Sinking Particles from R/V Kaiyo-Maru cruise KY0103-02 in the Northwestern Sub-Arctic Pacific in 2001 (SEEDS I project)

Website: https://www.bco-dmo.org/dataset/2911
Version: 09Feb2010
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Project
» Subarctic-Pacific Iron Experiment for Ecosystem Dynamics Study I (SEEDS I)

Program
» Iron Synthesis (FeSynth)

Contributors	Affiliation	Role
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Dataset Description

SEEDS 2001 Sinking Particles
mass flux (average of 4 cups) for each depth and each deployment.
POC and PON (used to calculate C and N flux).
Metals (by ICP-AES)
- Al, Ca, Fe, Mg, Mn, P, Sr, Ti, and Zn on dry material
- Ba, Cr, Cu also measured but subject to analytical problems.
- Na, K, S used to check seasalt mass balance.
Si also measured (but on different filter to metals).
d13C

Methods & Sampling

Traps were suspended from each of the buoys:
- CENTRE: 20 m
- IN: 40, 60, 100, 200 m
- OUT: 20, 40, 60 and 100 m

Traps were recovered several times.

Deployment times (days):
- CENTRE: 3.95, 2.83, 2.02, 1.98, 1.93, 2.05
- IN: 3.99, 2.84, 2.03, 2.00, 1.95, 2.01

- OUT: 5.17, 3.97, 3.42

Notes from original xls file: Sinking_particles.xls
Drifting sediment trap experiment by CREST/NIES

(dm) 105 lines of comments before data begins.
(dm) all comments except 7 lines prefaced with (dm) are copied from original file.
Comments (dm) by fcsv file compiler

(dm) NOTE that I traps 200m data collected with different style (Aono type trap)

Cylindrical sediment trap of Knauer design was used.
Eight traps deployed on each cross-frame.
The cylindrical trap is separable into upper cylinder and bottom cup.
The upper cylinder has a baffle at the open end. (see picture)
(DMO Note: No picture enclosed)

- All the traps was filled with a high density gradient solution(approximately 39 permil containing 2 % formalin).
- The solution was prepared with filtered seawater sampled nearbystation of the Fe infusion and NaCl was added.
- At the deployment of the trap half volume of the high density solution might be replaced with surrounding seawater.
- Center drifter was deployed to locate the center of Fe patch which had 20 m depth trap positioning buoys radar reflector and drogue.
- Inside drifter was deployed at the distance of 0.3 mile from the center drifter which had 40 60 100 and 200 m depth traps positioning buoys and radar reflector.
- Outside drifter was deployed at the distance of 20 mile from the center drifter which had 20 40 60 and 100 m depth traps positioning buoys and radar reflector.
- Trap design of 200 m depth was different (0.16 m in diameter and 4 traps on a frame).
- The detail of the design is described in Th234 data set file.

20 m trap sample of center drifter in Run 2 was lost by an accidental event at deck recovery.
20 m trap of center drifter in Run 4 was lost because of the breakage of hydro wire.

Recovered sample in the bottom cup was transferred into 500 mL polystyrene bottle.
Formalin was added at final concentration of 5 % for preservation until on shore analysis.
The folmalin used was neutralized with sodium borate (Borax).
Large zooplankton (swimmer was removed under microscope.

Regular design traps (Knauer Type)

- 2-3: Nuclepore for biogenic Si analysis
- 4: Nuclepore for metallic element analysis
- 5: Nuclepore for spare
- 6: GF/F for C N analysis by Carlo Erba elemental analyzer (EA1110)
- 7: GF/F for C13 analysis of organic carbon by Delta Plus (Finnigan MAT combined with the Carlo Erba elemental analyzer)
- 8: GF/F for spare

Size of the filters were 47mm in diameter and pore size of Nuclepore filter was 0.6 micro meter.
Pre-weighted filter was used for filtration.
The pre-weighting procedure was identical to the sample weighting.
Filter with trapped material was immediately frozen in -30 degree C freezer.
Filters were dried in a vacuum freeze dryer.
After drying the filter it was kept in a clean balance room controlled at 23 degree C and 50 % humidity.
The reproducibility of the weight measurement was 0.05 mg for each filter.
Total mass flux was calculated from 4 replicate measurement of Nuclepore filters.
The weight of GF/F samples were also measured however the stability of the weight
was poorer than that of Nuclepore filter.
For C/N analysis GF/F filter was fumed in a desiccator containing conc.
HCl to vaporize the inorganic carbon.

