# 15N2-based N2 fixation rates from the Eastern Tropical South Pacific 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/555666
**Data Type**: Cruise Results
**Version**: 2016-02-29

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

| Contributors | Affiliation | Role |
|---|---|---|
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**Abstract**
15N2 incubation-based N2 fixation rates, nitrate plus nitrite concentration and d15N, sediment trap PN mass flux and isotopic composition from the Eastern Tropical South Pacific, 2010 and 2011.

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## Coverage

**Spatial Extent**: **N**:-15 **E**:-80 **S**:-20 **W**:-100
**Temporal Extent**: 2010-02-01 - 2011-04-19

## Dataset Description

15N2 incubation-based N2 fixation rates, nitrate plus nitrite concentration and d15N, sediment trap PN mass flux and isotopic composition from the Eastern Tropical South Pacific, 2010 and 201

### Methods & Sampling

**Water column sample collection:** Samples were collected on the R/V Atlantis in January through February 2010, and the R/V Melville in March through April 2011 on a zonal transect along 20º S between 80º W and 100º W, with exact station locations and sample depths, nutrient concentrations and isotopic compositions reported below. Water column samples were collected by Niskin bottles deployed on a rosette equipped with conductivity-temperature-depth (CTD) sensors. All samples were collected into acid-washed, sample-rinsed HDPE bottles, and samples from the upper 400 m passed a 0.2 µm filter before collection. All samples were stored at -20º C until analysis on land.

**15N2 fixation rate measurements**: Short-term N2 fixation rate measurements incubated with 15N2 gas from Sigma Aldrich (lot #s SZ1670V and MBBB0968V) were carried out in acid-washed, sample-rinsed light transparent 4 L polycarbonate bottles amended with 1.5 mL of 99% 15N2  and 1.5 mL of 0.5M NaH13CO3. Incubations were performed under simulated in situ conditions of temperature and light and run for staggered periods (e.g. 0, 12, 24 and 48 hrs). Incubations were terminated by filtration of the 4 L sample onto a precombusted 25 mm Whatman GF/F, which was then analyzed by mass spectrometry at the University of Southern California for d15N and d13C. During ESTP 1, periodic time zero incubations were measured, with samples filtered within 5 to 10 minutes of injection of 15N2. Zero time enrichments were typically near natural abundance levels with the greatest observed enrichment in 8 experiments at 23‰, essentially at natural abundance level for our tracer experiments. We assumed natural abundance (0.3663 atom %) for calculations. Limits of detection are about 10-14 µg for N and 6-10 µg for C. Reproducibility as the standard deviation for isotopic analysis is about ±0.3‰ for d15N and ±0.2‰ for d13C, and about ±0.1-0.2 µg for mass determinations.

#### 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

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## Data Files

| File |
|---|
| **Nfix.csv** (Comma Separated Values (.csv), 308 bytes)<br>MD5:58ff632e413b759cd7575e87a37c4f4f<br>Primary data file for dataset ID 555666 |

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## Related Publications

Montoya, J. P., M. Voss, P. Kahler, and D. G. Capone. 1996. A Simple, High-Precision, High-Sensitivity Tracer Assay for N (inf2) Fixation. Applied and Environmental Microbiology 62: 986-993.
https://aem.asm.org/content/62/3/986
*Methods*

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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 | sample depth | meters |
| Nfix_umol_N_m2_d | 24 hr 15N2 fixation rate | umol N m-2 d-1 |
| Nfix_stdev | 24 hr 15N2 fixation rate standard deviation | umol N m-2 d-1 |
| cruise_id | cruise_id | unitless |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | CTD |
| **Generic Instrument Name** | CTD - profiler |
| **Generic Instrument Description** | The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Gas Chromatograph |
| **Generic Instrument Name** | Gas Chromatograph |
| **Generic Instrument Description** | Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC) |

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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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