Major nutrient concentrations in seawater from an incubation experiment carried out in China in April 2011

Website: https://www.bco-dmo.org/dataset/855966
Data Type: Other Field Results, experimental
Version: 1
Version Date: 2021-07-16

Project
» Atmospheric Deposition Impacts on Marine Ecosystems (ADIMA)

Contributors	Affiliation	Role
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Abstract
This dataset reports major nutrient concentrations in seawater from an incubation experiment carried out in China in April 2011.

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Coverage

Spatial Extent: **N**:30.7178 **E**:122.936 **S**:30.6367 **W**:122.666
Temporal Extent: 2011-04 - 2011-04

Methods & Sampling

Seawater for incubation experiments was collected at two sites located in and near the Yangtze River plume in April 2011 aboard a local fishing boat. Site 1 was within the plume, and site 2 was further away from the river discharge point. Site 1 was nearer to the mouth of the Yangtze River, between two islands in an area with visible suspended sediment (30° 43′ 04″N, 122° 39′ 58″E). Site 2 was east of the Zhoushan Archipelago in waters influenced by the Kuroshio Current outside the area of high sediment resuspension from the Yangtze River, and had a salinity of 31.7ppt (30° 38′ 12.2″N, 122° 56′ 8.51″ E). Site 1, being more heavily influenced by the river discharge, had a salinity of 28.7ppt. Assuming river water has a salinity of zero and ocean water has a salinity of 33, the water we collected at site 1 was a mixture of 87% seawater and 13% river water, while site 2 was 96% seawater and 4% river water. Both of these sites are clearly affected by the Yangtze River outflow, and this is reflected in their salinity levels and nutrient characteristics.

Trace metal clean techniques were used to collect incubation water and during all handling and sample processing steps. Acid cleaning included a 1 week Citranox soaking step, followed by a 1week 10% hydrochloric acid soaking step, followed by a thorough milliQ rinse. All containers and equipment were stored double bagged until use after acid cleaning. For each experiment, surface seawater was collected using a

peristaltic pump with acid cleaned C-Flex tubing, passed through 80 µm mesh into acid clean, sample rinsed 50L carboys, and transported to Shengsi Island in the dark. Transport took less than 2 h. In the lab, water was dispensed into 500 mL acid clean, sample rinsed, clear polycarbonate bottles. Nutrient additions included nitrogen (N, as 10 µM NaNO3 + 0.5 µM (NH4)2SO4), phosphorus (P, as 0.5 µM NaH2PO4), or N + P together, and these concentrations were designed to approximately double the background concentrations of these nutrients observed at site 1. Control bottles contained no nutrient additions.

Aerosol treatments included aerosols representing 5 different dates of collection (see below). To simulate 10 days of a moderately strong deposition event for this region (1 g m−2 d−1) over a 10 m mixed layer, 1 mg aerosol on the filter was added per L of seawater. The aerosol filter was cut to the correct size to deliver the appropriate amount of aerosol and then added directly to the bottles. No prior leaching step was included to increase the solubility of the aerosols. The annual average deposition flux for the region is 4.6–98 g m−2 y−1. The deposition rate assumed for the additions is thus an order of magnitude above average and represents strong wind or dust storm conditions. For aerosol NW37, concentrations of 0.2 mg L−1 (similar to average or typical loading at the site) and 5 mg L− (very high deposition, strong dust storm conditions) were also included to test phytoplankton responses to aerosol dosing. Bottles were incubated in a flowing seawater pool by pumping coastal seawater into the pool at a rate high enough to maintain ambient coastal seawater temperatures without allowing the pool to warm from sunlight. No attempt to artificially manipulate temperature was made. The pool was shaded with a neutral density shade cloth to attenuate sunlight 50% for both site 1 and site 2 experiments. Three bottles per treatment were sampled at "time zero" (collected immediately after nutrient or aerosol additions were made) and on the final day of the incubation 3 days later. The incubation time of 3 days was selected because it is long enough to observe changes in phytoplankton community structure based on prior studies, while avoiding major bottle effects that occur with longer-term incubation experiments.

