PNsink mass flux and d15N from floating sediment trap deployments collected on the R/V Atlantis (AT15-61) and R/V Melville (MV1104) in 2010-2011 (N2 fixation ETSP project)

Website: https://www.bco-dmo.org/dataset/555713
Data Type: Cruise Results
Version: 2015-04-09

Project
» Collaborative Research: Documenting N2 fixation in N deficient waters of the Eastern Tropical South Pacific (N2 fixation ETSP)

Contributors	Affiliation	Role
Capone, Douglas G.	University of Southern California (USC-WIES)	Lead Principal Investigator
Berelson, William M.	University of Southern California (USC-WIES)	Principal Investigator
Hansell, Dennis	University of Miami Rosenstiel School of Marine and Atmospheric Science (UM-RSMAS)	Principal Investigator
Hammond, Douglas E.	University of Southern California (USC)	Co-Principal Investigator
Knapp, Angela N.	University of Miami Rosenstiel School of Marine and Atmospheric Science (UM-RSMAS)	Co-Principal Investigator, Contact
Prokopenko, Maria	University of Southern California (USC-WIES)	Scientist
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Methods & Sampling

Sinking particulate nitrogen (PNsink) mass and d15N analysis: Sinking particulate material was collected using surface-tethered floating particle-interceptor traps (PIT) equipped with 12 polycarbonate cylinders, deployed for up to 70 hours. Floating sediment traps were deployed at 200 m at Stations 3 and 5 on the 2010 cruise; for all other stations, traps were deployed at 100 m. Sediment trap samples were collected into a brine solution and then filtered and split into replicate samples. In most cases, two splits were collected from each sediment trap, one of which was acidified to remove inorganic carbon. In 2010 filtration removed the contribution of “swimmers” from sediment trap material. On the 2011 cruise, “swimmers” were identified by dissecting microscopy and hand-picked from sediment trap samples using sterilized micropipettors and forceps to remove their isotopic contribution to the sinking flux. Mass and isotopic fluxes were determined by dividing the mass of sinking particulate material captured in each trap by the trap surface area and by the duration (hrs) of trap deployment. Subsequently, the total mass flux was multiplied by the %N determined by combustion analysis of trap samples at the UC Davis Stable Isotope Facility to calculate PNsink mass fluxes;

the d15N of trap samples was determined at the same time. The limit of detection for combustion analysis is 1.5 µmols N and the precision of the d15N measurement is + 0.3‰. No systematic difference was observed in the d15N of acidified vs. non-acidified trap samples.

References:

Soutar, A., Kling, S. A., Crill, P. A. & Duffrin, E. MONITORING MARINE-ENVIRONMENT THROUGH SEDIMENTATION. Nature 266, 136-139, doi:10.1038/266136a0 (1977).

Knauer, G. A., Martin, J. H. & Bruland, K. W. Fluxes of particulate carbon, nitrogen, and phosphorus in the upper water column of the northeast Pacific. Deep-Sea Research 26, 97-108, doi:10.1016/0198-0149(79)90089-X (1979).

Data Processing Description

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- added cruise id column
- replaced blank cells with nd

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Data Files

File
SedTrap.csv (Comma Separated Values (.csv), 466 bytes) MD5:91e14c5ae00556306dec17f0b3886c28 Primary data file for dataset ID 555713

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Parameters

Parameter	Description	Units
date	sample collection date (local). Format: yyyy-mm-dd	unitless
station	station	unitless
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
depth	Depth trap was deployed	meters
traps_per_depth	Number of traps deployed per depth (Total # sample splits)	unit
duration	Length of trap deployment	hours
PNsink_flux	Particulate Nitrogen sinking mass flux	milli mol N m-2 d-1
PNsink_flux_sd	Particulate Nitrogen sinking mass flux; 1 standard deviation	milli mol N m-2 d-1
del15N_PNsink	Particulate Nitrogen sinking flux d15N (per mil relative to N2 in air)	per mil
del15N_PNsink_sd	Particulate Nitrogen sinking flux d15N (per mil relative to N2 in air); 1 standard deviation	per mil
cruise_id	cruise_id	unitless

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Instruments

Dataset-specific Instrument Name	dissecting microscope
Generic Instrument Name	Microscope - Optical
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

Dataset-specific Instrument Name	Sed Trap - Float
Generic Instrument Name	Sediment Trap - Floating
Generic Instrument Description	Floating sediment traps are specially designed sampling devices deployed to float in the water column (as opposed to being secured to a mooring at a fixed depth) for periods of time to collect particles from the water column that are falling toward the sea floor. In general a sediment trap has a container at the bottom to collect the sample and a broad funnel-shaped opening at the top with baffles to keep out very large objects and help prevent the funnel from clogging. The 'Sediment Trap -Floating' designation is used for a floating type of sediment trap about which no other design details are known.

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Deployments

AT15-61

Website	https://www.bco-dmo.org/deployment/58785
Platform	R/V Atlantis
Start Date	2010-01-29
End Date	2010-03-03
Description	See more information at R2R: https://www.rvdata.us/search/cruise/AT15-61

MV1104

Website	https://www.bco-dmo.org/deployment/555585
Platform	R/V Melville
Start Date	2011-03-23
End Date	2011-04-23
Description	See more information at R2R: https://www.rvdata.us/search/cruise/MV1104

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Project Information

Collaborative Research: Documenting N2 fixation in N deficient waters of the Eastern Tropical South Pacific (N2 fixation ETSP)

Coverage: Eastern Tropical South Pacific

Description from NSF award abstract:
Several independent lines of geochemical and remote sensing evidence suggest that dinitrogen (N2) fixation may be associated with surface waters downstream of major oxygen minimum zones (OMZs) and in particular in the Eastern Tropical South Pacific (ETSP). However, little direct evidence supports these inferences. Besides substantiating these indirect assessments, documenting significant N2 fixation in the ETSP would provide insight into two longstanding controversies: Is the marine N budget balanced, as implied by modeling and paleoceanographic data, and if so, how are the processes that add and remove N spatially, and thus temporally coupled?

In this project researchers at the University of Southern California and the University of Miami will test the hypothesis that fixation occurs in the ETSP at areal rates that equal or exceed those previously documented in more well-studied regions such as the oligotrophic waters of the sub/tropical North Atlantic. If scaled to the surface area of ETSP waters, this could add an additional 10-50 Tg N per year of inputs to the global marine N budget. They will undertake two cruises in the ETSP during early and late summer in two consecutive years to assess the quantitative significance of N2 fixation as a source of new N to surface waters using complementary biological and geochemical tools. N2 fixation rates will be evaluated on two temporal/spatial scales: daily/local (bottle 15N2 incubations and floating sediment traps); and seasonal/regional (d15N budget using moored sediment traps and water column TDN d15N). These estimates provide detailed observations of potential N2 fixation during station occupation in two summer seasons, when rates are expected to be greatest, as well as prolonged observation over lower expected N2 fixation periods. A combination of these different estimates will aim to determine if N2 fixation in this region can help balance the marine N budget. If all goes as planned, this study will determine the quantitative importance of N2 fixation in the ETSP, and whether these previously undocumented rates can help resolve the marine N budget. Implications include the ability of the marine N cycle to maintain homeostasis, and thus the global C cycle on glacial/interglacial time scales.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0850801
NSF Division of Ocean Sciences (NSF OCE)	OCE-0850905

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