Trap dimensions:
- Length (L) m 0.63

- Inside diameter (Di) m 0.07
- Outside diameter (Do) m 0.075
- Aspect ratio (AR) 8.86
- Collection area (A) m2 0.00385
- Trap volume (V) m3 0.00239
- Trap volume (V) litres 2.386
- Baffle length (Lb) m 0.076
- Baffle diameter (Dib) m 0.013
- Baffle aspect ratio (ARb) 5.85

Aono type trap (used I traps at 200 m only collection area 0.020106 m2
Trap collection area 0.003848 m2

Data Processing Description

Notes from original xls file: Sinking_particles.xls
Total mass flux measurement
Nuclepore filter weight with sample was measured for 4 cups from
one depth of the drifting sediment trap.

CN analysis
No. 6 GF/F filter was used for CN analysis. of *(DMO Note: ????)*
The filters were freeze-dried and then inorganic carbon was removed by an acid treatment in *(DMO Note: ????)*
The filters were freeze-dried and then fumed in desiccator with conc. HCl for 4-5 hours to remove inorganic carbon.
Organic carbon and nitrogen were analyzed by EA1110 elemental analyzer (Carlo Erba) calibrated with acetoanilide (C8H9NO) standard reagent.
C and N fluxes were calculated from mg yield of C and N with collection area of the trap and drifting period.

ICPAES analysis of trapped material of drifting sediment trap acid digestion by HNO3/HClO4/HF ppm (mg/kg in dry wt.
Nuclepore filter with sample was enclosed in a double sealed Teflon digestion vessel with stainless steel outer jacket with 2 ml HNO3 and 1ml HClO4.
The digestion vessel was heated at 150 degree C for 7 hours to decompose organic material.
One ml of HF was added into the Teflon vessel and silicate was decomposed on a hot plate.
The final weight of sample solution was adjusted to 4 g and served to ICP atomic emission spectrometric analysis.
Blank was corrected from with the results of the same procedure only using blank Nuclepore filter and acid reagents.
Nippon Jarrel Ash type ICAP750 was used for the ICPAES analysis.

Biogenic Si was measured using different Nuclepore filter with that for metallic element analysis.
Nuclepore filter with trapped material was treated with 0.5 M Na2CO3 solution for 3 hours at 85 degree C.
The extracted biogenic Si was measured by ICPAES same as metallic elements.
Samples for 200 m depth (from Aono type trap had different history from other depths.
Samples other than 200 m preserved under neutralized pH formalin solution and applied swimmer picking out procedure were filtered within two months after recovery.
Because 200 m trap has two sample cups samples were divided after five months of recovery and served for ICP analysis for Si and other elements.
C/N analysis fo samples for 200 m depth was done in similar period with other depths.
The total mass of 200 m analysis suming up for C N Si and elements are significantly smaller than 100 %.
These results are not accurate than other depths.
Filter weight is that of the digested filter different from the average of four Nuclepore filter.

Al Ca Fe Mg Mn P Sr Ti Zn This element group was well within ICPAES measurement range with minimum blank correction.
The element group (Ba Cr Cu and Na K Shas analytical problem relating to blank correction and digestion efficiency
B comes from preservative.
Na K and S are nominated to check analytical accuracy to sum up the total mass which usually comes from seawater components.

