

# Niskin bottle data from R/V Kilo Moana, R/V Roger Revelle cruises KM0414, ZHNG09RR from the Hawaiian Islands HOT Site, NW SubArctic Pacific Ocean K2 Site, 2004-2005 (VERTIGO project)

**Website:** <https://www.bco-dmo.org/dataset/2969>

**Version:** 05 September 2006

**Version Date:** 2006-09-05

## Project

» [VERTical Transport In the Global Ocean](#) (VERTIGO)

## Program

» [Ocean Carbon and Biogeochemistry](#) (OCB)

Contributors	Affiliation	Role
<a href="#">Siegel, David</a>	University of California-Santa Barbara (UCSB-ICESS)	Principal Investigator
<a href="#">Chandler, Cynthia L.</a>	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

---

## Table of Contents

- [Dataset Description](#)
  - [Methods & Sampling](#)
  - [Data Processing Description](#)
- [Data Files](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Program Information](#)
- [Funding](#)

---

## Dataset Description

Niskin Bottle Data

## Methods & Sampling

see cruise specific documentation

## Data Processing Description

see cruise specific documentation

[ [table of contents](#) | [back to top](#) ]

---

## Data Files

File	
<b>bottle_KM0414.csv</b>	(Comma Separated Values (.csv), 124.69 KB) MD5:5361a0dde41beb32d9e6b8e591238b5a
version 05 September 2006 (original version 13 July 2005)	
PI: Dave Siegel	
prepared by OCB DMO using mkCruBtl.pl (v050711) KM0414 niskin bottle data	
<b>bottle_ZHNG09RR.csv</b>	(Comma Separated Values (.csv), 168.51 KB) MD5:1f5c8adadaf9cc2676f3a8d6417b7ba0
version 05 September 2006 (original verion 30 January 2006)	
PI: Dave Siegel (UCSB)	
VERTIGO RR K2 Niskin bottle base data prepared by OCB DMO (WHOI)	

[ [table of contents](#) | [back to top](#) ]

## Parameters

Parameter	Description	Units
event	unique sampling event number composite of date and time (GMT)	YYyday_hhmm
date_HST	date sampling began (local HST)	YYYYMMDD
time_HST	time sampling began (local HST)	hhmm
lon	longitude, negative denotes West	decimal degrees
lat	latitude, negative denotes South	decimal degrees
cast	CTD cast number	dimensionless
bot	Niskin bottle number	dimensionless
press	pressure, from CTD	decibars
depth	depth; calculated from pressure	meters
temp	temperature, from CTD, ITS-90	degrees Celsius

potemp	potential temperature, ITS-90	degrees Celsius
sal	salinity, from CTD, PSS-78 (PSU)	dimensionless
sigma_0	sigma-theta (potential density)	kg/meter <sup>3</sup>
O2_umol_kg	oxygen, dissolved	umol/kg
fluor	fluorescence, uncalibrated	voltage
turb	turbidity, Seapoint	voltage
date	sampling date (GMT)	YYYYMMDD
time	sampling time (GMT)	hhmm
T_local	local time (GMT +11)	hhmm
Pmax	maximum pressure recorded	decibars
O2_satP	oxygen saturation	percent
trans	transmissivity	voltage
PIC	Particulate Inorganic Carbon as measured by transmissometer	voltage
PAR	Photosynthetically Available Radiation (or SPAR ?? see .cnv headers)	voltage

[ [table of contents](#) | [back to top](#) ]

---

## Instruments

<b>Dataset-specific Instrument Name</b>	Niskin bottle
<b>Generic Instrument Name</b>	Niskin bottle
<b>Generic Instrument Description</b>	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.

