produced by benthic filter feeders. Broader Impacts: The project will provide new insight into the impacts of invasive dreissenid mussels, which are now threatening many large lakes and reservoirs across the United States. Dreissenid mussels appear to be responsible for a number of major changes that have occurred in the Great Lakes, including declines of pelagic plankton populations, declines in fish populations, and, ironically, nuisance algal blooms in the nearshore zone. As a result, conventional management models no longer apply, and managers are uncertain about appropriate nutrient loading targets and fish stocking levels. The data and models resulting from this project will help to guide those decisions. Additionally, the project will provide insight to bottom boundary layer physics, with

applicability to other large lakes, atidal coastal seas, and the deep ocean. The project will leverage the collaboration and promote interdisciplinary education for undergraduate and graduate students from two universities (UW-Milwaukee and Purdue). The project will support 3 Ph.D. students and provide structured research experiences to undergraduates through a summer research program. The project will also promote education of future aquatic scientists by hosting a Biophysical Coupling Workshop for graduate students who participate in the annual IAGLR conferences, and the workshop lectures will be published for general access through ASLO e-Lectures and on an open-access project website. Background publications are available at:http://onlinelibrary.wiley.com/doi/10.1002/2014JC010506/fullhttp://link.... Note: This is an NSF Collaborative Research Project.

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Funding

Funding Source	Award
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