Elemental flux was calculated from concentration of the element multiplied by the total mass flux estimated from the trapped material weight on the four Nuclepore filter.
Calculated sum of all the elements well agree with 100 %.
Silicate Ca was estimated using crustal abundance of Ca to Al and the rest of Ca was estimated as carbonate.
Inorganic carbon was estimated from the carbonate calcium.
The total sum of elements other than 200 m samples are excellent.
Preservation for 200 m samples might not be good.
(dm) mass check calculations assume element in stated form.
(dm) calculatedMass = flux / atomic mass element * molecular mass stated form

Isotope analysis of organic carbon of trapped material
No. 7 GF/F filter for each trap was served for carbon isotopic analysis by
Carlo Erba elemental analyzer (EA1110) combined with a mass spectrometer (Delta Plus Finniga MAT).
The filter was fumed by HCl.
Filter used indicates the division of sample served for combustion furnace of the elemental analyzer.
MCC is Mass Check Calculation (added to params toward end of records

BCO-DMO Processing Notes
CSV file generated by Doug Mackie from original spreadsheet Sinking_particles.xls

BCO-DMO Edits
- Parameter names modified to conform to BCO-DMO convention
- lat/lon for deployment and recovery added from buoy drift data

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Data Files

File
sinkpart.csv(Comma Separated Values (.csv), 21.91 KB) MD5:394bba9603694c596959ab017f8b55d5 Primary data file for dataset ID 2911

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Parameters

Parameter	Description	Units
trap	trap	text
depth	depth	meters
date_start	date Trap deployment JST	YYYYMMDD
time_start	time Trap deployment JST	HHMM
lon_start	longitude of Trap deployment (negative denotes West)	decimal degrees
lat_start	latitude of Trap deployment (negative denotes South)	decimal degrees

date_end	date Trap recovery JST	YYYYMMDD
time_end	time Trap recovery JST	HHMM
lon_end	longitude of Trap recovery (negative denotes West)	decimal degrees
lat_end	latitude of Trap recovery (negative denotes South)	decimal degrees
Drifting_period	Drifting period days	decimal days
mass_Cup_2mg	mass Cup 2	mg
mass_Cup_3mg	mass Cup 3	mg
mass_Cup_4mg	mass Cup 4	mg
mass_Cup_5mg	mass Cup 5	mg
mass_avg	mass avg	mg
mass_st_dev	mass st dev	mg
mass_RSD_percent	mass RSD percent	percentage
mass_flux	mass flux	mg/m2/day
PON	PON	mg
POC	POC	mg
N_flux	N flux	mg/m2/day
C_flux	C flux	mg/m2/day
metals_filter_number	metals filter number	integer

dry_wt	dry wt	mg
Al	Al	mg/kg
Ca	Ca	mg/kg
Fe	Fe	mg/kg
Mg	Mg	mg/kg
Mn	Mn	mg/kg
P	P	mg/kg
Sr	Sr	mg/kg
Ti	Ti	mg/kg
Zn	Zn	mg/kg
B	B	mg/kg
Ba	Ba	mg/kg
Cr	Cr	mg/kg
Cu	Cu	mg/kg
Na	Na	mg/kg
K	K	mg/kg
S	S	mg/kg
Silica_filter_number	Silica filter number	integer
silica_filter_dry_wt	silica filter dry wt	mg

Si_percent	Si percent	percentage
total_mass_flux	total mass flux	mg/m2/day
N_mass_flux	N mass flux	mg/m2/day
C_mass_flux	C mass flux	mg/m2/day
Si_mass_flux	Si mass flux	mg/m2/day
Al_mass_flux	Al mass flux	mg/m2/day
Ca_mass_flux	Ca mass flux	mg/m2/day
Fe_mass_flux	Fe mass flux	mg/m2/day
Mg_mass_flux	Mg mass flux	mg/m2/day
Mn_mass_flux	Mn mass flux	mg/m2/day
P_mass_flux	P mass flux	mg/m2/day
Sr_mass_flux	Sr mass flux	mg/m2/day
Ti_mass_flux	Ti mass flux	mg/m2/day
Zn_mass_flux	Zn mass flux	mg/m2/day
B_mass_flux	B mass flux	mg/m2/day
Ba_mass_flux	Ba mass flux	mg/m2/day
Cr_mass_flux	Cr mass flux	mg/m2/day
Cu_mass_flux	Cu mass flux	mg/m2/day
Na_mass_flux	Na mass flux	mg/m2/day

