

All 234Th data pertaining to the upwelling velocity calculations from R/V Yellowfin cruises to the San Pedro Ocean Time-series (SPOT) in 2013 and 2014

Website: <https://www.bco-dmo.org/dataset/685297>

Data Type: Other Field Results

Version: 08 March 2017

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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
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Coverage

Spatial Extent: Lat:33.55 Lon:-118.4

Temporal Extent: 2013-01-16 - 2014-06-19

Dataset Description

All 234Th data pertaining to the upwelling velocity calculations. Measurements were made at the San Pedro Ocean Time-series (SPOT) station (33°33'N, 118°24'W). Data are also published in Table B2 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](https://doi.org/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.

Thorium-234: Vertical profiles from the surface to 200 m were collected for thorium via Niskin/CTD on every

cruise. Ten liters were collected at eight depths, chosen based on the fluorescence profile observed during the CTD's descent. A ^{229}Th spike of known activity was added to the samples as they were being transferred from Niskins into 10 L or 20 L polycarbonate carboys (to an activity ~ 0.9 dpm/L) and allowed to equilibrate for at least 24 h. The recovery yield of ^{229}Th in each sample was used in all calculations of ^{234}Th to correct for methodological efficiency. The samples were coprecipitated with MnO_2 using the technique originally developed by Rutgers van der Loeff and Moore (1999) and detailed in Haskell et al. (2013). Samples were filtered onto a 0.45 μm Pall Supor Membrane filter (142 mm). The filters were dried at room temperature, placed in a plastic test tube, and placed in an Ortec low background gamma detector (intrinsic germanium, well-type, 150cc active volume). ^{234}Th has readily identifiable gamma peaks at 63.2 keV (branching ratio $\sim 4\%$) and 92.4+92.8 keV (branching ratio $\sim 5.5\%$). All reported activities of ^{234}Th have been calculated using the sum of these two peaks. Each sample was counted until counting uncertainty was below 8%. Counts were corrected for ^{234}Th decay, ingrowth from ^{238}U between collection and filtration, and production from co-precipitated ^{238}U , which was measured by re-counting multiple samples from each profile six months after collection (45 half-lives). Standardization was done using a solution of known ^{238}U activity.

Data Processing Description

BCO-DMO Processing:

- modified parameter names to conform with BCO-DMO naming conventions;
- formatted date to yyyy-mm-dd;
- replaced "-" and blanks (missing data) with "nd";
- added site name, lat, and lon from information on metadata form.

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Data Files

File
234Th.csv (Comma Separated Values (.csv), 2.37 KB) MD5:56a36f358e579debcf61b9e6bdc89b78
Primary data file for dataset ID 685297

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Parameters

Parameter	Description	Units
site	Name of the site	unitless
lat	Latitude of the site	decimal degrees
lon	Longitude of the site	decimal degrees
cruise_id	Cruise identifier	unitless
date	Date of sampling formatted as yyyy-mm-dd	unitless
Th_surf	Thorium-234 at the surface	disintegrations per minute per liter (dpm L ⁻¹)
Th_surf_sd	Standard deviation of thorium at the surface	disintegrations per minute per liter (dpm L ⁻¹)
Th_deep	Thorium-234 at deep depth	disintegrations per minute per liter (dpm L ⁻¹)
Th_deep_sd	Standard deviation of thorium at deep depth	disintegrations per minute per liter (dpm L ⁻¹)
D_Th	Depth-integrated thorium-234 deficiency to 100m	disintegrations per minute per square meter per day (dpm m ⁻² d ⁻¹)
D_Th_sd	Standard deviation of depth-integrated thorium deficiency to 100m	disintegrations per minute per square meter per day (dpm m ⁻² d ⁻¹)
P_Th	Thorium-234 export on sinking particles across the 100m horizon	disintegrations per minute per square meter per day (dpm m ⁻² d ⁻¹)
P_Th_sd	Standard deviation of thorium export on sinking particles across the 100m horizon	disintegrations per minute per square meter per day (dpm m ⁻² d ⁻¹)
year	4-digit year	unitless
month	2-digit month	unitless
day	2-digit day	unitless
yday	Year day (sequential day of year, eg. Jan 1 = 1)	unitless

Instruments

Dataset-specific Instrument Name	Seabird CTD
Generic Instrument Name	CTD Sea-Bird
Dataset-specific Description	Vertical profiles from the surface to 200 m were collected for thorium via Niskin/CTD on every cruise.
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	Ortec low background gamma detector
Generic Instrument Name	Gamma Ray Spectrometer
Generic Instrument Description	Instruments measuring the relative levels of electromagnetic radiation of different wavelengths in the gamma-ray waveband.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Vertical profiles from the surface to 200 m were collected for thorium via Niskin/CTD on every cruise.
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.

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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.

Funding

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