All measurements used in the net oxygen production estimates from R/V Yellowfin cruises to the San Pedro Ocean Time-series (SPOT) in 2013 and 2014

Website: https://www.bco-dmo.org/dataset/683989
Data Type: Cruise Results
Version: 08 March 2017
Version Date: 2017-03-08

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)

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
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Table of Contents

Coverage

Spatial Extent: **Lat**:33.55 **Lon**:-118.4
Temporal Extent: 2013-01-16 - 2014-06-19

Dataset Description

All measurements used in the net oxygen production estimates from data collected at the San Pedro Ocean Time-series (SPOT) station (33 33'N, 118 24'W). Data are also published as Table 3 in the following publication: Haskell, W. Z., et al. 2016. An organic carbon budget for coastal Southern California determined by estimates of vertical nutrient flux, net community production and export. Deep-Sea Research I, 116, 49-76. doi:10.1016/j.dsr.2016.07.003

Methods & Sampling

See complete methodology in Haskell et al. (2016). In summary:
This study is part of an effort aimed at characterizing the biological response to upwelling at SPOT on 21 cruises between January 2013 and June 2014; the Upwelling Regime In-Situ Ecosystem Efficiency (Up.R.I.S.E.E.) study.

Dissolved oxygen/argon ratios: Samples for O2/Ar analysis were collected from Niskin bottles in 300 and 500 mL glass flasks equipped with airtight Louwers-Hapert valves (with 3 high-vacuum greased Viton O-rings

in valve stem) and side arms. Prior to sampling, each bottle was poisoned with 150 uL saturated HgCl2, dried in an oven at 50 C, then evacuated to <1 mtorr and weighed. Samples were later sent to the laboratory of Rachel Stanley (WHOI) where they were analyzed for O2 (m/z = 32) and Ar (m/z = 40) by peak jumping using a Finnigan MAT 253 IRMS.

CTD oxygen sensor calibration: The CTD oxygen sensor (Seabird SBE 43) was calibrated using Winkler titrations on samples collected in duplicate at 5 depths on every CTD cast. Winkler titrations were performed the day after each cruise for most of the one day cruises, and typically two days following each two-day cruise, with equipment and procedure outlined by Langdon (2010). In one case (Up-1), Winkler analyses were performed 4 days after the cruise.

Oxygen mixed layer depths were determined as the depth at which the oxygen concentration was 0.5% different from the surface concentration (Castro-Morales and Kaiser, 2012) and ranged between 10 m and 35 m. Euphotic depths were typically between 35 m and 65 m, with the exception of Up-8 and Up-15 (30 m and 70 m). For 9 cruises (Up-13 to Up-21), the base of the euphotic zone was determined with the CTD as the depth at which 1% of the surface photosynthetically available radiation (PAR) is measured. Prior to Up-13, there was no PAR sensor on the CTD unit. Since the deep chlorophyll-a maximum (DCM; determined from CTD fluorescence profiles) is almost always above the euphotic depth in Southern California Bight (Cullen and Eppley, 1981), for the remainder of the cruises, the euphotic depth was defined as 10 m below the DCM. However, during Up-2, -3, and -4, the DCM was within the mixed layer. For these three cruises, the euphotic depth was defined as 15 m below the MLD.

Data Processing Description

BCO-DMO Processing:
-modified parameter names to conform with BCO-DMO naming conventions;
-formatted dates to yyyy-mm-dd;
-created separate columns for MLD and EuphD;
-added site name, lat, and lon from information on metadata form.

[table of contents | back to top]

Data Files

File	
net_O2_production.csv	(Comma Separated Values (.csv), 8.72 KB) MD5:aa05ade167cd069f3e5366323ffb49e6
Primary data file for dataset ID 683989	

[table of contents | back to top]

Parameters

Parameter	Description	Units
cruise_id	Cruise identifier	unitless
date	Date of sampling formatted as yyyy-mm-dd	unitless
MLD	Mixed layer depth; Oxygen mixed layer depths were determined as the depth at which the oxygen concentration was 0.5% different from the surface concentration.	meters (m)
EuphD	Euphotic depth; see "Acquisition Description" for methodology.	meters (m)
depth	Sample depth	meters (m)
O2_sat	Oxygen saturation concentration calculated in mmol kg-1 using temperature and salinity measured by Seabird CTD (Garcia and Gordon, 1992), then converted to uM assuming a density of 1.0255 kg/L.	micromolar (uM)
delta_O2_to_Ar	Biological supersaturation of oxygen calculated from measurements of O2/Ar by IRMS.	unitless
site	Name of the site	unitless
lat	Latitude of the site	decimal degrees
lon	Longitude of the site	decimal degrees
year	4-digit year	unitless
month	2-digit month	unitless
day	2-digit day	unitless
yrday	Year day (sequential day of year, eg. Jan 1 = 1)	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Seabird CTD
Generic Instrument Name	CTD Sea-Bird
Generic Instrument Description	A Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics. This instrument designation is used when specific make and model are not known or when a more specific term is not available in the BCO-DMO vocabulary. Refer to the dataset-specific metadata for more information about the specific CTD used. More information from: http://www.seabird.com/

Dataset-specific Instrument Name	Finnigan MAT 253 IRMS
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Samples were sent to the laboratory of Rachel Stanley (WHOI) where they were analyzed for O2 (m/z = 32) and Ar (m/z = 40) by peak jumping using a Finnigan MAT 253 IRMS.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Samples for O2/Ar analysis were collected from Niskin bottles.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	PAR sensor
Generic Instrument Name	Photosynthetically Available Radiation Sensor
Generic Instrument Description	A PAR sensor measures photosynthetically available (or active) radiation. The sensor measures photon flux density (photons per second per square meter) within the visible wavelength range (typically 400 to 700 nanometers). PAR gives an indication of the total energy available to plants for photosynthesis. This instrument name is used when specific type, make and model are not known.

Dataset-specific Instrument Name	Seabird SBE 43
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	The CTD oxygen sensor (Seabird SBE 43) was calibrated using Winkler titrations on samples collected in duplicate at 5 depths on every CTD cast.
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

[table of contents | back to top]

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.

[table of contents | back to top]

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260296
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260692

[table of contents | back to top]