Data Directory
Sediment Trap

Methodology and PI Notes for Global Sediment Trap Data

Project: Global export and recycling of biogenic material into the ocean interior; A synthesis

Project Description

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Sediment Trap Data Tables

The data presented in the following tables are taken from a combination of published and unpublished sources. Special permission was obtained directly from the appropriate researchers to include the unpublished data.

The data tables represent the most basic calculations and information from the sediment trap projects that have collected particle material in the deep ocean. The particle mass flux has been reported to include the >1mm size fraction and <1mm size fraction of the particulate material. The elemental analysis is reported on the <1mm size fraction and includes organic carbon, inorganic carbon, biogenic silicon, nitrogen and aluminum. No dissolved portions of the sample are included, no analysis of the >1mm size fraction is reported.

The 5 elemental components of organic carbon, inorganic carbon, biogenic silicon, nitrogen and aluminum are reported in 2 data tables.

Table 1 contains annual integrated data from each sediment trap in mass flux (annual flux in g m-2 yr-1; average annual flux in mg m-2 d-1) , concentration (%) and mole ratios (C-org/C-inorg.; C-org/ Si-bio; Si-bio/C-inorg; C-org/ N and C-org/Al).

Table 2 contains the original; time-series data from each sediment

trap in mass flux, (mg m-2 d-1) concentration (%), mole ratios (C-org/C-inorg.; C-org/ Si-bio; Si-bio/C-inorg; C-org/ N and C-org/Al) and net mass in cup (in mg)

In some cases where published data units had to be converted to SMP formatted data units, the following calculations were used.

Conversion factors and calculations from references:

C-inorganic flux calculated from CaCO3 flux:

C-inorg. flux = CaCO3 flux * 8.33

Si-biogenic flux calculated from OPAL flux:

Si-bio. flux = OPAL (SiO2 with 10% H2O) flux / 2.4

(Ref. Mortlock and Froelich)

Si-bio. flux = OPAL (SiO2) flux * 2.14

C-organic flux calculated from Organic Mater (OM) flux:

C-org. flux = Organic Matter (OM) flux / 1.86

C-org. flux = Organic Matter (OM) flux / 2.86

C-org. flux = Organic Matter (OM) flux / 2.5

N-flux calculated from organic carbon flux and C/N mole ratio:

N-flux = C-org. flux / C-org./N (moles)

Al-total flux calculated from Lithogenic flux:

Al flux = Lithogenic flux/ 12.5

Methods:

Preservatives and Poisons used:

Formaldehyde based **(FORM)**

Glutaraldehyde **(GLUT)**

Mercuric Chloride based **(HgCl2)**

Sodium Azide based **(NaN3)**

Mass Flux analysis:

Particle samples were removed from the collecting cup and sieved through a 1mm sieve. In most cases the <1mm portion was split into several working samples.

In order to get an accurate weight of the particulate sample, the salt water was removed by either centrifugation **(CEN)** or filtration **(FIL)**. The sample was then dried at approximately 60C, desiccated and weighed. The net weight in the cup was then calculated for both >1mm and <1mm size fraction.

Mass Flux Calculations:

Mass flux of the >1mm and <1mm size fraction was calculated by dividing the net weight in the cup by the trap opening area and the collecting time. The following equation was used:

(mass flux; mg m-2 d-1) =

(net wt. in cup; mg) /[(trap opening area ; m2)*(cup collecting time ; days)]

Component Mass Flux (C-org., C-inorg., Si-bio., N, and Al) calculations:

Component mass flux of C-org, C-inorg., Si-bio., N, Al was calculated in the <1mm size fraction using the concentration of each component multiplied by the <1mm mass flux.

