Concentrations of DMS, DMSPp, DMSPd, & DMSOd in relation to ocean acidification [H+] during the KOSMOS 2014 mesocosm experiment off Gran Canaria

Website: https://www.bco-dmo.org/dataset/769302
Data Type: Other Field Results
Version: 1
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Project
» Ocean Acidification: Influence of Ocean Acidification on Biotic Controls of DMS Emissions (OA on DMS)

Contributors	Affiliation	Role
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Abstract
Concentrations of DMS, DMSPp, DMSPd, & DMSOd in relation to ocean acidification [H+] during the KOSMOS 2014 mesocosm experiment off Gran Canaria. The full experiment took place from 23rd September to 25th November 2014.

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Coverage

Spatial Extent: **Lat**:27.928 **Lon**:-15.365
Temporal Extent: 2014-09-23 - 2014-11-25

Methods & Sampling

From Archer et al. (2018): The mesocosm experiment was conducted in Gando Bay, on the east coast of Gran Canaria (27° 55' 41" N, 15° 21' 55" W) in the subtropical North Atlantic. Sample processing, analysis and further experiments were conducted in the laboratories of Plataforma Oceánica de Canarias (PLOCAN), Gran Canaria. The full experiment took place from 23rd September to 25th November 2014. The design and deployment of the Kiel Off-Shore Mesocosms for future Ocean Simulations (KOSMOS) facility has previously been described in detail (Riebesell et al., 2013).

Sampling and analytical procedures: The experimental set-up and sampling of the mesocosms is described in Taucher et al. (2017).

Procedures for the analysis of reduced sulfur compounds was based on purge-and-cryotrap approaches

linked to a gas chromatograph with either flame FPD or mass spectrometric detector and is described in Archer et al. (2018).

Quantification of dissolved DMSO [DMSOd] closely followed the protocol of del Valle et al. (2007) and is reported in Archer et al. (2018).

Additional data from the experiment has been deposited on the PANGEA database: https://www.pangaea.de/?q=KOSMOS_2014

Data Processing Description

As described in Archer et al. (2018), [H+] was calculated from pH on the total scale (pHT) calculated from TA and DIC in CO2SYS (Pierrot et al., 2006) using the carbonate dissociation constants K1 and K2 of Lueker et al. (2000). On each sampling day, total alkalinity (TA) was measured using a potentiometric titration approach and dissolved inorganic carbon (DIC) by infrared absorption as described in Taucher et al., (2017).

Problem Report:
Note, a leak was detected in mesocsom M6 on Experimental Day 27. No further sampling was undertaken from that mesocosm.
Note, DMSOd was quantified over only the first phase of the experiment T-3 to T25.

BCO-DMO Processing:
- deleted empty columns;
- modified parameter names (removed brackets (special characters); replaced spaces w/ underscores; renamed [H+] to "proton_conc");
- filled in blanks with "nd" (no data);
- reformatted date to yyyymmdd (was mm/dd/yy).

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Data Files

File
KOSMOS14_DMSPO_CONCS.csv (Comma Separated Values (.csv), 11.75 KB) MD5:ef83431844148836acb80ddffeac00fc Primary data file for dataset ID 769302

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Related Publications

Archer, S. D., Suffrian, K., Posman, K. M., Bach, L. T., Matrai, P. A., Countway, P. D., … Riebesell, U. (2018). Processes That Contribute to Decreased Dimethyl Sulfide Production in Response to Ocean Acidification in Subtropical Waters. Frontiers in Marine Science, 5. doi:10.3389/fmars.2018.00245
Methods

Del Valle, D. A., Kieber, D. J., John, B., & Kiene, R. P. (2007). Light-stimulated production of dissolved DMSO by a particle-associated process in the Ross Sea, Antarctica. Limnology and Oceanography, 52(6), 2456–2466. doi:10.4319/lo.2007.52.6.2456
Methods

Lueker, T. J., Dickson, A. G., & Keeling, C. D. (2000). Ocean pCO2 calculated from dissolved inorganic carbon, alkalinity, and equations for K1 and K2: validation based on laboratory measurements of CO2 in gas and seawater at equilibrium. Marine Chemistry, 70(1-3), 105–119. doi:10.1016/s0304-4203(00)00022-0 https://doi.org/10.1016/S0304-4203(00)00022-0
Methods

Pierrot, D. E. Lewis,and D. W. R. Wallace. 2006. MS Excel Program Developed for CO2 System Calculations. ORNL/CDIAC-105a. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S.

