Temperature mooring data collected at Station AT55 in Lake Michigan from August 1, 2017 to April 20, 2018.

Website: https://www.bco-dmo.org/dataset/734541
Data Type: Other Field Results
Version: 2
Version Date: 2019-05-16

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

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Abstract
A fixed mooring was established to measure water column temperatures in Lake Michigan near Milwaukee, WI, from Aug 1 – Aug 17, 2017 at a 55 meters depth site and again during 2018 from April 5 – April 20, 2018. The mooring involved a large tripod to which a surface line was attached and along this line were temperature sensors at various depths.

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Coverage

Spatial Extent: **N**:43.095 **E**:-87.753217 **S**:43.069917 **W**:-87.7713
Temporal Extent: 2017-08-01 - 2018-04-20

Dataset Description

A fixed mooring was established to measure water column temperatures in Lake Michigan near Milwaukee, WI, from Aug 1 – Aug 17, 2017 at a 55 meters depth site and again during 2018 from April 5 – April 20, 2018. The mooring involved a large tripod to which a surface line was attached and along this line were temperature sensors at various depths. Depths may vary slightly due to unmeasured chain drift.

All temperature data collected during 2017 were smoothed using a 2s moving average before being interpolated onto a 2s sampling interval. All missing data is represented by NaN.

All temperature data collected during 2018 were smoothed using a 1s moving average before being interpolated onto a 1s sampling interval. Individual thermistor accuracies, ranges, and resolutions are included

in the attached file

Instrument Manufacturers: Sea-bird Scientific (SBE56); RBR (RBR TDR- 2050, RBR TR-1060); Onset (HOBO)

On 2019-04-08 an update was received for this dataset. This update contained an extension of the data for 2018.

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming convention
- combined YEAR, MONTH, DAY, HOUR, MINUTE, SECOND columns into one ISO_DateTime_UTC column.
- removed columns YEAR, MONTH, DAY, HOUR, MINUTE, and SECOND
- added lat, and lon columns.
- extracted height above bottom from column headings in submitted data file.
- reorganized the data file to have one column for depth and one column for temperature
- sorted data by depth, then ISO_DateTime_UTC.

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Data Files

File
TCHAIN.csv (Comma Separated Values (.csv), 2.17 GB) MD5:e4667318e45561fc3cb4ae0d742b13ce Primary data file for dataset ID 734541

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Supplemental Files

File
Instrument Metadata filename: TCHAIN_METADATA_042018.xlsx (Octet Stream, 419.17 KB) MD5:2f28595032f86b29f96be9ca9d131e94 Additional information describing the instruments used during collection.
mooring depiction filename: mooring.png (Portable Network Graphics (.png), 84.99 KB) MD5:c1e97c055f105fccc6d2690d8bd242ba Depiction of the mooring platform used for data collection.

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Parameters

Parameter	Description	Units
temp	average temperatures measured at various heights above the bed	degrees Celsius
ISO_DateTime_UTC	Date and Time formatted according to ISO 8601 date/time convention	unitless
HAB_cm	Height above bottom	centimeters (cm)
HAB_m	Height above bottom	meters (m)
lat	latitude with positive values northward	decimal degrees
lon	longitude with negative values westward	decimal degrees

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Instruments

Dataset-specific Instrument Name	RBR TDR- 2050, RBR TR-1060)
Generic Instrument Name	Data Logger
Generic Instrument Description	Electronic devices that record data over time or in relation to location either with a built-in instrument or sensor or via external instruments and sensors.

Dataset-specific Instrument Name	Onset (HOBO)
Generic Instrument Name	Data Logger
Generic Instrument Description	Electronic devices that record data over time or in relation to location either with a built-in instrument or sensor or via external instruments and sensors.

Dataset-specific Instrument Name	Sea-bird Scientific (SBE56)
Generic Instrument Name	Temperature Logger
Generic Instrument Description	Records temperature data over a period of time.

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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/full
http://link.springer.com/article/10.1007/s00348-012-1265-9
http://aslo.net/lomethods/free/2009/0169.pdf
http://www.sciencedirect.com/science/article/pii/S0380133015001458

Note: This is an NSF Collaborative Research Project.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1658390

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