Algae, bacteria, DOC, inorganic and organic nutrients collected from the Richard B Gump Research Station at Moorea LTER from 2010-2011 (MCR LTER and Coral DOM projects)

Website: https://www.bco-dmo.org/dataset/3670
Data Type: Other Field Results
Version: 2
Version Date: 2013-12-21

Project
» Moorea Coral Reef Long-Term Ecological Research site (MCR LTER)
» The coupling between DOM, algae, and microbes on coral reef platforms (Coral DOM)

Programs
» Long Term Ecological Research network (LTER)
» Emerging Topics in Biogeochemical Cycles (ETBC)

Contributors	Affiliation	Role
Carlson, Craig A.	University of California-Santa Barbara (UCSB-MSI)	Principal Investigator
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Abstract
This dataset contains experimental and survey biogeochemical and microbial data from samples collected at the Moorea Coral Reef LTER site (French Polynesia). Goals of the study were to investigate how benthic primary producers directly affect seawater chemistry (DO and DOC) and to examine impacts of released DOC on reef bacterioplankton growth and respiration. Rates of photosynthesis, respiration, and DOC relsease were assessed for several benthic reef organisms.

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Coverage

Spatial Extent: **N**:-17.46267 **E**:-149.82165 **S**:-17.58794 **W**:-149.88848
Temporal Extent: 2010-09-09 - 2011-09-14

Dataset Description

This dataset contains experimental and survey biogeochemical and microbial data from samples collected at the Moorea Coral Reef LTER site (French Polynesia). Goals of the study were to investigate how benthic primary producers directly affect seawater chemistry (DO and DOC) and to examine impacts of released DOC on reef bacterioplankton growth and respiration. Rates of photosynthesis, respiration, and DOC relsease were assessed for several benthic reef organisms (Haas et al. 2011).

Methods & Sampling

2010 and 2011 Data Acquisition:
Sampling from small boats occurred along transects at the Moorea Coral Reef LTER sites during September 2010 and September 2011. Benthic producers were collected from water depths of 1.0 to 1.5 meters at back and fringe reef locations. Bacterioplankton abundance was determined using flow cytometry (Nelson et al. 2011). DOC was measured by a high-temperature TOC analyzer according to methods of Carlson et al. (2010). To assess DOC release by primary producers, each benthic species was incubated using the method of Herndl and Velimirov (Haas et al. 2011). To determine if DOC released by primary producers affects mirobial populations, ~48 hour dark dilution culture incubations were performed to measure changes in concentration of DO, DOC, and bacterioplankton over time (Haas et el. 2011).

For more details on methodology, quality assurance and control procedures, and precision and accuracy of methods used, see the following references (full citations are below):
Bacterioplankton flow cytometry methods: Nelson et al. 2011.

Experimental designs, dissolved oxygen, pH, temperature, and specimen surface area methods: Haas et al. 2011, Herndl & Velimirov B. 1986.

Dissolved organic carbon method: Carlson et al. 2010.

Chlorophyll method: Smith et al. 1981.

Dissolved inorganic nutrients, particulate organic nutrients, and isotope ratios methodological references, calibrations, precision, and accuracy are detailed at the UCSB MSI Analytical Lab Website.

Data Processing Description

BCO-DMO made the following modifications: changed parameter names to conform with BCO-DMO conventions; replaced blanks and 'NA' with 'nd' to indicate no data; calculated month_gmt, day_gmt, and time_gmt from the local dates and times provided (local to French Polynesia (Papeete, Tahiti; UTC/GMT -10 hours; Time Zone Code TAHT)); rounded the following to 4 decimal places (originally submitted in Excel file with 11 decimal places): POC, PON, d13C, d15N, algal_area_O2, algal_area_C; replaced '<' with 'lt_' (less than) and '>' with 'gt_' (greater than) in depth_bottom column; removed parameters defined as 'internal reference code'.

