Gridded in-situ profiles from glider deployments in the San Pedro Channel, CA in 2013 and 2014

Website: https://www.bco-dmo.org/dataset/751128
Data Type: Other Field Results
Version: 1
Version Date: 2018-12-19

Project
» Collaborative Research: Use of Triple Oxygen Isotopes and O2/Ar to constrain Net/Gross Oxygen Production during upwelling and non-upwelling periods in a Coastal Setting (UpRISEE O2 upwelling)
» OCE-RIG: The impact of submesoscale processes on oligotrophic carbon cycling and the sensitivity of this interaction to climatically driven changes (SHiP)

Contributors	Affiliation	Role
Haskell, William	University of California-Santa Barbara (UCSB-MSI)	Principal Investigator
Hammond, Douglas E.	University of Southern California (USC)	Co-Principal Investigator
Prokopenko, Maria	Pomona College (Pomona)	Co-Principal Investigator
Jones, Burton	King Abdullah University of Science and Technology (KAUST)	Scientist, Contact
Levine, Naomi M.	University of Southern California (USC)	Scientist
Teel, Elizabeth N.	University of Southern California (USC)	Student, Contact
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes chlorophyll a fluorescence and water temperature from gridded in-situ profiles from a slocum glider deployed between March and July in 2013 and 2014 in the San Pedro Channel, located in the Southern California Bight off the coast of Los Angeles.

Table of Contents

Coverage

Spatial Extent: **N**:33.69088 **E**:-118.33291 **S**:33.4642 **W**:-118.516
Temporal Extent: 2013-03-12 - 2014-07-06

Dataset Description

This dataset includes chlorophyll a fluorescence and water temperature from gridded in-situ profiles from a Slocum Glider deployed between March and July in 2013 and 2014 in the San Pedro Channel, located in the

Southern California Bight off the coast of Los Angeles.

These data were published in Teel et al., 2018.

In addition to the tabular form of this dataset available by clicking the "Get Data" button on this page, it is also available as a Matlab (*.mat) file containing data matrices and vectors.
* Note that the tabular dataset has a "DEPTH" parameter, but there is none in the above .mat file. Each row of the matrices corresponds to 1m depth increments starting with the first row which corresponds to 1m depth to the last row number 80 corresponding to 80m depth.

Methods & Sampling

Glider deployment:
For this study, a slocum glider was deployed between March and July in 2013 and 2014 in the San Pedro Channel, located in the Southern California Bight off the coast of Los Angeles. The glider was deployed on a 28 km cross-channel path between Catalina Island and the Palos Verdes Peninsula and completed a single cross-channel pass every 1.5–2 days (average speed 1 km h−1). Data were collected between ~ 3 and 90 m, with the exception of when the glider crossed the major shipping lanes where the glider was constrained to depths below 20 m to avoid damage or loss from ship traffic.

The GMT time stamp indicates the earliest time stamp for data binned within a single profile.

Glider deployments were from small boats belonging to the USC Wrigley Marine Sciences Center or from the R/V Yellowfin.

Instruments:
Teledyne Webb G1 Slocum electric gliders equipped with a WET Labs EcoPuck FL3 fluorometer (used for Chlorophyll a fluorescence), a WET Labs EcoPuck BB3 sensor (used for backscatter at wavelengths of 532, 660, and 880 nm), and a Sea-Bird flow-through CTD (used for temperature, salinity, and pressure).

For more methodology information see Teel et al., 2018.

Data Processing Description

Data processing:
Glider data were processed in Matlab (versions R2012b, R2014a, R2015b, and R2016b). The glider data from each 2-day transect were gridded onto an idealized glider transect with 500 m horizontal resolution and 1m vertical resolution that was approximately perpendicular to the mean flow and the coastline. Only glider data within 5 km of the idealized transect were used in this analysis (Fig. 1). Each 500 m bin (N = 62) corresponded approximately with a single downcast and upcast. Only profiles with data for > 85 % of the vertical bins were used for further analyses, thereby excluding partial profiles from under the shipping lanes. The remaining missing data (< 15 % of each profile) were filled using 2-D interpolation from all neighboring bins. A total of 557 profiles from 2013 and 1049 profiles from 2014 were accepted for further analyses.

BCO-DMO Data Manager Processing notes:
* Script to transform originally submitted matlab data matrices and vectors into a tabular dataset attached as a supplemental document to this dataset landing page.
* Tabular version of the data available by pressing the "Get Data" button. NaNs in the matlab data are displayed as "nd" for no data in the BCO-DMO data system.
* Data was rounded in matlab (or else would be 13 decimal places). LAT and LON rounded to 5 decimal places. CHL and TEMP rounded to 3 decimal places.
* ISO_DateTime_UTC (yyyy-mm-ddTHH:MM:SSZ) timestamp with time zone added to the tabular dataset in addition to the matlab datenum column.
* Added depth column to tabular dataset based on submitter's information that each row in the mat file corresponds to 1m depth increments with row 1 starting at 1m.

