ECOpuck Fluorometer data from 12 Wire Flyer deployments conducted on R/V Sikuliaq cruise SKQ201701S in the Eastern Tropical North Pacific from January to February 2017

Website: https://www.bco-dmo.org/dataset/859980
Data Type: Cruise Results
Version: 1
Version Date: 2022-05-03

Project
» Collaborative Research: A metabolic index to predict the consequences of climate change for midwater ecosystems (Metabolic Index)

Contributors	Affiliation	Role
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Abstract
This dataset includes ECOpuck fluorometer data from 12 Wire Flyer deployments conducted on R/V Sikuliaq cruise SKQ201701S in the Eastern Tropical North Pacific from January to February 2017.

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Coverage

Spatial Extent: **N**:22.604527 **E**:-117.008989 **S**:21.222497 **W**:-118.591762
Temporal Extent: 2017-01-25 - 2017-02-12

Methods & Sampling

Data were collected from an ECOpuck fluorometer on Wire Flyer deployments from R/V Sikuliaq cruise SKQ201701S in the Eastern Tropical North Pacific during January and February 2017. The data have not been corrected for any time lags. The Chl and turbidity are from a Wet Labs Flbb-2k (470/695 nm Chl-a and 700nm turbidity).

The Wire Flyer position was calculated using measurements of the clump weight depth and the wire payout. The layback distance is the Flyer's distance behind the ship. The raw count values were converted with the following coefficients:

self.turb_darkcount=50

self.turb_scalefactor=0.0747

self.chloro_darkcount=41.

self.chloro_scalefactor=0.0072

self.lcm_msg.turb = self.turb_scalefactor * (turb_data - self.turb_darkcount)

self.lcm_msg.chl = self.chloro_scalefactor * (chloro_data - self.chloro_darkcount)

Known Problems/Issues:
There is an asymmetry between the up and down directions, likely due to the flow over the sensor. We have not yet determined a correction for this.

Data Processing Description

BCO-DMO Processing:
- concatenated data from 12 separate files into one dataset;
- replaced "NaN" with "nd" (no data);
- created new column "deployment_id" (based on original file name);
- converted date/time field to ISO8601 format.

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Data Files

File
ecopuck_2017.csv (Comma Separated Values (.csv), 60.81 MB) MD5:ab920f7c2651f957301f1811adaeafee Primary data file for dataset ID 859980

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Supplemental Files

File
SKQ201701S Wire Flyer Summary Plots filename: summary_plots.zip (ZIP Archive (ZIP), 16.49 MB) MD5:81e1ebe72d60bf253110a9aa93a5fc21 Summary plots of data from 12 Wire Flyer deployments conducted on R/V Sikuliaq cruise SKQ201701S. There is one PDF for each deployment. The file naming convention is YYYYMMDD_HHMMSS, set at the start of the deployment, e.g. 20170125_151748. The times are all in GMT, not local time.
Wire Flyer Launch and Recover Document filename: flyer_launch_and_recover_document.pdf (Portable Document Format (.pdf), 7.26 MB) MD5:f9274b8c8b003b9a39083191e4f2c76b Document describing the Wire Flyer launch and recovery procedures.
Wire Flyer Overview 2019 filename: Wire_flyer_overview_2019.pdf (Portable Document Format (.pdf), 15.84 MB) MD5:7c3c14f839142f115c5aa467894395d7 Slides from a presentation by Christopher Roman titled "The Wire Flyer vehicle system and high resolution hydrographic sections".