[ [table of contents](#) | [back to top](#) ]

## Deployments

### KM0414

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/57847">https://www.bco-dmo.org/deployment/57847</a>
<b>Platform</b>	R/V Kilo Moana
<b>Start Date</b>	2004-06-20
<b>End Date</b>	2004-07-10
<b>Description</b>	<p>VERTIGO project expedition to the U.S. Hawaii Ocean Time-series (HOT) site, near the deep-water Station ALOHA (A Long-Term Oligotrophic Habitat Assessment; 22° 45'N, 158° 00'W) located 100 km north of Oahu, Hawaii. Funded by: NSF OCE-0301139 Related information: VERTIGO cruise information from the VERTIGO Project site: <a href="https://cafethorium.whoi.edu/projects/vertigo/vertigo-hi/">https://cafethorium.whoi.edu/projects/vertigo/vertigo-hi/</a> HOT Web site: <a href="https://hahana.soest.hawaii.edu/index.html">https://hahana.soest.hawaii.edu/index.html</a> Original cruise data are available from the NSF R2R data catalog: <a href="http://www.rvdata.us/catalog/KM0414">http://www.rvdata.us/catalog/KM0414</a></p> <p><b>Methods &amp; Sampling</b></p> <p>Methodology Change history: YYMMDD 050712: added to OCB database; Cyndy Chandler (<a href="mailto:cchandler@whoi.edu">cchandler@whoi.edu</a>), OCB CDMO 060905: corrected HST time for CTD event 04185_1421 (per Chief Scientist request) DMO note: As of January 2006, optics data are still raw voltages, and have not yet been compared with in-situ data. The data should be used by others with caution until finalized. oxygen units reported as OMm/KG, assume umol/kg sigma-theta units not reported, assume kg/m<sup>3</sup></p>

### ZHNG09RR

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/57848">https://www.bco-dmo.org/deployment/57848</a>
<b>Platform</b>	R/V Roger Revelle
<b>Start Date</b>	2005-07-21
<b>End Date</b>	2005-08-27
<b>Description</b>	<p>VERTIGO 2005 expedition to the K2site in the NW Pacific near 45° N and 160° E Funded by: NSF OCE-0301139 Cruise information from the VERTIGO project site: <a href="https://cafethorium.whoi.edu/projects/vertigo/vertigo-k2/">https://cafethorium.whoi.edu/projects/vertigo/vertigo-k2/</a> Original cruise data for the Revelle are available from the NSF R2R data catalog: <a href="http://www.rvdata.us/catalog/ZHNG09RR">http://www.rvdata.us/catalog/ZHNG09RR</a></p> <p><b>Methods &amp; Sampling</b></p> <p>Methodology Change history: YMMDD 060123: Added by Cyndy Chandler (<a href="mailto:cchandler@whoi.edu">cchandler@whoi.edu</a>), OCB CDMO 060905: remove O2, T, C and derived params from station 20 per Chief Scientist request; sensor caps left on during deployment DMO note: event, date, time, latitude and longitude are from the CTD cast NMEA header lines; T_local (local time at study area) was computed by adjusting GMT time by +11 As of January 2006, oxygen, fluorescence, turbidity, transmissivity and PAR had not yet been compared with in-situ data and should be used by others with caution until finalized. PIC sensor: voltage 0 - 5: WET Labs PIC 001 (4th build) POC sensor: voltage 0 - 5: WET Labs CST-DR 391 - transmissometer scattering sensor: voltage 0 - 5: Seapoint scattering sensor</p>

[ [table of contents](#) | [back to top](#) ]

## Project Information

### VERTical Transport In the Global Ocean (VERTIGO)

**Website:** <https://cafethorium.whoi.edu/projects/vertigo/>

**Coverage:** HOT site and subarctic NW Pacific

#### *NSF Award Abstract:*

In this study, researchers at the Woods Hole Oceanographic Institution, Virginia Institute of Marine Science, University of California - Santa Cruz, University of California - Santa Barbara, University of Tasmania, and NIWA-Australia will work collaboratively to answer a difficult question in marine biogeochemistry: What controls the efficiency of particle transport between the surface and deep ocean? More specifically, what is the fate of sinking particles leaving the upper ocean and what factors influence remineralization length scales for different sinking particle classes? Knowing the efficiency of particle transport is important for an accurate assessment of the ocean carbon sink. Globally, the magnitude and efficiency of the biological pump will in part modulate levels of atmospheric carbon dioxide.

