Nitrogen-15 uptake rates from R/V Atlantis II cruise AII-119-5 in the North Atlantic in 1989 (U.S. JGOFS NABE project)

Website: https://www.bco-dmo.org/dataset/2604
Version: final
Version Date: 2002-10-30

Project
» U.S. JGOFS North Atlantic Bloom Experiment (NABE)

Program
» U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Contributors	Affiliation	Role
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Dataset Description

Nitrogen-15 uptake rates for labeled substrates of NO2, NO3, NH4 and UREA

Methods & Sampling

PI: James McCarthy and John Nevins
of: Harvard University
dataset: Nitrogen-15 uptake rates for labeled substrates of NO2, NO3, NH4 and UREA
dates: May 18, 1989 to June 06, 1989
location:
project/cruise: North Atlantic Bloom Experiment/Atlantis II 119, leg 5
ship: R/V Atlantis II

Methodology:

Summary of methods used to determine new production and N cycling by ^{15}N incorporation by phytoplankton, and euphotic zone NH_4^+ concentrations using a high sensitivity assay during cruise #119 of the R/V Atlantis II: A component of the U.S. JGOFS North Atlantic Bloom Experiment (NABE)

James J. McCarthy and John L. Nevins

^{15}N Uptake Experiments

Water from 6 depths in the euphotic zone distributed from 60 - 0.1% Io was obtained from routine "productivity" casts conducted by the Scripps PACODF group deploying a rosette sampler equiped with 30 l Niskin bottles fitted with teflon coated springs. Water for the ^{15}N experiments was transfered from the Niskin bottles to darkened 20 l polypropylene carboys, transported to a laboratory, and dispensed into 3 l polycarbonate incubation bottles. Three incubation bottles were prepared from each sample depth, and spiked with ^{15}N-labeled (>98 At%) NH_4^+, NO_3^-, or NO_2^- (or alternately urea) to ~10% of the ambient concentration, or not less than 10 nM. Ambient nutrient concentrations were provided by C. Garside who deployed a pump profiling system coupled to an auto analyzer in an operation prior to each productivity cast.

Immediately after labeling the samples, they were transfered to deck-board incubator tanks supplied with flowing sea-surface water providing mixed-layer temperature conditions, and screened with neutral density material to simulate the in situ light level. The experiments were incubated for 3-4 hrs and terminated by filtration through Whatman 47 mm GF/F glass fiber filters (precombusted at 450° C for 1 hr) and rinsed with 50 ml of GF/F filtered sea water. The filters were placed into individual polyethylene envelopes, dried at 60° in a gravity drying oven, and stored in an air tight container with silica gel desiccant. On selected samples in each profile, 500 ml of the filtrate was retained for NH_4^+ and NO_2^- extraction and subsequent isotopic analysis in order to determine the degree of isotope dilution which occurred during the course of the experiments. The method of Brzezinski (1987) incorporating solid phase extraction proceedures (J.T. Baker, 3 ml, C18 cartridges) was used to extract NH_4^+. In the case of NO_2^-, reagents were added to the filtrate to form an analine compound (Horrigan et al. 1990) which was then extracted using the solid phase techniques employed for NH_4^+. If necessary, prior to extraction, unenriched carrier NO_2^- or NH_4^+ was added to these samples to bring their mass to ~40µg of N for isotopic analysis. The final eluate was collected and stored in sealed 3 ml, combusted, Pyrex glass vials (1 hr @ 450° C). In the laboratory, shortly before isotopic analysis, the eluate was reduced to a volume of ~0.5 ml by evaporation on a hot plate at ~80° C, and transfered by pipette to a combusted Whatman 25 mm GF/F glass fiber filter and dried in a gravity oven at 60° C. With the the isotopic data obtained from the NO_2^- and NH_4^+ extraction samples, uptake rates corrected for isotope dilution and NH_4^+ remineralization and 1° nitrification rates were calculated (Horrigan et al. 1990).

^{15}N enrichment of the samples was determined by mass spectrometry in our laboratory at Harvard University, using methods and instrumentation described previously (Nevins and McCarthy 1982). Particulate N from each sample was obtained manometrically from the mass spectrometer sample preparation system and these data were used in the subsequent rate calculations. NH_4^+ uptake rates were calculated using concentration data obtained from the nM method of Brzezinski (1987), used with solid phase extraction (J.T. Baker, 3 ml, C18 cartridges). Other uptake rates were calculated using data from the ship-board auto analyzer system (C.Garside) obtained from discrete samples from the Niskin bottles.