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Data Files

File
biogeochem_microbes.csv (Comma Separated Values (.csv), 325.81 KB) MD5:6be44d685c82507499f3ad77071913ff Primary data file for dataset ID 3670

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Related Publications

Carlson, C. A., Hansell, D. A., Nelson, N. B., Siegel, D. A., Smethie, W. M., Khatiwala, S., Meyers, M. M., Halewood, E. (2010). Dissolved organic carbon export and subsequent remineralization in the mesopelagic and bathypelagic realms of the North Atlantic basin. Deep Sea Research Part II: Topical Studies in Oceanography, 57(16), 1433–1445. doi:10.1016/j.dsr2.2010.02.013
Methods

Haas, A. F., Nelson, C. E., Wegley Kelly, L., Carlson, C. A., Rohwer, F., Leichter, J. J., … Smith, J. E. (2011). Effects of Coral Reef Benthic Primary Producers on Dissolved Organic Carbon and Microbial Activity. PLoS ONE, 6(11), e27973. doi:10.1371/journal.pone.0027973
Methods

Herndl, G. J., & Velimirov, B. (1986). Microheterotrophic utilization of mucus released by the Mediterranean coral Cladocora cespitosa. Marine Biology, 90(3), 363–369. doi:10.1007/bf00428560 https://doi.org/10.1007/BF00428560
Methods

Nelson, C. E., Alldredge, A. L., McCliment, E. A., Amaral-Zettler, L. A., & Carlson, C. A. (2011). Depleted dissolved organic carbon and distinct bacterial communities in the water column of a rapid-flushing coral reef ecosystem. The ISME Journal, 5(8), 1374–1387. doi:10.1038/ismej.2011.12
Methods

Smith, R. C, Baker, K. S, & Dustan, P. (1981). Fluorometric Techniques For The Measurement Of Oceanic Chlorophyll In The Support Of Remote Sensing. UC San Diego: Scripps Institution of Oceanography. Retrieved from https://escholarship.org/uc/item/4k51f7p0
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Parameters