(Component mass flux in mg m-2 d-1) =

(% component in <1mm/100)* (<1mm mass flux in mg m-2 d-1)

Component Mole Flux was calculated with the following

equations:

C-org.mole flux in umole m-2 d-1= C-org. mass flux in mg m-2 d-1 / (12.01/1000)

C-inorg mol flux in umole m-2 d-1 = C-inorg mass flux in mg m-2 d-1 / 12.01/1000

Si-bio. mole flux in umole m-2 d-1 = Si-bio. mass flux in mg m-2 d-1 / 28.09/1000

N mole flux in umole m-2 d-1 = N mass flux in mg m-2 d-1 / 14.01/1000

Al mole flux in umole m-2 d-1 = Al mass flux in mg m-2 d-1 / 26.98 /1000

Elemental analysis:

>1mm size fraction:

The mass flux and concentration of the >1mm size fraction of the sample is reported when available. No analysis are preformed on the >1mm size fraction.

<1mm size fraction:

Elemental analysis is preformed on the <1mm size fraction of the sample. After processing of the <1mm size fraction of the sample, subsamples of the dried <1mm size fraction sample were weighed for each analysis.

C-inorganic analysis:

Weight loss analysis (%CaCO3 = %wt. loss after acid treatment): The concentration of CaCO3 is calculated by the weight difference between weight of the total sample and the weight of the sample after acidification. The weight loss is assumed to be CaCO3 and inorganic carbon is calculated from the following equation: % C-inorganic = %CaCO3/8.33

Coulometer analysis: The concentration of inorganic Carbon (CO2) is directly quantified by coulometric titration during sample acidification. The inorganic carbon (C-inorg.) is calculated as a % of the analyzed sample.

Gassimetric analysis: The sample is acidified and the evolved CO2 is

manometricly quantified.

The inorganic carbon (C-inorg.) is calculated as a % of the analyzed sample.

Carbon difference (inorganic C = total C – organic C): The concentration of inorganic carbon quantified by the difference between total Carbon and Organic Carbon (acidified sample) as analyzed by a Carbon elemental analyzer.

Si-biogenic analysis:

Selective Alkaline dissolution: The biogenic Si is selectively dissolved from the sample by treating the sample with an alkaline solution (either Na2CO3 or NaOH) with heat for a period of time. The Si is analyzed by various detectors, usually colorimetric spectrophotometer or by ICP-ES. The concentration of Si in the sample is then calculated.

Total Si and Al analysis. The sample is totally dissolved by alkaline fusion (lithium-meta borate fusion) or by acid digestion (open beaker or sealed microwave heating). The Si and Al in the liquefied sample is analyzed by various detectors, (ICP-ES, ICP-MS, AA). The Si and Al concentration are then calculated. The biogenic Si is calculated by subtracting the lithogenic Si fraction from the total Si. The lithogenic Si fraction of the sample is calculated from the product of the Al concentration of the sample and the Si/Al crustal ratio (Si/Al =3.4 mass).

C-organic analysis

Carbon analysis of decalcified sample: A sample is decalcified by various acids (HCL, Sulfurous acid, Phosphoric acid) and techniques (direct contact, fuming) and is analyzed by a carbon analyzer. The concentration of carbon is reported as % organic carbon of the sample.

Carbon difference (organic C = total C – inorganic C): The concentration of organic carbon is quantified by the difference between total carbon content (carbon elemental analyzer) and inorganic carbon content (coulometric method)

Wet Chemical carbon analysis: The organic carbon content of the sample is extracted by chemical solutions and is determined by a carbon elemental analyzer.

N analysis:

N in total sample: N was analyzed in the total sample with an elemental N analyzer

N in decalcified sample: N was analyzed in a decalcified sample with an elemental N analyzer

Al analysis:

Total Al analysis. The sample is totally dissolved by alkaline fusion (lithium-meta borate fusion) or by acid digestion (open beaker or sealed microwave heating). The Al in the liquefied sample is analyzed by various detectors, (ICP-ES, ICP-MS, AA). The Al concentration as % Al in the sample.

Average daily settling fluxes

The average daily fluxes were calculated by dividing the sum of the net mass in each cup by the trap area multiplied by the collecting time duration

Measured settling fluxes =

Average daily settling fluxes = Measured settling fluxes / duration (days)

Annual settling Fluxes

Annual settling fluxes = Measured settling fluxes x 365/ duration (days)

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