Trace Metal Concentrations from Barbados incubation experiment, February 2012 (ADIMA project)

Website: https://www.bco-dmo.org/dataset/552954
Data Type: Other Field Results
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Project
» Atmospheric Deposition Impacts on Marine Ecosystems (ADIMA)

Contributors	Affiliation	Role
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Abstract

Trace metal concentrations in seawater samples from an incubation experiment from offshore West Barbados (13.191912, -59.640579) collected in February, 2012.

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Coverage

Spatial Extent: **Lat**:13.1919 **Lon**:-59.6406
Temporal Extent: 2012-02 - 2012-02

Methods & Sampling

Sampling and Analytical Methodology:
Nutrient and aerosol addition bioassay experiments were carried out over 3 days in February 2012. Seawater was collected from offshore (water depth >700 m) outside the Bellairs Research Institute at West Barbados (13° 11.309'N, 59° 38.267'W). Surface water was pumped into acid cleaned sample rinsed carboys using a peristaltic pump with acid washed Teflon tubing and pre filtered through a 50 um mesh acid washed Nitex$^©$ net to remove grazers. The seawater was stored in the dark until transport to the lab (within <2 hours). Seawater was dispensed into acid washed and sample rinsed polycarbonate bottles (500 mL each), pre-labeled with treatment type (12-20 bottles per treatment). Treatments included single nutrient (N, P, Fe) additions as well as a combination of N and P and a combination of N and Fe at concentrations representative of deep water in this area. Three aerosol treatments were used in this study representing aerosols deposited in three seasons, winter, spring and summer. Aerosols representing each of the seasons were added at concentrations simulating high and low deposition rates. High deposition was calculated to represent the cumulative deposition flux over 10 days of a strong dust storm event over the North Atlantic (300 g m^{-2} yr^{-1}) to the upper 10 m mixed layer. Low deposition treatments were equivalent to the normal average deposition rate for Barbados (10 g m^{-2} yr^{-1}) during spring and summer. A control (no addition, blank filter) treatment and procedural blanks (Milli-Q water) were also included. All bottles were incubated in a pool filled with circulating seawater to maintain

local surface ocean temperature. The pool was covered with a neutral density shading screen to reduce light intensity by 50%. Water samples used for the experiment (pre additions) was collected to characterize the baseline conditions (baseline, 5 replicates) and 3 replicate bottles for each treatment were also collected immediately after the additions were administered (time zero, t0). The experiment took place over 3 days, and each day 3 (for nutrients) or 5 (for aerosols) randomly selected bottles for each treatment were collected at 4pm in the afternoon (e.g. time points t1-t3). Immediately upon collection each bottle was sampled for chlorophyll *a*, flow cytometry, nutrients, and trace metal concentrations.

60 mL subsamples of the 0.2 um filtered water were collected in acid washed sample rinsed LDPE bottles for trace metal analyses. Seawater samples were acidified to pH<2.0 by adding 45 uL concentrated trace metal grad HNO_3 at least 24 hours prior to column chemistry. Nobias Chelate-PA1 resin (HITACH, Japan) was used for seawater matrix removal and trace metal pre-concentration (Biller & Bruland, 2012; Sohrin et al., 2008). Recovery yields are summarized in Table 3. 5 mL eluant from each sample was analyzed for a suite of trace metals (Mn, Fe, Co, Ni, Cu, Cd, Pb) by HR-ICPMS (Thermo Element XR). Samples were introduced into the instrument with a peristaltic pump at a flow rate of ~120 uL min^{-1} and passed through an ESI-PC3 Peltier cooled spray chamber before entering the torch. Sample and gas flow rates were optimized for each run; values were 0.75-0.80 ml min^{-1} and 0.20-0.24 ml min^{-1}, respectively. Nickel sample and skimmer cones (Spectron) were used to reduce instrumental blank and memory effects. In, Y and Sc were added to each sample as internal standards for calibrating sensitivity shift of the instrument.