[table of contents | back to top]

Data Files

File	
gridded_glider.csv Primary data file for dataset ID 751128	(Comma Separated Values (.csv), 10.35 MB) MD5:45c36b7f0cc53eadc431a6471a2bb0b0
GriddedGlider_TandCHL.mat MatLAB .mat file containing gridded in-situ profiles from glider deployments in the San Pedro Channel, CA in 2013 and 2014. For metadata and access to a tabular, ascii version of these data, see dataset landing page: https://www.bco-dmo.org/dataset/751128 * Note that the tabular dataset served from page https://www.bco-dmo.org/dataset/751128 has a "DEPTH" parameter, but there is no DEPTH within the .mat file. Each row of the matrices corresponds to 1m depth increments starting with the first row which corresponds to 1m depth to the last row number 80 corresponding to 80m depth.	(MATLAB Data (.mat), 2.18 MB) MD5:364b0450f06d2164c2920a6b33aaef64

[table of contents | back to top]

Supplemental Files

File	
Gridded glider .mat to .csv filename: gridded_glider.m Matlab m-file script to take gridded glider matricies and vectors in from a .mat file, transform it to a tabular dataset and export it as .csv.	(Octet Stream, 2.60 KB) MD5:fc306d5861247c5aeecb0a4c6576cdb3

[table of contents | back to top]

Related Publications

Cetinić, I., Toro-Farmer, G., Ragan, M., Oberg, C., & Jones, B. H. (2009). Calibration procedure for Slocum glider deployed optical instruments. Optics Express, 17(18), 15420. doi:10.1364/oe.17.015420
https://doi.org/10.1364/OE.17.015420
Methods

Teel, E. N., Liu, X., Seegers, B. N., Ragan, M. A., Haskell, W. Z., Jones, B. H., & Levine, N. M. (2018). Contextualizing time-series data: quantification of short-term regional variability in the San Pedro Channel using high-resolution in situ glider data. Biogeosciences, 15(20), 6151–6165. doi:10.5194/bg-15-6151-2018
Methods

Teel, E. N., Liu, X., Seegers, B. N., Ragan, M. A., Haskell, W. Z., Jones, B. H., & Levine, N. M. (2018). Supplement of Contextualizing time-series data: quantification of short-term regional variability in the San Pedro Channel using high-resolution in situ glider data. Supplement of Biogeosciences, 15(20), 6151–6165. doi: 10.5194/bg-15-6151-2018-supplement
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
BINID	Bin identifier	unitless
DATENUM_GMT	Matlab datenum (Greenwich Mean Time)	unitless
ISO_DateTime_UTC	Timestamp (UTC) in standard ISO 8601:2004(E) format yyyy-mm-ddTHH:MM:SSZ	yyyy-MM-dd'T'HH:mm:ss'Z'
YEAR	Year in format yyyy	unitless
LAT	Latitude	decimal degrees (DD)
LON	Longitude	decimal degrees (DD)
DEPTH	Depth	meters (m)
CHL	Chlorophyll a fluorescence	milligrams per meter cubed (mg/m^3)
TEMP	Water temperature	degrees Celsius (C)

Instruments

Dataset-specific Instrument Name	Sea-Bird flow-through CTD
Generic Instrument Name	CTD Sea-Bird
Dataset-specific Description	Sea-Bird flow-through CTD (used for temperature, salinity, and pressure)
Generic Instrument Description	Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics, no specific unit identified. This instrument designation is used when specific make and model are not known. See also other SeaBird instruments listed under CTD. More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	WET Labs EcoPuck FL3
Generic Instrument Name	Fluorometer
Dataset-specific Description	WET Labs EcoPuck FL3 fluorometer (used for Chlorophyll a fluorescence).
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	WET Labs EcoPuck BB3
Generic Instrument Name	Optical Backscatter Sensor
Dataset-specific Description	WET Labs EcoPuck BB3 sensor (used for backscatter at wavelengths of 532, 660, and 880 nm)

Deployments

UpRISEE_SPOT_13-14

Website	https://www.bco-dmo.org/deployment/684011
Platform	R/V Yellowfin
Start Date	2013-01-16
End Date	2014-06-19
Description	A series of cruises were conducted from January 2013 to June 2014 to the San Pedro Ocean Time-Series (SPOT) station. These cruises were part of a study aimed at characterizing the biological response to upwelling at SPOT: the Upwelling Regime In-Situ Ecosystem Efficiency (Up.R.I.S.E.E.) study.

