Nitrate, nitrite, and nitrous oxide isotope measurements from the Eastern Tropical South Pacific ocean collected on RVIB Nathaniel B. Palmer cruise NBP1305 from June to July 2013

Website: https://www.bco-dmo.org/dataset/744679
Data Type: Cruise Results
Version: 1
Version Date: 2018-08-28

Project
» Biogeochemistry of nitrous oxide cycling in the eastern tropical South Pacific (N2O Cycling)

Contributors	Affiliation	Role
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Abstract
Nitrate, nitrite, and nitrous oxide isotope measurements from the Eastern Tropical South Pacific ocean collected on RVIB Nathaniel B. Palmer cruise NBP1305 from June to July 2013. The data in this dataset were published in Peters et al. (2018) and Casciotti et al. (2018).

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Coverage

Spatial Extent: **N**:-11.99976 **E**:-70.58334 **S**:-22.21654 **W**:-85.9989
Temporal Extent: 2013-06-27 - 2013-07-19

Dataset Description

Nitrate, nitrite, and nitrous oxide isotope measurements from the Eastern Tropical South Pacific ocean (NBP13-05). The data in this dataset were published in Peters et al. (2018) and Casciotti et al. (2018).

Methods & Sampling

Samples were collected from a standard Niskin bottle rosette.

Nitrate isotope analyses were conducted by denitrifier method (Sigman et al., 2001; Casciotti et al., 2002) with updates (McIlviin and Casciotti, 2011). Nitrite was removed from samples containing more than 0.1 uM nitrite, using sulfuric acid (Granger and Sigman, 2009). Standards include USGS32, USGS34, and USGS35.

Nitrite isotope analyses were conducted by azide method (McIlvin and Altabet, 2005). Standards include N23, N7373, and N10219.

Nitrous oxide isotope analyses were conducted as described in McIlvin and Casciotti, 2010. N2O isotope measurements were calibrated against a laboratory N2O working gas.

The water mass analysis for the oxygen deficient zone waters was conducted as described in Peters et al., 2018, Deep Sea Research II, Estimating fixed nitrogen loss and associated isotope effects using concentration and isotope measurements of NO3-, NO2-, and N2 from the Eastern Tropical South Pacific oxygen deficient zone.

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Data Files

File
ETSP_NBP13-05.csv (Comma Separated Values (.csv), 126.91 KB) MD5:d1c9102c3a7f7b5fa0f1c9dc849c9d0a Primary data file for dataset ID 744679

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Related Publications

Casciotti, K. L., Forbes, M., Vedamati, J., Peters, B., Martin, T., & Mordy, C. W. (2018). Nitrous oxide cycling in the Eastern Tropical South Pacific as inferred from isotopic and isotopomeric data. Deep Sea Research Part II: Topical Studies in Oceanography. doi:10.1016/j.dsr2.2018.07.014
Results

Peters, B., Horak, R., Devol, A., Fuchsman, C., Forbes, M., Mordy, C. W., & Casciotti, K. L. (2018). Estimating fixed nitrogen loss and associated isotope effects using concentration and isotope measurements of NO 3 – , NO 2 – , and N 2 from the Eastern Tropical South Pacific oxygen deficient zone. Deep Sea Research Part II: Topical Studies in Oceanography. doi:10.1016/j.dsr2.2018.02.011
Results

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Parameters

Parameter	Description	Units
CTD_cast	cast identifier from cruise	unitless
STN	station identifier from cruise	unitless
date	date; formatted as yyyy-mm-dd	unitless
DEPTH	sample depth	meters
PRESSURE	pressure	decibars
latitude	latitude of sampling	degrees North

longitude	longitude of sampling	degrees East
TEMPERATURE	temperature	degrees C
SALINITY	salinity	PSU
SIGMA_THETA	sigma-theta	kg/m3
SBE_OXYGEN	oxygen measured by SBE	umol/kg
O2_SAT_mL_L	oxygen saturation in milliliters per liter	ml/L
O2_SAT_umol_kg	oxygen saturation in micromoles per kilogram	umol/kg
AOU	apparent oxygen utilization	umol/kg
NO3_sample_IDs	internal reference number for sample	unitless
sulfamic_treated	An asterisk indicates a sample was treated with sulfamic acid to remove nitrite prior to nitrate isotopic analysis	unitless
d15N_NO3	delta 15N of nitrate	per mil vs. N2
d15N_NO3_sd	standard deviation of d15N_NO3	per mil
d18O_NO3	delta 18O of nitrate	per mil vs. VSMOW
d18O_NO3_sd	standard deviation of d18O_NO3	per mil
d15N_NO2	delta 15N of nitrite	per mil vs. N2
d15N_NO2_sd	standard deviation of d15N_NO2	per mil
d18O_NO2	d18O of nitrite	per mil vs. VSMOW
d18O_NO2_sd	standard deviation of d18O_NO2	per mil
N2O_sample_ID_1	internal reference number for sample (replicate 1 of 2)	unitless