Department of Energy, Oak Ridge, Tennessee. doi: 10.3334/CDIAC/otg.CO2SYS_XLS_CDIAC105a.
Methods

Riebesell, U., Czerny, J., von Bröckel, K., Boxhammer, T., Büdenbender, J., Deckelnick, M., … Schulz, K. G. (2013). Technical Note: A mobile sea-going mesocosm system – new opportunities for ocean change research. Biogeosciences, 10(3), 1835–1847. doi:10.5194/bg-10-1835-2013
Methods

Taucher, J., Bach, L. T., Boxhammer, T., Nauendorf, A., Achterberg, E. P., … Algueró-Muñiz, M. (2017). Influence of Ocean Acidification and Deep Water Upwelling on Oligotrophic Plankton Communities in the Subtropical North Atlantic: Insights from an In situ Mesocosm Study. Frontiers in Marine Science, 4. doi:10.3389/fmars.2017.00085
Methods

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Parameters

Parameter	Description	Units
Date	Date; format: yyyymmdd	unitless
Experimental_Day	Experimental day	unitless
Mesocosm	Mesocosm identifier	unitless
Proton_Conc	Proton concentration [H+]	nanomoles per liter (nmol L-1)
DMS	Seawater DMS concentration	nanomoles per liter (nmol L-1)
DMSPp	Particulate DMSP concentration	nanomoles per liter (nmol L-1)
DMSPd	Dissolved DMSP concentration	nanomoles per liter (nmol L-1)
DMSOd	Dissolved DMSO concentration	nanomoles per liter (nmol L-1)

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Instruments

Dataset-specific Instrument Name	gas chromatograph
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Procedures for the analysis of reduced sulfur compounds was based on purge-and-cryotrap approaches linked to a gas chromatograph with either flame FPD or mass spectrometric detector.
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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Project Information

Ocean Acidification: Influence of Ocean Acidification on Biotic Controls of DMS Emissions (OA on DMS)

Coverage: Sub-tropical Atlantic and Gulf of Maine

NSF Award Abstract:

To date, investigations into the biogeochemical consequences of predicted increases in pCO2 and reduced pH in the oceans (ocean acidification, OA) over the next century have largely focused on the production and fate of carbon. Considerably less is known about how OA will influence other biogeochemical cycles or the exchange of reactive trace gases between ocean and atmosphere. Variations in trace gas exchange will alter atmospheric chemistry, including aerosol formation and growth, and potentially feedback on climate change.

In this project, a research team at the Bigelow Laboratory for Ocean Sciences will study the influence of OA on the biological processes that govern the concentrations and hence emission, of dimethyl sulfide (DMS) in the surface oceans. The team will study OA effects on the DMS-cycle in three natural-water mesocosm experiments designed to encompass natural community responses to predicted changes in pCO2 of varying degrees. They will exploit the opportunity to participate in a major experiment in sub-tropical oceanic waters involving the deployment of nine large scale (~60 m3) free floating, pelagic mesocosms, as part of the German-funded BIOACID Program. Two replicate experiments conducted using the new mesocosm facilities at Bigelow will further expand the environmental range of DMS-OA studies. Through a combination of standard analytical approaches, recently developed cutting-edge tracer approaches to determine process rates, as well as the underlying organism diversity and genetic response of microbes involved with biogenic sulfur cycling, they will determine how altered pH influences key biological pathways governing DMS concentrations and the organisms responsible during the experiments.

Broader Impacts: The information generated will be used to inform on-going development of global ocean-atmosphere coupled models, able to examine the influence of ocean acidification on climate change. The information will also be used to further develop physiology-based mechanistic approaches to biogeochemical ecosystem models. A Postdoctoral Research Scientist will be trained in the experimental approaches, will gain modeling experience by working with European scientists, and will develop international and US collaborations, with a common aim to increase our understanding of ocean acidification on ecosystem function. Four undergraduates, two interns and two REU-students, will gain valuable experience by participating in the Bigelow experiments. An additional undergraduate with a mathematical background will be mentored in and participate in the interpretation and modeling aspects. Extensive outreach to K-12 students and teachers as well as the general public will be pursued as part of established Bigelow programs in which all PIs will participate (BLOOM, Cafe Scientifique). Joint programs with Colby College (Changing Oceans semester) and Island Institute will reach undergraduates and Maine island K-8 schools, respectively.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1316133

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