Project Information

Collaborative Research: Use of Triple Oxygen Isotopes and O2/Ar to constrain Net/Gross Oxygen Production during upwelling and non-upwelling periods in a Coastal Setting (UpRISEE O2 upwelling)

Coverage: Northeast Pacific Ocean

The marine biological pump is one of the primary pathways via which anthropogenic carbon dioxide may be sequestered from the atmosphere and exported to the deep ocean as organic carbon. While the link between nutrient supply and high primary productivity in upwelling regions is well established, factors controlling the organic carbon export efficiency of upwelling ecosystems are not well known. Scientists from the University of Southern California and Pomona College plan to determine the factors that control the rates and magnitudes of two components of biological production, Net Community Production (NCP) and Gross Primary Production (GPP), as well as particulate organic carbon export efficiency, at the San Pedro Ocean Time Series, a coastal site in the California Borderland during periods of minimal and high upwelling velocity over a 2-year span. At this site, past and ongoing observations of hydrography and carbon rain will provide an historical context for interpreting results and mechanisms at work.

Rates of NCP and GPP will be quantified at different upwelling intensity, using dissolved oxygen to argon (O2/Ar) ratios and the oxygen triple isotope composition of dissolved oxygen (O2). The export of organic carbon will be established using 234Th (thorium) profiles in the water column, coupled with floating sediment trap deployments, and the development of a carbon isotope balance for the water column. Upwelling will be characterized using non-steady state budgets for atmospheric 7Be (beryllium) input and its depth-integrated decay, as well as estimating rates based on remote measurements of wind stress curl and budgets for dissolved inorganic carbon and silicon. Application of the O2/Ar ratio and the oxygen triple isotope approach will require depth-integrated profiles of these tracers to evaluate the impact of upwelling on mixed layer inputs and use of non-steady state models during seasonal transitions in upwelling. The comprehensive data set to be obtained should provide insights into the organic carbon export efficiency under variable upwelling regimes and help to relate the satellite-based measurements of chlorophyll to the organic carbon export of these highly productive ecosystems.

Broader Impacts: One graduate and one undergraduate student from the University of Southern California and two undergraduate students from Pomona College would be supported and trained as part of this project.

OCE-RIG: The impact of submesoscale processes on oligotrophic carbon cycling and the sensitivity of this interaction to climatically driven changes (SHiP)

NSF Award Abstract:

Overview: Anthropogenically induced warming has begun to change the global oceans and has the potential to alter the ocean carbon sink. Future changes in mixed layer depth and the delivery of nutrients into the surface ocean are hypothesized to be the primary processes that will impact primary production and carbon cycling in the ocean. Both of these processes are significantly impacted by submesoscale physical dynamics (1-10 km). However, current global climate models used to understand climate sensitivity do not resolve these important features, and so are missing a fundamental mechanism impacting ocean carbon cycling. In this project, the PI will develop a novel biogeochemical and ecosystem model that captures the impact of submesoscale processes on carbon cycling in a framework that is computationally tractable for large-scale simulations.

The Spatially Heterogeneous Dynamic Plankton (SHiP) model will represent a distribution of resource environments at the subgridscale and will include five phytoplankton functional groups, as well as light, nitrogen, and phosphorus limitation on phytoplankton growth. This research will focus on two oligotrophic sites, the Bermuda Atlantic Time-series Station (BATS) and the Hawaii Ocean Time-series (HOT). The SHiP model will be used to explore the impact of the observed submesoscale dynamics captured by the APEX/ISUS profiling nitrate floats on primary production, species dynamics, and carbon export flux. A suite of model simulations will also be conducted to investigate the sensitivity of carbon cycling at BATS and HOT to changes in the frequency and intensity of submesoscale front formation, such as might occur under future climate scenarios. Finally, the measurement-driven SHiP simulations will be compared against an idealized Regional Ocean Modeling System simulation that explicitly resolves submesoscale dynamics.

Intellectual Merit: Submesoscale processes have been shown to have a significant impact on ocean physics, however, the role that these processes play in carbon cycling remains unknown. This study will provide an observation-based analysis of the impact of submesoscale features on community composition and function in oligotrophic gyres and the sensitivity of this interaction to climatically driven changes. In addition, this work will validate a novel approach for mechanistically incorporating the impact of submesoscale dynamics into coarse-resolution models. This research will provide a computationally tractable framework for exploring the impact of changes in climate on global carbon cycling while including the impact of submesoscale processes.

Broader Impacts: The investigator and students associated with this project will collaborate with the Neighborhood Academic Initiative (NAI) at USC to develop an ocean sciences module including a field trip on an oceanographic research vessel. The NAI strives to improve high school graduation and college matriculation rates in the school district surrounding USC, which serves predominantly Latino/Hispanic and African-American communities. The module will also expose the students to oceanography, and help local high school teachers develop an ocean sciences lesson plan to incorporate into their curriculum.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260296
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260692
NSF Ocean Sciences Research Initiation Grants (NSF OCE-RIG)	OCE-RIG-1323319