Oxygen and Gas Tension data collected from ODZ Floats Deployed from the RV Sally Ride Cruises SR2011 and SR2114 in the Eastern Tropical North Pacific from 2020 to 2023 (N-loss in the ETNP ODZ project)

Website: https://www.bco-dmo.org/dataset/983583
Data Type: Cruise Results
Version: 1
Version Date: 2025-08-26

Project
» Collaborative Research: Multiyear autonomous measurement of N-loss in the ETNP ODZ (N-loss in the ETNP ODZ)

Contributors	Affiliation	Role
D'Asaro, Eric	University of Washington Applied Physics Laboratory (UW APL)	Principal Investigator
McNeil, Craig L.	University of Washington Applied Physics Laboratory (UW APL)	Principal Investigator
Altabet, Mark A.	University of Massachusetts Dartmouth (UMass Dartmouth)	Co-Principal Investigator
Cunningham, Clifford	Duke University Department of Biology (Duke - Bio)	Scientist
Newman, Sawyer	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Table of Contents

Coverage

Location: Eastern Tropical Pacific Oxygen Depletion Zone
Spatial Extent: **N**:17.31845 **E**:-90.631261 **S**:8.990436 **W**:-107.803648
Temporal Extent: 2020-12-21 - 2022-05-12

BCO-DMO Processing Description

* The primary data file of this dataset (983583_v1_odz_float_oxygen_and_gtd_data.csv) is comprised of merged pre and post calibrated ODZ float data files. New columns have been added to this data file that indicate the name of the original source file (column "SourceFileName"), the serial number of the associated ODZ float (column "ODZFloatSN"), and a column indicating if a row of data was derived from a pre or post calibrated data file (column "CalibrationFlag").
* An ISO formatted date time column has been created called "DateTime. This column was created from the

"timestring" column, where the format has been converted from %d-%b-%Y %H:%M:%S to %Y-%m-%d %H:%M:%S.
* Latitude and longitude values have been rounded to 6 degrees of precision.

Problem Description

Data Quality Statement from the Authors:
* GTD data is presented without quality control. Some profiles are clearly wrong.

[table of contents | back to top]

Related Publications

McNeil, C. L., D'Asaro, E. A., Altabet, M. A., Hamme, R. C., & Garcia-Robledo, E. (2023). Autonomous observations of biogenic N2 in the Eastern Tropical North Pacific using profiling floats equipped with gas tension devices. Frontiers in Marine Science, 10. https://doi.org/10.3389/fmars.2023.1134851 https://doi.org/doi:10.3389/fmars.2023.1134851
Results

[table of contents | back to top]

Related Datasets

IsRelatedTo

D'Asaro, E., McNeil, C. L., Altabet, M. A., Cunningham, C. (2025) **Oxygen and Gas Tension data collected from Argo Floats Deployed from the RV Sally Ride Cruises SR2011 and SR2114 in the Eastern Tropical North Pacific from 2020 to 2023 (N-loss in the ETNP ODZ project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-08-26 http://lod.bco-dmo.org/id/dataset/983497 [view at BCO-DMO]
Relationship Description: This dataset is supplemental to Argo and ODZ float oxygen datasets created during the same R/V Sally Ride cruises, providing calibration and validation reference points derived from shipboard STOX sensors.

D'Asaro, E., McNeil, C. L., Altabet, M. A., Cunningham, C. (2025) **Sally Ride STOX Oxygen Profiles.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-09-15 http://lod.bco-dmo.org/id/dataset/984383 [view at BCO-DMO]
Relationship Description: These float data are validated by shipboard STOX profile data, which are used to define low-oxygen calibration points and apply drift corrections to float optode measurements.

[table of contents | back to top]

Parameters

Parameter	Description	Units
MatlabSerialDateNumber	Datetime output of measurement capture exported from the Argo float as a MATLAB serial date number (days since 0000-01-01, decimals represent fraction of day).	unitless
timestring	Datetime output of measurement capture exported from the Argo float.	unitless

DateTime	FAIR compliant datetime output of measurement capture from the Argo float converted to ISO format.	unitless
latitude	Latitude of the ODZ float at the point of measurement capture in decimal degrees; a positive value indicates a northern coordinate.	decimal degrees
longitude	Longitude of the ODZ float at the point of measurement capture in decimal degrees; a negative value indicates a western coordinate.	decimal degrees
OptodeTemperature_C	Temperature output by the optode in degrees C.	degrees C
CTDTemperature_C	Temperature measured by the SBE41CT in degrees C.	degrees C
CTDSalinity_PSU	Salinity measured by the SBE41CT in PSU.	PSU
CTDPressure_dbar	Pressure measured by the SBE41CT in dbar.	dbar
OptodeOxygenFromSensor_micromolkg	Oxygen output by the optode in micromoles per kg.	micromoles per kg
OptodeOxygenCalibrated_micromolkg	Recalibrated oxygen from the data in micromoles per kg.	micromoles per kg
GTDtemperature_C	Temperature output by the optode in degrees C.	degrees C
GTDGasTension_mbar	Gas tension measured by the GTD in millibar. This has no quality control. Some data is bad.	millibar
ODZFloatSN	Serial number of the ODZ float associated with the represented measurement.	unitless
CalibrationFlag	Flag indicating if the data in a given row is from a pre or post calibrated file or (precalibrated_data or postcalibrated_data).	unitless
SourceFileName	Original file name from which the BCO-DMO primary data file (983583_v1_odz_float_oxygen_and_gtd_data.csv) was compiled.	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Aanderaa (Xylem) Oxygen Optodes
Generic Instrument Name	Aanderaa Oxygen Optodes
Dataset-specific Description	All Argo floats used for data collection were equipped with Aaneraa (Xylem) oxygen optodes.
Generic Instrument Description	Aanderaa Oxygen Optodes are instrument for monitoring oxygen in the environment. For instrument information see the Aanderaa Oxygen Optodes Product Brochure.