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Related Publications

Roman, C., Ullman, D. S., Hebert, D., & Licht, S. (2019). The Wire Flyer Towed Profiling System. Journal of Atmospheric and Oceanic Technology, 36(2), 161–182. doi:10.1175/jtech-d-17-0180.1
Methods

Wishner, K. F., Seibel, B. A., Roman, C., Deutsch, C., Outram, D., Shaw, C. T., ... Riley, S. (2018). Ocean deoxygenation and zooplankton: Very small oxygen differences matter. Science Advances, 4(12), eaau5180. doi:10.1126/sciadv.aau5180
Results

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Parameters

Parameter	Description	Units
deployment_id	identifier for the deployment; indicates the start date and time of deployment in format: YYYYMMDD_hhmmss (time zone is GMT)	unitless
temp_counts	raw temperature data	unitless
timestamp	time stamp in microunix seconds	microunix seconds
chl	chlorophyll	micrograms per liter (ug/L)
turb_counts	raw turbidity reading	unitless
chl_counts	raw chl-a reading	unitless
turb	turbidity; calculated from the raw count value	NTU
datestring	date-time string (GMT) in format where xxx represent milliseconds: YYYY-MM-DD hh:mm:ss.xxx	unitless
ISO_DateTime_UTC	date-time string converted to ISO8601 format: YYYY-MM-DDThh:mm:ss.xxxxxxZ. Note that data are accurate to milliseconds (not microseconds)	unitless
lat	Latitude. This is either the ship or the flyer position, but it is the best position available. If the Flyer position was known, accounting for the tow cable, this is the value used here. If the flyer position was not known (e.g. maybe the winch cable counter failed), the ship position was recorded	degrees North
lon	Longitude. This is either the ship or the flyer position, but it is the best position available. If the Flyer position was known, accounting for the tow cable, this is the value used here. If the flyer position was not known (e.g. maybe the winch cable counter failed), the ship position was recorded	degrees East

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Instruments

Dataset-specific Instrument Name	ECOpuck fluorometer
Generic Instrument Name	Wet Labs ECO Puck
Generic Instrument Description	The Puck is a miniature version of the ECO series of sensors, specifically designed for use in AUVs, profiling floats, and Slocum gliders with a dry science bay. This compact optical sensor is available in combinations of backscattering and fluorescence measurements. Manufacturer's website: https://www.seabird.com/auv-rov-sensors/eco-puck/family?productCategoryI...

Dataset-specific Instrument Name	Wet Labs Flbb-2k
Generic Instrument Name	WETLabs ECO FLBB scattering fluorescence sensor
Dataset-specific Description	The Chl and turbidity are from a Wet Labs Flbb-2k, 470/695 nm Chl-a and 700nm turbidity.
Generic Instrument Description	A dual-optical-sensor that carries a single-wavelength chlorophyll fluorometer (470nm ex/695nm em) and backscattering sensor (700 nm) that measures phytoplankton and particle concentration. It operates by using blue (470nm) and red (700 nm) LEDs that alternately flash. The blue LED stimulates chlorophyll fluorescence in plants while the red light illuminates the total particle field. The backscattering sensor has an in-water centroid angle of 142 degrees and can be calibrated to measure turbidity. The fluorometer can typically measure phytoplankton concentrations in the range 0-30 ug/l, with a sensitivity of 0.015 ug/l. The backscattering sensor can measure within the range 0-3 m-1, with a sensitivity of 0.0015 m-1. The instrument output in the standard version is digital and uses a low power mode and stores data. Other variants are used. The instrument is rated to a depth of 600m as standard, with the options of deeper instruments rated up to 6000m and instruments with bio-wipers, rated to 300 m. This instrument comes in the following optional models: FLbb(RT), FLbb(RT)D, FLbbB, FLbbS, FLbbBS, FLbb2k. Refer to the datasheet from the manufacturer: https://www.seabird.com/asset-get.download.jsa?id=55460873804