Because of the strong diel pattern observed in NO_3^- uptake through out the period of observations, it would be inappropriate to use the discrete rates directly in estimates of new production (eg. an f ratio). We are preparing a manuscript (McCarthy, Nevins and Garside) which will present the results of an analysis which uses these data to model NO_3^- uptake on an integrated daily basis.

Literature Cited:

Brzezinski, M.A. 1987.

Colorimetric determination of nanomolar concentrations of ammonium in seawater using solvent extraction. *Mar. Chem.* 19: 322-330.

Horrigan, S.G., J.P. Montoya, J.L. Nevins, J.J. McCarthy, H.W. Ducklow, R. Goericke and T. Malone. 1990.

Nitrogenous nutrient transformations in the spring and fall in the Chesapeake Bay. *Est. Coast. Shelf Sci.* 30: 369-391.

Nevins, J.L. and J.J. McCarthy. 1982.

^{15}N tracer studies in marine ecosystems. *Nuclide Spectra* (Publ. 1041/1082 Nuclide Corp.) 17: 1-2.

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Data Files

File
N_uptake.csv (Comma Separated Values (.csv), 4.77 KB) MD5:aa724042a53f3ddf72ae95ee3d71863d Primary data file for dataset ID 2604

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Parameters

Parameter	Description	Units
year	year (as YYYY)	dimensionless
event	event number from event log	dimensionless
sta	station number from event log	dimensionless
cast	CTD rosette cast number, from event log	dimensionless
bot	bottle number	dimensionless
depth	sample depth	meters
pNO2	N-15 uptake from nitrite labeled substrate	nanomolar/hour
pNO3	N-15 uptake from nitrate labeled substrate	nanomolar/hour
pNH4	N-15 uptake from ammonium labeled substrate	nanomolar/hour
pUrea	N-15 uptake from urea labeled substrate	nanomolar/hour

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Instruments

Dataset-specific Instrument Name	Niskin Bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	a rosette sampler equiped with 30 l Niskin bottles fitted with teflon coated springs
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

AII-119-5

Website	https://www.bco-dmo.org/deployment/57738
Platform	R/V Atlantis II
Start Date	1989-05-15
End Date	1989-06-06
Description	late bloom cruise; 31 locations; 61N 22W to 41N 17W

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Project Information

U.S. JGOFS North Atlantic Bloom Experiment (NABE)

Website: http://usjgofs.whoi.edu/research/nabe.html

Coverage: North Atlantic

One of the first major activities of JGOFS was a multinational pilot project, North Atlantic Bloom Experiment (NABE), carried out along longitude 20° West in 1989 through 1991. The United States participated in 1989 only, with the April deployment of two sediment trap arrays at 48° and 34° North. Three process-oriented cruises where conducted, April through July 1989, from R/V *Atlantis II* and R/V *Endeavor* focusing on sites at 46° and 59° North. Coordination of the NABE process-study cruises was supported by NSF-OCE award # 8814229. Ancillary sea surface mapping and AXBT profiling data were collected from NASA's P3 aircraft for a series of one day flights, April through June 1989.

A detailed description of NABE and the initial synthesis of the complete program data collection efforts appear in: Topical Studies in Oceanography, JGOFS: The North Atlantic Bloom Experiment (1993), Deep-Sea Research II, Volume 40 No. 1/2.

The U.S. JGOFS Data management office compiled a preliminary NABE data report of U.S. activities: Slagle, R. and G. Heimerdinger, 1991. U.S. Joint Global Ocean Flux Study, North Atlantic Bloom Experiment, Process Study Data Report P-1, April-July 1989. NODC/U.S. JGOFS Data Management Office, Woods Hole Oceanographic Institution, 315 pp. (out of print).

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Program Information

U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Website: http://usjgofs.whoi.edu/

Coverage: Global

The United States Joint Global Ocean Flux Study was a national component of international JGOFS and an integral part of global climate change research.

The U.S. launched the Joint Global Ocean Flux Study (JGOFS) in the late 1980s to study the ocean carbon cycle. An ambitious goal was set to understand the controls on the concentrations and fluxes of carbon and associated nutrients in the ocean. A new field of ocean biogeochemistry emerged with an emphasis on quality measurements of carbon system parameters and interdisciplinary field studies of the biological, chemical and physical process which control the ocean carbon cycle. As we studied ocean biogeochemistry, we learned that our simple views of carbon uptake and transport were severely limited, and a new "wave" of ocean science was born. U.S. JGOFS has been supported primarily by the U.S. National Science Foundation in collaboration with the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the Department of Energy and the Office of Naval Research. U.S. JGOFS, ended in 2005 with the conclusion of the Synthesis and Modeling Project (SMP).

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Funding

Funding Source	Award
National Science Foundation (NSF)	unknown NABE NSF

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