Parameter	Description	Units
cruiseid	Name of the research campaign/cruise/deployment.	dimensionless
year	4-digit year. in YYYY format	unitless
campaign	Experiment or cruise event during which the sample was collected.	dimensionless
sample	Unique identified code for each sample collected.	dimensionless
month_gmt	2-digit month (GMT).	mm (01 to 12)
day_gmt	2-digit day of month (GMT).	dd (01 to 31)
time_gmt	Time (GMT). In HHMM format. 2400 hour clock.	HHMM
date_local	Date in local time.	mm/dd/yy
time_local	Time; local to French Polynesia (Papeete, Tahiti; UTC/GMT -10 hours; Time Zone Code TAHT).	HHMM
lat	Latitude in decimal degrees North (negative = south).	decimal degrees
lon	Longitude in decimal degrees East (negative = west).	decimal degrees
depth_bottom	Approximate bottom depth in meters.	meters
depth	Sampling depth in meters.	meters
bac_plank	Bacterioplankton abundance in 10^8 cells/Liter. Originally named 'BACT'. Methodological reference is Nelson et al. 2011, The ISME Journal.	10^8 cells per liter
phytopl_tot	Total Phytoplankton abundance in cells/mL by flow cytometry. (2011 data only.)	cells per milliliter
prochloro	Prochlorococcus abundance in cells/mL by flow cytometry. (2011 data only.)	cells per milliliter
synecho	Synechococcus abundance in cells/mL by flow cytometry. (2011 data only.)	cells per milliliter
DOC	Dissolved organic carbon concentration by HTCO in micromolar units. Glass fiber filtrate type GF/F (Whatman). Methodological reference is Carlson et al. 2010, DSRII.	micromolar (uM)
TDN	Total dissolved nitrogen by HTCO in micromolar units. Glass fiber filtrate type GF/F (Whatman). (2011 data only.)	micromolar (uM)
NO3	Nitrate concentration in micromolar units by flow injection autoanalyzer (Lachat QuikChem 8000; difference of nitrate+nitrite and nitrate). Glass fiber filtrate type GF/F (Whatman). (2010 data only.)	micromolar (uM)
NO2	Nitrite concentration in micromolar units by flow injection autoanalyzer (Lachat QuikChem 8000). Glass fiber filtrate type GF/F (Whatman).	micromolar (uM)
NO3_NO2	Nitrite+Nitrate concentration in micromolar units by flow injection autoanalyzer (Lachat QuikChem 8000). Glass fiber filtrate type GF/F (Whatman). (2011 data only.)	micromolar (uM)
PO4	Ortho-Phosphate concentration in micromolar units by flow injection autoanalyzer (Lachat QuikChem 8000). Glass fiber filtrate type GF/F (Whatman).	micromolar (uM)
silicate	Silicate concentration in micromolar units by flow injection autoanalyzer (Lachat QuikChem 8000). Glass fiber filtrate type GF/F (Whatman). (2011 data only.)	micromolar (uM)
NH4	Ammonium ion concentration in micromolar units by flow injection autoanalyzer (Lachat QuikChem 8000). Glass fiber filtrate type GF/F (Whatman).	micromolar (uM)
chl_a_fluor	Chlorophyll-a concentration by acetone-extracted fluorometry (Turner AU-10). Reference is Smith et al. 1981, Ref. Rep. SIO. Collected on Glass fiber filter type GF/F (Whatman). (2010 data only.)	micrograms per liter (ug/L)
POC	Particulate organic carbon measured by combustion analysis (CEC 440HA). Collected on Glass fiber filter type GF/F (Whatman). (2010 data only.)	micrograms per liter (ug/L)
PON	Particulate organic nitrogen measured by combustion analysis (CEC 440HA). Collected on Glass fiber filter type GF/F (Whatman). (2010 data only.)	micrograms per liter (ug/L)
delta_13C	Particulate carbon stable isotope ratios by combustion analysis and mass spectometry (Finnigan Delta Plus Advantage in Continuous Flow Mode). Collected on Glass fiber filter type GF/F (Whatman). (2010 data only.)	dimensionless
delta_15N	Particulate nitrogen stable isotope ratios by combustion analysis and mass spectometry (Finnigan Delta Plus Advantage in Continuous Flow Mode). Collected on Glass fiber filter type GF/F (Whatman). (2010 data only.)	dimensionless
temp_inc	Incubation temperature in degrees celsius/centigrade measured via Hach-Lange HQ40D handheld multimeter. Originally named 'DOpH Inc Temp'. (2010 data only.)	degrees C
time_inc_min	Incubation time in minutes. Originally named 'DOpH Incubation Time'. (2010 data only.)	minutes
time_inc_hrs	Incubation time in hours. (2011 data only.)	hours
algal_area_O2	Estimated algal/coral surface area from specimens used in oxygen/pH change measurements (methodology detailed in Haas et al. 2011 PLoS ONE). Originally named 'Surface area DOpH'. (2010 data only.)	square centimeters (cm^2)
weight_g	Coral/algal dry weight in grams; methodological reference is Haas et al. 2011 PLoS ONE. (2010 data only.)	grams
algal_area_C	Estimated algal/coral surface area from specimens used in DOC release measurements (methodology detailed in Haas et al. 2011 PLoS ONE). Originally named 'Surface Area DOC'. (2010 data only.)	square centimeters (cm^2)
O2_umol_L	Dissolved oxygen in micromolar units (not salinity corrected) measured via Hach-Lange HQ40D handheld multimeter. Originally named 'DO'. (2010 data only.)	micromolar (uM)
pH	pH measured via Hach-Lange HQ40D handheld multimeter. (2010 data only.)	dimensionless
ISO_DateTime_UTC	Date and time (UTC) formatted to ISO8601 standard. T indicates start of time string; Z indicates UTC.	yyyy-MM-dd'T'HH:mm:ss'Z'