K_mass_flux	K mass flux	mg/m2/day
S_mass_flux	S mass flux	mg/m2/day
Crustal_Ca_mass_flux	Crustal Ca mass flux	mg/m2/day
carb_Ca_mass_flux	carb Ca mass flux	mg/m2/day
Inorganic_C_mass_flux	Inorganic C mass flux	mg/m2/day
C_to_N	C/N ratio	dimensionless
C_to_P	C/P ratio	dimensionless
N_to_P	N/P ratio	dimensionless
C_to_Si	C/Si ratio	dimensionless
CO3_to_C	CO3/C ratio	dimensionless
MCC_Inorg_CO3	Mass Check Calculation for Inorg CO3	tbd
MCC_NH2	Mass Check Calculation for NH2	tbd
MCC_CH2O	Mass Check Calculation for CH2O	tbd
MCC_SiO2	Mass Check Calculation for SiO2	tbd
MCC_Al2O3	Mass Check Calculation for Al2O3	tbd
MCC_Ca	Mass Check Calculation for Ca	tbd
MCC_Fe2O3	Mass Check Calculation for Fe2O3	tbd
MCC_MgO	Mass Check Calculation for O	tbd
MCC_PO4	Mass Check Calculation for PO4	tbd

MCC_ZnO	Mass Check Calculation for ZnO	tbd
MCC_BO3	Mass Check Calculation for BO3	tbd
MCC_NaCl	Mass Check Calculation for NaCl	tbd
MCC_KCl	Mass Check Calculation for KCl	tbd
MCC_SH2	Mass Check Calculation for SH2	tbd
MCC_total_element_mass_calculated	Mass Check Calculation for total element mass calculated	tbd
MCC_calculated_mass_minus_actual_mass	Mass Check Calculation for calculated mass-actual mass	tbd
MCC_mass_percent_excess	Mass Check Calculation for mass percent excess	percentage
d13C_filter_used	d13C filter used	text
delta_C13	delta C13	tbd

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Instruments

Dataset-specific Instrument Name	Sediment Trap
Generic Instrument Name	Sediment Trap
Generic Instrument Description	Sediment traps are specially designed containers deployed in the water column for periods of time to collect particles from the water column falling toward the sea floor. In general a sediment trap has a jar at the bottom to collect the sample and a broad funnel-shaped opening at the top with baffles to keep out very large objects and help prevent the funnel from clogging. This designation is used when the specific type of sediment trap was not specified by the contributing investigator.

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Deployments

KY0103-02

Website	https://www.bco-dmo.org/deployment/57835
Platform	R/V Kaiyo-Maru
Start Date	2001-07-13
End Date	2001-08-06
Description	Patch enrichment = Leg 2: 13 Jul 2001 (Kushiro)--06 Aug 2001 (Tokyo)Note: No cruise track was contributed for this deployment. Data are plotted outside what is displayed as the "best availble" cruise track from the data contributed

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Project Information

Subarctic-Pacific Iron Experiment for Ecosystem Dynamics Study I (SEEDS I)

Website: http://www.seeds-exp.jp/en/index.html

Coverage: Western subarctic gyre in the North Pacific at 48.5°N, 165°E

An in situ test of the iron limitation hypothesis in the subarctic North Pacific Oceanwas performed. First experiment of two (see SEEDS 2004)

A single enrichment of dissolved iron caused a large increase in phytoplanktonstanding stock and decreases in macronutrients and dissolved carbon dioxide. The dominant phytoplankton species shifted after the iron addition from pennate diatoms to a centric diatom, *Chaetoceros debilis*, that showed a very high growth rate, 2.6 doublings per day. Conclusion was that the bioavailability of iron regulates the magnitude of the phytoplankton biomass and the key phytoplankton species that determine the biogeochemical sensitivity to iron supply of high-nitrate, low-chlorophyll waters.