Data Processing Description

Data Processing:
NA: not available

BCO-DMO Processing Notes
 - Generated from original file: "Data_Trace metal concentrations from Barbados incubation experiment.xlsx" contributed by Chia-Te Chien
 - Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
 - Common parameter names standardized between the four contributed Barbados datasets
 - Experiment Site Id and Lat/Lon appended to enable data discovery in MapServer
 - Single "Treatment and Time" field split into two fields - "Treatment" and "Time Point"
 - "nd" (no data) inserted into blank fields

Data Files

File
ADIMA_Barbados_Trace_Metals.csv(Comma Separated Values (.csv), 7.05 KB) MD5:d78122a584ee1245bd02ac1a104cd1e2
Primary data file for dataset ID 552954

Related Publications

Biller, D. V., & Bruland, K. W. (2012). Analysis of Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb in seawater using the Nobias-chelate PA1 resin and magnetic sector inductively coupled plasma mass spectrometry (ICP-MS). Marine Chemistry, 130-131, 12–20. doi:10.1016/j.marchem.2011.12.001
Methods

Sohrin, Y., Urushihara, S., Nakatsuka, S., Kono, T., Higo, E., Minami, T., … Umetani, S. (2008). Multielemental Determination of GEOTRACES Key Trace Metals in Seawater by ICPMS after Preconcentration Using an Ethylenediaminetriacetic Acid Chelating Resin. Analytical Chemistry, 80(16), 6267–6273. doi:10.1021/ac800500f
Methods

Parameters

Parameter	Description	Units
Experiment_Site	Identifier where experiments were conducted	text
Lat	Approximate Latitude Position of Experiment Site; South is negative	decimal degrees
Lon	Approximate Longitude Position of Experiment Site; West is negative	decimal degrees
Treatment	Treatments	text
Time_Point	Experiment time point	days
Cd	Cd	nmol/kg
Pb	Pb	nmol/kg
Mn	Mn	nmol/kg
Fe	Fe	nmol/kg
Co	Co	nmol/kg
Ni	Ni	nmol/kg
Cu	Cu	nmol/kg

Instruments

Dataset-specific Instrument Name	ICP Mass Spec
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	5 mL eluant from each sample was analyzed for a suite of trace metals (Mn, Fe, Co, Ni, Cu, Cd, Pb) by HR-ICPMS (Thermo Element XR).
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

Dataset-specific Instrument Name	Mass Spec
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	Samples were introduced into the instrument with a peristaltic pump at a flow rate of ~120 ⎕L min-1 and passed through an ESI-PC3 Peltier cooled spray chamber before entering the torch
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

Deployments

ADIMA_Barbados

Website	https://www.bco-dmo.org/deployment/552888
Platform	lab Bellairs Research Institute
Start Date	2012-02-01
End Date	2012-02-01
Description	Nutrient and aerosol addition bioassay experiments were carried out over 3 days in February 2012. Seawater was collected from offshore (water depth >700 m) outside the Bellairs Research Institute at West Barbados (13o 11.309'N, 59o 38.267'W).

Project Information

Atmospheric Deposition Impacts on Marine Ecosystems (ADIMA)

Website: http://pmc.ucsc.edu/~apaytan/page_projects.html

Coverage: Gulf of Aqaba, Atlantic Ocean (Bermuda Time Series Station), Monterey Bay

Chemical components delivered to the surface ocean through atmospheric deposition influence ocean productivity and ecosystem structure thus are tightly related to the global carbon cycle and climate. Accordingly, the major aim of this project is to quantitatively estimate the variable impact of aerosols on marine phytoplankton and to determine the specific effects on various taxa. Such data could in the future be used to better understand the global impact of aerosols on the oceanic ecosystem. To accomplish this goal the PI will monitor aerosol dry deposition fluxes, determine aerosol sources, obtain the chemical composition and solubility of aerosols, and evaluate the contribution of aerosols to nutrient and trace metal budgets of seawater at two oceanographically different sites (Bermuda and Monterey Bay) representing open ocean and coastal setting. The effects of the different aerosol "types" (defined by source and chemical characteristics) on specific phytoplankton taxa will also be evaluated using pure culture and natural samples bioassays. This project is particularly important in light of the role atmospheric deposition can resume in oligotrophic and coastal settings and the predicted future global conditions of increased aridity and urbanization and associated changes in dust fluxes and composition.

Funding