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Instruments

Dataset-specific Instrument Name	Flow Cytometer
Generic Instrument Name	Flow Cytometer
Generic Instrument Description	Flow cytometers (FC or FCM) are automated instruments that quantitate properties of single cells, one cell at a time. They can measure cell size, cell granularity, the amounts of cell components such as total DNA, newly synthesized DNA, gene expression as the amount messenger RNA for a particular gene, amounts of specific surface receptors, amounts of intracellular proteins, or transient signalling events in living cells. (from: http://www.bio.umass.edu/micro/immunology/facs542/facswhat.htm)

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
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

MCR10-1

Website	https://www.bco-dmo.org/deployment/58829
Platform	Richard B Gump Research Station - Moorea LTER
Start Date	2010-09-05
End Date	2010-09-17
Description	Various boats, including the following, were used to sample from the research station: Gump Safe boat, boats 609, 509, and 389.

MCR11-1

Website	https://www.bco-dmo.org/deployment/473348
Platform	Richard B Gump Research Station - Moorea LTER
Start Date	2011-09-07
End Date	2011-09-14

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Project Information

Moorea Coral Reef Long-Term Ecological Research site (MCR LTER)

Website: http://mcr.lternet.edu/

Coverage: Island of Moorea, French Polynesia

From http://www.lternet.edu/sites/mcr/ and http://mcr.lternet.edu/:
The Moorea Coral Reef LTER site encompasses the coral reef complex that surrounds the island of Moorea, French Polynesia (17°30'S, 149°50'W). Moorea is a small, triangular volcanic island 20 km west of Tahiti in the Society Islands of French Polynesia. An offshore barrier reef forms a system of shallow (mean depth ~ 5-7 m), narrow (~0.8-1.5 km wide) lagoons around the 60 km perimeter of Moorea. All major coral reef types (e.g., fringing reef, lagoon patch reefs, back reef, barrier reef and fore reef) are present and accessible by small boat.

The MCR LTER was established in 2004 by the US National Science Foundation (NSF) and is a partnership between the University of California Santa Barbara and California State University, Northridge. MCR researchers include marine scientists from the UC Santa Barbara, CSU Northridge, UC Davis, UC Santa Cruz, UC San Diego, CSU San Marcos, Duke University and the University of Hawaii. Field operations are conducted from the UC Berkeley Richard B. Gump South Pacific Research Station on the island of Moorea, French Polynesia.

MCR LTER Data: The Moorea Coral Reef (MCR) LTER data are managed by and available directly from the MCR project data site URL shown above. The datasets listed below were collected at or near the MCR LTER sampling locations, and funded by NSF OCE as ancillary projects related to the MCR LTER core research themes.

This project is supported by continuing grants with slight name variations:

- LTER: Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR II - Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR IIB: Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR III: Long-Term Dynamics of a Coral Reef Ecosystem
- LTER: MCR IV: Long-Term Dynamics of a Coral Reef Ecosystem

The coupling between DOM, algae, and microbes on coral reef platforms (Coral DOM)

Coverage: Moorea, French Polynesia

This project is part of the ETBC (Emerging Topics in Biogeochemical Cycles) program.

From NSF award proposal:
The proposed research will investigate the coupling between primary producers and the utilization of dissolved organic matter (DOM) by marine heterotrophic microbes on coral reefs. Previous metagenomic studies of the microbial communities associated with near-pristine and degraded coral reefs demonstrated a shift from a microbial food web similar to the open ocean (*Prochlorococcus* spp. and SAR11-like bacteria) to a community dominated by "super-heterotrophs", most closely related to known pathogens like *E. coli*, *Staphylococcus* spp., *Streptococcus* spp., *Enterobacter* spp. and *Vibrio* spp. This shift is associated with a decline in coral cover and an increase in coral disease prevalence. Our previous research has also shown that dissolved organic carbon (DOC) concentrations are lower on coral reef platforms compared to measurements of offshore waters (60-80 µM). On degraded reefs, we have observed DOC measurements as low as 30 - 40 µM, a value similar to concentrations observed in the deep Pacific Ocean. The observation of low DOC measurements on degraded reefs is decoupled from the high abundance of macroalgae, which one might expect would raise levels of DOC through the release of photosynthate into the water column.