N2O_sample_ID_2	internal reference number for sample (replicate 2 of 2)	unitless
N2O_conc	N2O concentration	nM
N2O_conc_sd	standard deviation of N2O_conc	nM
N2O_SP	N2O site preference	per mil
N2O_SP_sd	standard deviation of N2O_SP	per mil
d15N_N2O	delta 15N of N2O	per mil vs. N2
d15N_N2O_sd	standard deviation of d15N_N2O	per mil
d18O_N2O	delta 18O of N2O	per mil vs. VSMOW
d18O_N2O_sd	standard deviation of d18O_N2O	per mil
d15Na	delta 15N of N2O-alpha	per mil vs. N2
d15Na_sd	standard deviation of d15Na	per mil
d15Nb	delta 15N of N2O-beta	per mil vs. N2
d15Nb_sd	standard deviation of d15Nb	per mil
Kelvin	Temperature in Kelvin	K
ln_Ko	natural logarithm of Ko, the solubility of N2O in seawater as per Weiss and Price, 1980	unitless
Ko	solubility of N2O in seawater, as per Weiss and Price, 1980	mol N2O/kg/atm
N2O_sat_mol_kg	concentration of N2O at equilibrium with atmosphere at in situ temperature and salinity	mol N2O/kg
N2O_sat_nmol_L	concentration of N2O at equilibrium with atmosphere at in situ temperature and salinity, converted to nmol/L	nmol N2O/L

delta_N2O	N2O supersaturation, deltaN2O = [N2O]obs - [N2O]sat	nmol N2O/L
ESPIW	% Eastern South Pacific Intermediate Water, as per Peters et al., 2018 Deep Sea Research II	%
ESSW	% Equatorial Subsurface Water, as per Peters et al., 2018 Deep Sea Research II	%

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Instruments

Dataset-specific Instrument Name	ThermoFinnigan DeltaPLUS XP
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	All isotopic measurements were made on a ThermoFinnigan DeltaPLUS XP isotope ratio mass spectrometer.
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).

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Deployments

NBP1305

Website	https://www.bco-dmo.org/deployment/744692
Platform	RVIB Nathaniel B. Palmer
Start Date	2013-06-24
End Date	2013-07-27
Description	Additional cruise information is available at: http://www.marine-geo.org/link/entry.php?id=NBP1305 and https://gcmd.nasa.gov/KeywordSearch/Metadata.do?EntryId=NBP1305

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Project Information

Biogeochemistry of nitrous oxide cycling in the eastern tropical South Pacific (N2O Cycling)

Coverage: Peruvian Oxygen Deficient Zone

The eastern tropical South Pacific (ETSP) is a hot spot for oceanic nitrogen cycling. This region of upwelling and

The eastern tropical South Pacific (ETSP) is a hot spot for oceanic nitrogen cycling. This region of upwelling and high productivity fuels high rates of oxygen consumption below the mixed layer, nitrate regeneration from nitrification, and ultimately denitrification of nitrate to N2 gas. The climatically important trace gas nitrous oxide (N2O) also reaches extreme high concentrations in the oxycline and extreme low concentrations in the heart of the oxygen minimum zone (OMZ), indicating active cycling in this region. Despite many years of investigation, the mechanism of N2O production in this hot spot is ambiguous because of the potential overlap or coupling of nitrification and denitrification processes at low oxygen tensions.

The investigators employed novel stable isotopic techniques to identify processes involved with nitrous oxide production and consumption in the water column at multiple sites within the eastern tropical South Pacific. They also sought to map the natural distributions of nitrate, nitrite and nitrous oxide concentrations and isotopes at high spatial resolution in order to develop a dataset with which to constrain ocean models based on their rate measurements.

Incubation experiments were carried out at sea to quantify the rates of nitrification and N2O cycling in samples throughout the oxygen minimum zone. In addition, approximately 1000 samples were collected for nitrate and nitrite isotopic analysis and 500 samples for N2O isotopic analysis. The investigators worked closely with other researchers onboard to work towards developing the most coherent picture of nitrogen cycling in the eastern tropical Pacific to date.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1233339
NSF Division of Ocean Sciences (NSF OCE)	OCE-1140404

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