Dataset-specific Instrument Name	Wire Flyer
Generic Instrument Name	Wire Flyer Towed Profiling System
Generic Instrument Description	Description from Roman et al. (2019): The Wire Flyer towed vehicle is a platform able to collect high-resolution water column sections. The vehicle is motivated by a desire to effectively capture spatial structures at the submesoscale. The Wire Flyer profiles up and down along a ship-towed cable autonomously using controllable wings for propulsion. At ship speeds between 2 and 5 kt (1.02–2.55 m s−1), the vehicle is able to profile over prescribed depth bands down to 1000 m. The vehicle carries sensors for conductivity, temperature, depth, oxygen, turbidity, chlorophyll, pH, and oxidation reduction potential. During normal operations, the vehicle is typically commanded to cover vertical regions between 300 and 400 m in height with profiles that repeat at kilometer spacing. The vertical profiling speed can be user-specified up to 150 m min−1. During operations, an acoustic modem is used to communicate with the vehicle to provide status information, data samples, and the ability to modify the sampling pattern. Detailed information can be found in the following publication: Roman, C., Ullman, D. S., Hebert, D., & Licht, S. (2019). The Wire Flyer Towed Profiling System. Journal of Atmospheric and Oceanic Technology, 36(2), 161–182. doi:10.1175/jtech-d-17-0180.1

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Deployments

SKQ201701S

Website	https://www.bco-dmo.org/deployment/755461
Platform	R/V Sikuliaq
Start Date	2017-01-19
End Date	2017-02-15
Description	See additional cruise information from R2R: https://www.rvdata.us/search/cruise/SKQ201701S

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Project Information

Collaborative Research: A metabolic index to predict the consequences of climate change for midwater ecosystems (Metabolic Index)

Coverage: Eastern Tropical North Pacific

Description from NSF award abstract:
With climate change, ocean temperatures are expected to increase which in turn will reduce oxygen availability and increase metabolic oxygen demand in marine organisms. The investigators will conduct shipboard physiological experiments for various marine organisms and determine their distributions in relation to environmental conditions within an oxygen minimum zone (OMZ) in the Eastern Pacific Ocean. The goal will be to model and map a Metabolic Index (MI) to predict how vertical and horizontal distributions for these species might change throughout the world's oceans in the future. The MI is defined as the ratio between environmental oxygen supply and temperature-dependent oxygen demand. Oxygen supply includes both the environmental oxygen concentration across a habitat range and the physiological features of organisms that facilitate oxygen uptake, such as gills and circulatory systems. Thus, the MI will integrate measured tolerance and environmental exposure to low oxygen with environmental data. The investigators will measure tolerance to low oxygen, focusing on under-studied organisms, including the effect of temperature and organism size. They will sample along a natural gradient in oxygen content south of the California Current in the Eastern Pacific. The science team and a videographer will develop a blog about deep-sea biology and climate change using web-based and video technologies. Four graduate students will be funded on this project, and in conjunction with a recently developed course in pelagic ecology, several undergraduates will have the opportunity to participate in seagoing research.

This research fills a critical need for a physiology-based metric that can be used to predict changing marine communities as the oceans warm and hypoxic zones expand. Modern OMZs are extensive and characterized by deep-water (300-800 m) oxygen partial pressures lethal to most marine organisms, yet thriving communities exist there. Climate change is predicted to further deplete oxygen. The investigators will model and map a Metabolic Index (MI) for diverse marine species to help predict how in vertical and horizontal distributions of species may change throughout the world's oceans in the future. The MI will derive oxygen supply and demand data from published and planned measurements of the minimum environmental partial pressure of oxygen to which individual species are exposed (based on their distributions in the water column) and the minimum requirements to support routine aerobic metabolic demand (from shipboard respiration measurements of individuals). During research cruises in the Eastern Pacific along a gradient of OMZ intensity, the investigators will conduct shipboard physiological measurements to determine metabolic demand for understudied mesozooplankton and gelatinous taxa and determine the size- and temperature dependence for diverse species for incorporation into the MI. Vertically-stratified net sampling and in situ photography will identify and characterize unique OMZ community features, such as the lower oxycline biomass peak present in some OMZs and the oxygen-dependence of day and night habitat depths for vertically-migrating species. The MI will be mapped using climatological data to both test and generate hypotheses about the response of oceanic communities to climate change. In preliminary analysis, the MI suggests a metabolic constraint at a MI of ~2 that may act to limit vertical and horizontal habitat ranges.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1458967

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