Data was collected at a total of 13 stations and from 3 moored sediment traps.
- Stations were occupied IN patch for days 0, 2, 4, 7, 9, 11 and 13.
- Stations were occupied OUT patch for days 2, 4, 7, 9, 11, 13.

It is not explicitly stated but it appears that at all stations two CTDsampling rosette casts were made: clean and rms. The clean rosette appears to have typically sampled the mixed layer (<50 m) e.g. 5, 10, 20, 30, 50 m. The rms rosette appears to have typically sampled the euphotic zone (<200m) e.g. 10, 20, 30, 40, 50, 80, 100, 150, 200 m.

Sediment traps were deployed at:
- CENTRE: 20 m
- IN: 40, 60, 100, 200 m
- OUT: 20, 40, 60 and 100 m

Traps were recovered several times. Deployment times (days):
- CENTRE: 3.95, 2.83, 2.02, 1.98, 1.93, 2.05
- IN: 3.99, 2.84, 2.03, 2.00, 1.95, 2.01
- OUT: 5.17, 3.97, 3.42

BCO-DMO/Doug Mackie Note:
Throughout these data, stations are identified as D2-I, D2-O, etc.
D2-I indicates "Day 2, in patch station".
while D2-O indicates "Day 2, out patch station".
This applies to all station identifiers.

Related file

SEEDS 2001 Project Documentation

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Program Information

Iron Synthesis (FeSynth)

Coverage: Global

The two main objectives of the Iron Synthesis program (SCOR Working Group proposal, 2005), are:
1. Data compilation: assembling a common open-access database of the *in situ* iron experiments, beginning with the first period (1993-2002; Ironex-1, Ironex-2, SOIREE, EisenEx, SEEDS-1; SOFeX, SERIES) where primary articles have already been published, to be followed by the 2004 experiments where primary articles are now in progress (EIFEX, SEEDS-2; SAGE, FeeP); similarly for the natural fertilizations S.O.JGOFS (1992), CROZEX (2004/2005) and KEOPS (2005).

2. Modeling and data synthesis of specific aspects of two or more such experiments for various topics such as physical mixing, phytoplankton productivity, overall ecosystem functioning, iron chemistry, CO2 budgeting, nutrient uptake ratios, DMS(P) processes, and combinations of these variables and processes.

SCOR Working Group proposal, 2005. "The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling".
http://www.scor-int.org/Working_Groups/wg131.htm

See also: SCOR Proceedings Vol. 42 Concepcion, Chile October 2006, pgs: 13-16 2.3.3 Working Group on The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling.

The first objective of the Iron Synthesis program involves a data recovery effort aimed at assembling a common, open-access database of data and metadata from a series of *in-situ* ocean iron fertilization experiments conducted between 1993 and 2005. Initially, funding for this effort is being provided by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).

Through the combined efforts of the principal investigators of the individual projects and the staff of Biological and Chemical Oceanography Data Management Office (BCO-DMO), data currently available primarily through individuals, disparate reports and data agencies, and in multiple formats, are being collected and prepared for addition to the BCO-DMO database from which they will be freely available to the community.

As data are contributed to the BCO-DMO office, they are organized into four overlapping categories:
1. Level 1, basic metadata
(e.g., description of project/study, general location, PI(s), participants);
2. Level 2, detailed metadata and basic shipboard data and routine ship's operations
(e.g., CTDs, underway measurements, sampling event logs);
3. Level 3, detailed metadata and data from specialized observations
(e.g., discrete observations, experimental results, rate measurements) and
4. Level 4, remaining datasets
(e.g., highest level of detailed data available from each study).

Collaboration with BCO-DMO staff began in March of 2008 and initial efforts have been directed toward basic project descriptions, levels 1 and 2 metadata and basic data, with detailed and more detailed data files being incorporated as they become available and are processed.

Related file

Program Documentation

The Iron Synthesis Program is funded jointly by the Scientific Committee on Oceanic Research (SCOR) and the

U.S. National Science Foundation (NSF).