The data generated from the proposed research are key to understanding the microbial, chemical, and ecological dynamics on today's coral reefs. The proposed research plan will consist of five inter-related objectives that will use a combination of field surveys, molecular characterization (microbes and DOM) and experimental approaches to assess the overall hypothesis. We propose to use a combination of archived samples from previous reef expeditions as well as conduct two field visits to reefs in French Polynesia (Moorea) and the Line Islands (Kiritimati) for focused sampling and experimentation. The biogeochemistry, local physical oceanography, and detailed reef ecology has been well characterized and continues to be monitored as part of the MCR-LTER program at Moorea. This environmental context will be useful in interpreting our experimental and field results at Moorea. We will also compare two field sites, Moorea and Kiritimati to ensure that our results are not specific to one region.

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Program Information

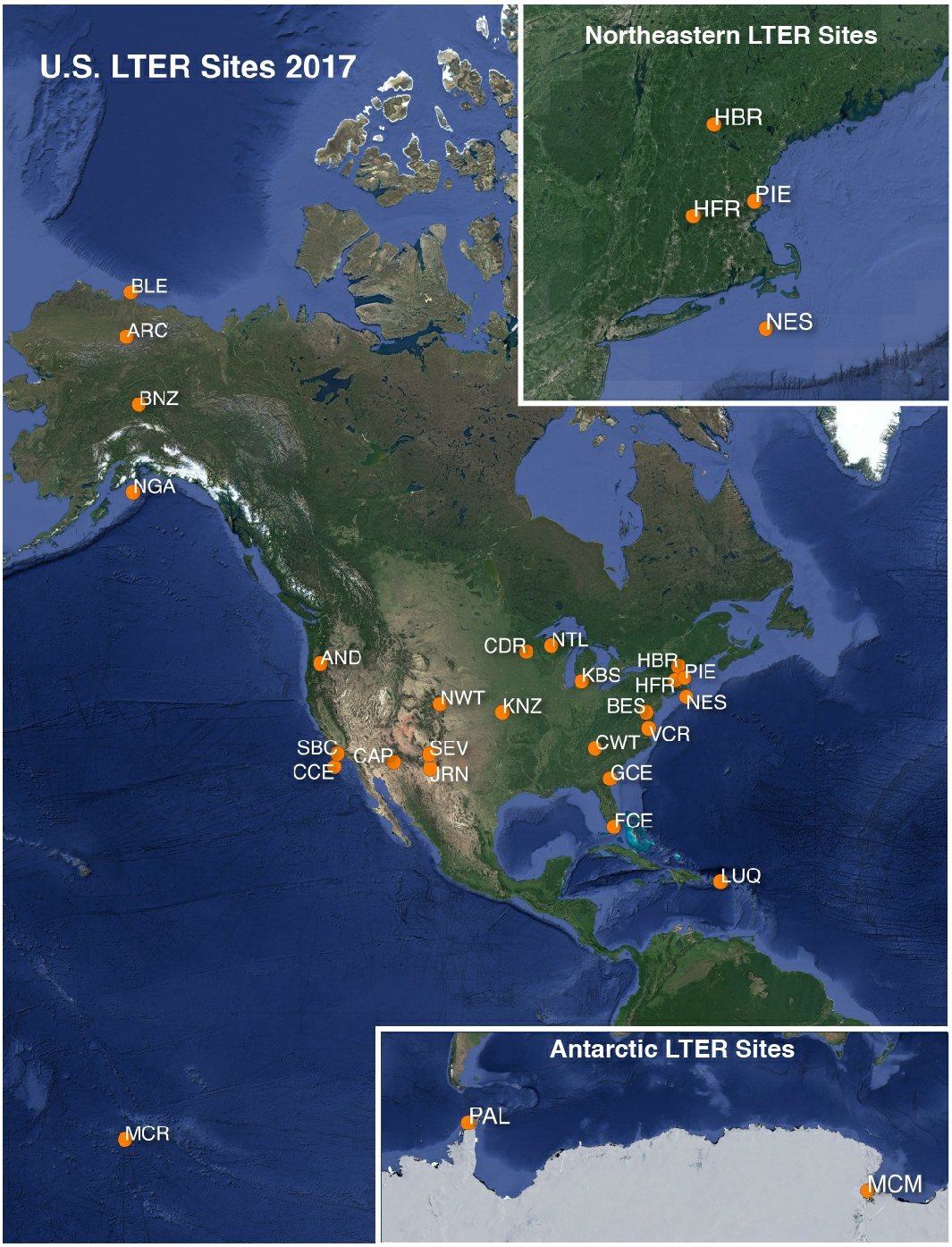
Long Term Ecological Research network (LTER)