Dataset-specific Instrument Name	Seabird 41C CTD Sensors
Generic Instrument Name	CTD Sea-Bird 41
Dataset-specific Description	All Argo floats used for data collection were equipped with Seabird 41C temperature, salinity, and pressure sensors.
Generic Instrument Description	The Sea-Bird SBE 41 CTD module was originally developed in 1997 for integration with sub-surface oceanographic floats. It uses MicroCAT Temperature, Conductivity, and Pressure sensors.

[table of contents | back to top]

Deployments

SR2011

Website	https://www.bco-dmo.org/deployment/955215
Platform	R/V Sally Ride
Start Date	2020-12-16
End Date	2021-01-06
Description	More information is available from R2R: https://www.rvdata.us/search/cruise/SR2011

SR2114

Website	https://www.bco-dmo.org/deployment/931391
Platform	R/V Sally Ride
Start Date	2021-12-23
End Date	2022-01-21
Description	Additional cruise information is available from R2R: https://www.rvdata.us/search/cruise/SR2114

[table of contents | back to top]

Project Information

Collaborative Research: Multiyear autonomous measurement of N-loss in the ETNP ODZ (N-loss in the ETNP ODZ)

NSF Award Abstract:
Several regions of the deep ocean naturally contain almost no oxygen. Because of this lack of oxygen, microbes living in these regions live in ways that differ from those in oxygenated waters consuming nitrate ions instead of oxygen for respiration. Use of nitrate for microbial respiration results in the production of nitrogen gas which is called denitrification. The resulting removal of nitrate has consequences for the whole ocean as nitrogen is an important nutrient controlling plant growth; however, whereas plants can use nitrogen in the form of nitrate, they cannot, with a few exceptions, use nitrogen gas. There remains a number of uncertainties regarding how much denitrification occurs in the ocean, what controls it, and how it varies in time and space. Traditional studies of ocean denitrification have been limited by the time ships can be at sea and the relatively small proportion of the ocean they can observe. Our project plans to remedy this problem by using vehicles called floats that can operate autonomously in the ocean for three years or more as they drift with currents over hundreds of kilometers. We will outfit ten floats with sensors to measure oxygen and nitrogen gas which will be placed throughout the oxygen-depleted region of the Pacific Ocean to the west of Mexico. This is the largest such region in the ocean from which we have two years of results from a prototype float which validated our approach. This study may well transform our understanding of ocean denitrification and ultimately benefit society as a whole through greater confidence in predictions of the ocean's nitrogen cycle and capacity to fix carbon dioxide under current and future conditions. Application and further development of float systems using commercially available technology will directly benefit successor studies, and more broadly showcase the use of water-following platforms to tackle difficult oceanographic problems. Advances from this study are expected to carry over to other disciplines including ocean biogeochemical modeling. Outreach activities, support for an early career scientist, and student training are included in the project. For the outreach activities, the investigators plan to tie into well-established after-school programs serving underrepresented populations in Massachusetts and established opportunities for public presentations using float related display materials at the University of Washington.

Oxygen deficient zones (ODZs), despite constituting a small fraction of total oceanic volume, play important roles in regulating global ocean carbon and nitrogen cycles including hosting 30 to 50% of the global loss of fixed nitrogen. Unfortunately, current uncertainty in ODZ nitrogen loss derives from substantial temporal and spatial variability in rates that remain under-sampled by ship-based measurements. While local regulation of nitrogen loss by oxygen and organic matter availability are well accepted, temporal/spatial variability in the nitrogen flux is likely a result of the influence of physical forcings such as remote ventilation, seasonal variability, and mesoscale eddies. Understanding how the impact of physical forcings on nitrogen loss as mediated through oxygen and organic flux will be required to fully understand the causes and consequences of any future ODZ expansion. To improve our understanding of ODZ nitrogen loss, we will carry out a multiyear, autonomous float-based observational program to address outstanding questions regarding bioavailable nitrogen loss in ODZs. As the largest ODZ and region of our pilot deployments, our operation area will be the Eastern Tropical N. Pacific (ETNP) where our study will determine over a multi-year period, in-situ nM-level oxygen and biogenic nitrogen on float profiles spanning geographic gradients in oxygen and surface productivity. For the first time, our study will also determine in situ nitrogen loss rates from changes in nitrogen concentration during 1 to 2 week Lagrangian float drifts along a constant density surface. A pilot 2 yr float deployment in the ETNP documents our ability to do so. Critically, our float-based approach more closely matches the frequency and distribution of observations to the expected variability in biogenic nitrogen production as compared to prior work and will dramatically increase the data density for this region by acquiring >500 profiles/drifts for nitrogen and >1000 profiles for nM oxygen.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1154741
NSF Division of Ocean Sciences (NSF OCE)	OCE-1153295
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851361
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851210
Office of Naval Research (ONR)	N00014-20-1-2849

[table of contents | back to top]