

Hawaii Ocean Timeseries (HOT) sampling station locations from multiple cruises on the R/V Kilo Moana, R/V Knorr, and R/V Ka`imikai-O-Kanaloa, in the Hawaiian Islands: stations Kahe, ALOHA, Kena and WHOTS Mooring from 2008-2009 (Silica Cycling project)

Website: <https://www.bco-dmo.org/dataset/3882>

Version: 27 February 2013

Version Date: 2013-02-27

Project

» [Silica Cycling and the Role of Diatoms in the North Pacific Subtropical Gyre](#) (Silica Cycling)

Contributors	Affiliation	Role
Brzezinski, Mark A.	University of California-Santa Barbara (UCSB)	Principal Investigator, Contact
Gegg, Stephen R.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

HOT Sampling Stations occupied for the Silica Cycling Project - Station Number, Station Name, Latitude, Longitude

Methods & Sampling

Generated from HOT Chief Scientist Cruise Reports by BCO-DMO Staff

Data Processing Description

Generated from HOT Chief Scientist Cruise Reports by BCO-DMO Staff

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Data Files

File
HOT_Stations.csv (Comma Separated Values (.csv), 210 bytes) MD5:34f45c5aa83bc8cf7f433fcd079ed00
Primary data file for dataset ID 3882

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Parameters

Parameter	Description	Units
Station_Number	Station Number	dimensionless
Station_Id	Station Id	text
Lat	Station Latitude in decimal degrees (South is negative)	decimal degrees
Lon	Station Longitude in decimal degrees (West is negative)	decimal degrees

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Deployments

KM0801

Website	https://www.bco-dmo.org/deployment/59000
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-01-28
End Date	2008-02-01
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0802

Website	https://www.bco-dmo.org/deployment/59001
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-02-22
End Date	2008-02-26
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0806

Website	https://www.bco-dmo.org/deployment/59002
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-05-26
End Date	2008-05-30
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0811

Website	https://www.bco-dmo.org/deployment/59003
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-06-24
End Date	2008-06-28
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0813

Website	https://www.bco-dmo.org/deployment/59004
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-07-25
End Date	2008-07-29
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0815

Website	https://www.bco-dmo.org/deployment/59005
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-08-15
End Date	2008-08-19
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0820

Website	https://www.bco-dmo.org/deployment/59006
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-10-09
End Date	2008-10-13
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0822

Website	https://www.bco-dmo.org/deployment/59007
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2008-11-29
End Date	2008-12-03
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0902

Website	https://www.bco-dmo.org/deployment/59008
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-01-19
End Date	2009-01-23
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0907

Website	https://www.bco-dmo.org/deployment/59009
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-02-16
End Date	2009-02-20
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0915

Website	https://www.bco-dmo.org/deployment/59012
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-07-02
End Date	2009-07-06
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0918

Website	https://www.bco-dmo.org/deployment/59013
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-07-23
End Date	2009-07-27
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KM0920

Website	https://www.bco-dmo.org/deployment/59014
Platform	R/V Kilo Moana
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-08-17
End Date	2009-08-21
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KN195-07

Website	https://www.bco-dmo.org/deployment/59010
Platform	R/V Knorr
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-04-27
End Date	2009-05-01
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets

KOK0909

Website	https://www.bco-dmo.org/deployment/59011
Platform	R/V Ka`imikai-O-Kanaloa
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-05-26
End Date	2009-05-30
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KOK0916

Website	https://www.bco-dmo.org/deployment/59015
Platform	R/V Ka`imikai-O-Kanaloa
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-09-23
End Date	2009-09-27
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KOK0917

Website	https://www.bco-dmo.org/deployment/59016
Platform	R/V Ka`imikai-O-Kanaloa
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-11-02
End Date	2009-11-06
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

KOK0920

Website	https://www.bco-dmo.org/deployment/59017
Platform	R/V Ka`imikai-O-Kanaloa
Report	http://hahana.soest.hawaii.edu/hot/cruises.html
Start Date	2009-12-08
End Date	2009-12-12
Description	HOT - Cruise Schedules, Chief Scientist Reports and Cast Sheets Cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Silica Cycling and the Role of Diatoms in the North Pacific Subtropical Gyre (Silica Cycling)

Coverage: North Pacific Subtropical Gyre north of Hawaii, near (30 N, 140 W)

This study examines the unique silicon cycle of the North Pacific Subtropical Gyre (NPSG).

Most marine silicon cycle studies have focused on the more productive coastal waters or the Southern Ocean where diatoms typically dominate the phytoplankton. Although diatom biomass is much lower in subtropical gyres, silica production is significant in global terms. Silicon cycle studies of the Sargasso Sea in the 1990's implied that subtropical gyres account for 13% of global marine silica production. More recent data from the NPSG show much higher rates of silica production that would increase the contribution of subtropical gyres to as much as 40%. The new estimate is uncertain and based on few data, but suggests that the contribution of subtropical gyres has been underestimated. Differences in the silicon cycle between the NPSG and the Sargasso Sea go beyond differences in average production rates. The two systems are several months out of phase with each other in terms of their seasonal silica production cycles. Unlike the Sargasso Sea, where diatoms bloom regularly in spring in response to winter convective overturn, permanent stratification prevents

spring diatom blooms events in the NPSG, where annual diatom blooms occur in summer, when stratification is strongest and nutrient concentrations are at a seasonal minimum. These enigmatic summer blooms contribute significantly to carbon and nitrogen export in the NPSG and likely dominate the annual silicon cycle.