Water samples for nutrient analyses from the incubation experiments were filtered (0.2µm PES) in a laminar flow hood following trace metal clean techniques. Sample bottles were stored in clean plastic bags and stored frozen. Nitrate (plus nitrite) and phosphate were analyzed via a Lachat Autoanalyzer as described previously (Mackey K. R. et al., 2012) using standards prepared in low nutrient seawater. Detection limits were determined as three times the standard deviation of the blank (5 replicates of low nutrient seawater), and were 0.28µM for nitrate and 0.005 µM for phosphate.

Data Processing Description

BCO-DMO Processing:
- split the original Location column into Site, Latitude, and Longitude;
- converted latitude and longitude to decimal degrees from degrees, minutes, seconds;
- renamed fields to comply with BCO-DMO naming conventions.

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Data Files

File
china_inc_nutrients.csv (Comma Separated Values (.csv), 1.17 KB) MD5:5bf792982a8d0f606f3f8a833aadfdd7 Primary data file for dataset ID 855966

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Related Publications

Mackey, K. R. M., Kavanaugh, M. T., Wang, F., Chen, Y., Liu, F., Glover, D. M., … Paytan, A. (2017). Atmospheric and Fluvial Nutrients Fuel Algal Blooms in the East China Sea. Frontiers in Marine Science, 4. doi:10.3389/fmars.2017.00002
Results

Mackey, K. R. M., Mioni, C. E., Ryan, J. P., & Paytan, A. (2012). Phosphorus Cycling in the Red Tide Incubator

Region of Monterey Bay in Response to Upwelling. Frontiers in Microbiology, 3. doi:10.3389/fmicb.2012.00033
Methods

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Related Datasets

IsRelatedTo

Paytan, A., Mackey, K. R. (2021) **Seawater Trace Metal Concentrations from China incubation experiment conducted in April 2011.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-07-16 doi:10.26008/1912/bco-dmo.855813.1 [view at BCO-DMO]
Relationship Description: Both datasets are the results of the same incubation experiment.

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Parameters

Parameter	Description	Units
Site	Location/site number	unitless
Latitude	Site latitude	decimal degrees North
Longitude	Site longitude	decimal degrees East
Treatment	treatment in the incubation experiment:Control: Control bottles contained no nutrient additions N: nitrogen addition (N, as 10 µM NaNO3 + 0.5 µM (NH4)2SO4) P: phosphorus addition (P, as 0.5 µM NaH2PO4) N+P: N+P addition together NW32: One of the aerosol treatments. 1 mg aerosol on the MW32 (collected 19 Nov 2010) filter was added per L of seawater. MW: northwestern (NW) back trajectories originating over mainland China NW34: One of the aerosol treatments. 1 mg aerosol on the MW34 filter (collected 23 Nov 2010) was added per L of seawater. MW: northwestern (NW) back trajectories originating over mainland China NW37: One of the aerosol treatments. 1 mg aerosol on the MW37 filter (collected 29 Nov 2010) was added per L of seawater. MW: northwestern (NW) back trajectories originating over mainland China PO19: One of the aerosol treatments. 1 mg aerosol on the PO19 filter (collected 16 Aug 2010) was added per L of seawater. PO: back trajectories originating over the Pacific Ocean PO24: One of the aerosol treatments. 1 mg aerosol on the PO24 filter (collected 26 Aug 2010) was added per L of seawater. PO: back trajectories originating over the Pacific Ocean	unitless
NO3_from_additions	The amount of nitrate added to the incubation container	micromolar (uM)
PO43_from_additions	The amount of phosphate added to the incubation container	micromolar (uM)
NO3_at_time_zero_Concentration	Mean nitrate concentration in the beginning of experiment	micromolar (uM)
NO3_at_time_zero_Standard_error	Standard error of nitrate concentrations in the beginning of experiment	micromolar (uM)
PO43_at_time_zero_Concentration	Mean phosphate concentration in the beginning of experiment	micromolar (uM)
PO43_at_time_zero_Standard_error	Standard error of phosphate concentrations in the beginning of experiment	micromolar (uM)

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Instruments

Dataset-specific Instrument Name	Lachat Autoanalyzer
Generic Instrument Name	Nutrient Autoanalyzer
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

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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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0850467

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