Website: http://www.lternet.edu/

Coverage: United States

adapted from http://www.lternet.edu/

The National Science Foundation established the LTER program in 1980 to support research on long-term ecological phenomena in the United States. The Long Term Ecological Research (LTER) Network is a collaborative effort involving more than 1800 scientists and students investigating ecological processes over long temporal and broad spatial scales. The LTER Network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs. The LTER research sites represent diverse ecosystems with emphasis on different research themes, and cross-site communication, network publications, and research-planning activities are coordinated through the LTER Network Office.



Site Codes

AND	Andrews Forest LTER
ARC	Arctic LTER
BES	Baltimore Ecosystem Stu
BLE	Beaufort Lagoon Ecosystems LTER
BNZ	Bonanza Creek LTER
CCE	California Current Ecosystem LTER
CDR	Cedar Creek Ecosystem Science Reserve
CAP	Central Arizona-Phoenix LTER
CWT	Coweeta LTER
FCE	Florida Coastal Everglades LTER
GCE	Georgia Coastal Ecosystems LTER
HFR	Harvard Forest LTER
HBR	Hubbard Brook LTER
JRN	Jornada Basin LTER
KBS	Kellogg Biological Station LTER
KNZ	Konza Prairie LTER
LUQ	Luquillo LTER
MCM	McMurdo Dry Valleys LT
MCR	Moorea Coral Reef LTEF
NWT	Niwot Ridge LTER
NTL	North Temperate Lakes I
NES	Northeast U.S. Shelf LTE
NGA	Northern Gulf of Alaska I
PAL	Palmer Antarctica LTER
PIE	Plum Island Ecosystems LTER
SBC	Santa Barbara Coastal L
SEV	Sevilleta LTER
VCR	Virginia Coast Reserve L

2017 LTER research site map obtained from https://lternet.edu/site/lter-network/

Emerging Topics in Biogeochemical Cycles (ETBC)

Website: http://www.nsf.gov/pubs/2007/nsf07049/nsf07049.jsp

Coverage: global

The original call for proposals for Emerging Topics in Biogeochemical Cycles (ETBC) was issued in September 2007 by the US NSF Directorate for Geosciences (NSF 07-049).

The Geosciences Directorate (GEO) is substantially augmenting our past funding sources to explicitly support emerging areas of interdisciplinary research. We seek to foster transformational advances in our quantitative or mechanistic understanding of biogeochemical cycles that integrate physical-chemical-biological processes over the range of temporal and/or spatial scales in Earthâ€™s environments. We encourage submission of proposals that address emerging topics in biogeochemical cycles, the water cycle or their coupling, across the interfaces of atmosphere, land, and oceans. Proposals must cross the disciplinary boundaries of two or more divisions in Geosciences (e.g. ATM, EAR, OCE) or of at least one division in Geosciences and a division in another NSF directorate.

Although funding programmatic disciplines continues to provide a robust and adaptable framework to build our understanding of the geosciences and the earth as a system, there are classes of emerging and challenging problems that require integration of concepts and observations across diverse fields. Our goal is to enhance such integration. Successful proposals need to develop intellectual excitement in the participating disciplinary communities. Also encouraged are proposals that have broader educational, diversity, societal, or infrastructure impacts that capitalize on this interdisciplinary opportunity.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0927411

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