Time series of rate measurements will be made in collaboration with the HOT program to define the annual silicon cycle at station ALOHA. The project will also collaborate with the new "Center for Microbial Oceanography: Research and Education" (CMORE) Science and Technology Center at the University of Hawaii to study summer blooms. Funding for this portion of the project is from NSF OCE-0648130.

Separately funded laboratory studies (NSF OCE-0726726; Title: Biological characterization of the nitrogen-fixing *Rhizosolenia-Richelia* symbiosis), looked at the role of diatom-diazotroph associations (DDAs) in elemental cycling in the NPSG.

Nitrogen-fixation provides a key input of new nitrogen into oligotrophic, oceanic regions. Work over the past two decades has highlighted the role of *Trichodesmium*. More recently, the role of coccoid cyanobacteria as well as symbiotic associations of the filamentous cyanobacteria *Richelia intracellularis* with species of diatoms (*Rhizosolenia* and *Hemiaulus*) has received attention. Little is known of the growth rates, nutrient needs, chemical composition, or environmental tolerances of these DDAs. However, it is clear that DDAs are numerically important in some oceans and can play a major role in mediating new nitrogen inputs. Recent models have identified the need for species-specific parameters, but these are lacking for DDAs. In particular, temperature dependent properties require quantification for application to global warming scenarios.

Laboratory studies of both the *Rhizosolenia-Richelia* and *Hemiaulus-Richelia* DDA are now possible due to the reproducible cultivation of this association. This four-year research program will quantify temperature and salinity effects on growth rates and NB2B-fixation rates. It will explore the role of silicate and phosphate (inorganic and organic) in controlling growth rates, chemical composition and NB2B-fixation through host-symbiont interactions. Field studies will address the distribution of both these DDAs and their contribution to Si cycling in large diatom blooms reported from the central N. Pacific gyre.

The mass accumulation of the DDAs in sediment traps as well as in the sedimentary record suggest DDAs are important vectors to depth. The potentially high sinking rates relative to *Trichodesmium* permit rapid export of new N and sequestration of C. This work will quantify settling rates under conditions of phosphate and silicate-limited growth and provide the first estimates of potential losses due to sinking. This program will provide the first broad characterization of a DDA and provide valuable input data for models.

DDA blooms are potential means to remove C and N quickly from the euphotic zone via mass sedimentation of the diatom host. Diatom remains in sediments suggest this is an important vector for sedimentary deposition. The autecological work in this study will produce information important for interpreting how such events can occur. In addition, temperature tolerance studies will yield data useful for understanding how this DDA could respond to warming oceans.

The proposed research on Si cycling combined with ongoing studies of C, N and P cycling at station ALOHA will allow, for the first time, an opportunity for a coordinated analysis the cycling of all four of these elements simultaneously in an oligotrophic gyre. The pairing of field work with laboratory studies to determine the role of DDAs will expand understanding of the mechanisms controlling the contribution of diatoms to elemental cycling in open ocean ecosystems.

RELATED PUBLICATIONS

Brzezinski MA, Krause JW, Church MJ, Karl DM, Li B, Jones JL, Updyke B. "The annual silica cycle of the North Pacific subtropical gyre," *Deep Sea Research I*, v.58, 2011, p. 998.

Duhamel S., Bjorkman K. M., Van Wambeke F., Moutin T., Karl DM. "Characterization of alkaline phosphatase activity in the North and South Pacific Subtropical Gyres: Implications for phosphorus cycling," *Limnology and Oceanography*, v.56, 2011, p. 1244.

Krause J.W., Brzezinski M.A., Jones J.L. "Application of low-level beta counting of ^{32}Si for the measurement of silica production rates in aquatic environments," *Marine Chemistry*, v.127, 2011, p. 40.

Krause J.W., Brzezinski M.A., Villareal, T.A., Wilson C. "Increased kinetic efficiency for silicic acid uptake as a driver of summer diatom blooms in the North Pacific subtropical gyre," *Limnology and Oceanography*, v.57, 2012, p. 1084.

Villareal, T.A.; Adornato, L.; Wilson, C.; Shoenbachler, C.A. "Summer blooms of diatom-diazotroph assemblages (DDAs) and surface chlorophyll in the N. Pacific gyre - a disconnect" *Journal of Geophysical Research-Oceans*,

v.116, 2011, p. DOI: 10.1.

Villareal T.A., Brown, C. G., Brzezinski M.A., Krause J.W., Wilson C.. "Summer Diatom Blooms in the North Pacific Subtropical Gyre: 2008-2009," PLoS ONE, v.7, 2012, p. e33109.

Watkins-Brandt K.S., Letelier R.M., Spitz Y.H., Church M.J., Bottjer D., White Angelique. "Addition of inorganic or organic phosphorus enhances nitrogen and carbon fixation in the oligotrophic North Pacific," Marine Ecology Progress Series, v.432, 2011, p. 17.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0648130

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