The research team intends to test two basic hypotheses about remineralization control, namely: (1) particle source characteristics are the dominant control on the efficiency of particle transport; and/or that (2) mid-water processing, either by zooplankton or bacteria, controls transport efficiency. To do so, they will conduct process studies at sea focused on particle flux and composition changes in the upper 500-1000m of the ocean. The basic approach is to examine changes in particle composition and flux with depth within a given source region using a combination of approaches, many of which are new to the field. These include neutrally buoyant sediment traps, particle pumps, settling columns and respiration chambers, along with the development of new biological and geochemical tools for an integrated biogeochemical assessment of the biological pump. Two sites will be studied extensively on three-week process study cruises: the Hawaii Ocean Time-series site (HOT) and a new moored time-series site in the subarctic NW Pacific (Japanese site K2; 47°N 160°E). There are strong contrasts between these sites in rates of production, export, particle composition and expected remineralization length scales.

Evidence for variability in the flux vs. depth relationship of sinking particles is not in dispute, but the controls on particle transport efficiency through the twilight zone remain poorly understood. A lack of reliable flux and particle characterization data within the twilight zone has hampered our ability to make progress in this area,

and no single approach is likely to resolve these issues. The proposed study will apply quantitative modeling to determine the net effects of the individual particle processes on the effective transport of carbon and other elements and to place the shipboard observations in the context of spatial and temporal variations in these processes

Besides the obvious contributions to the study of the oceanic and planetary carbon cycles, there are broader outcomes and impacts forthcoming from this project. Graduate and undergraduate students will be included in all aspects of the research, and the involvement of non-US PIs will encourage exchange of students and post-docs between labs in different countries. In addition, the component groups will continue to maintain science web sites designed for both public and scientific exchange where the broader and specific goals and outcomes of this work can be communicated.

*Original PI-provided project description:*

The main goal of VERTIGO is the investigation of the mechanisms that control the efficiency of particle transport through the mesopelagic portion of the water column.

Question: What controls the efficiency of particle transport between the surface and deep ocean? More specifically, what is the fate of sinking particles leaving the upper ocean and what factors influence remineralization length scales for different sinking particle classes? VERTIGO researchers have set out to test two basic hypotheses regarding remineralization control, namely:

1. particle source characteristics are the dominant control on the efficiency of particle transport; and/or that
2. mid-water processing, either by zooplankton or bacteria, controls transport efficiency.

To test their hypotheses, they will conduct process studies in the field focused on particle flux and composition changes in the upper 500-1000m of the ocean. The basic approach is to examine changes in particle composition and flux with depth within a given source region using a combination of approaches, many of which are new to the field. These include neutrally buoyant sediment traps, particle pumps, settling columns and respiration chambers, along with the development of new biological and geochemical tools for an integrated biogeochemical assessment of the biological pump. Three week process study cruises have been planned at two sites - the Hawaii Ocean Time-series site (HOT) and a new moored time-series site in the subarctic NW Pacific (Japanese site K2; 47°N 160°E) - where there are strong contrasts in rates of production, export, particle composition and expected remineralization length scales.

Evidence for variability in the flux vs. depth relationship of sinking particles is not in dispute but the controls on particle transport efficiency through the twilight zone remain poorly understood. A lack of reliable flux and particle characterization data within the twilight zone has hampered our ability to make progress in this area, and no single approach is likely to resolve these issues. The proposed study will apply quantitative modeling to determine the net effects of the individual particle processes on the effective transport of carbon and other elements, and to place the shipboard observations in the context of spatial and temporal variations in these processes. For rapid progress in this area, we have organized this effort as a group proposal taking advantage of expertise in the US and international community.

The efficiency of particle transport is important for an accurate assessment of the ocean C sink. Globally, the magnitude and efficiency of the biological pump will in part modulate levels of atmospheric CO<sub>2</sub>. We maintain that to understand present day ocean C sequestration and to evaluate potential strategies for enhancing sequestration, we need to assess possible changes in the efficiency of particle transport due to climate variability or via purposeful manipulations of C uptake, such as via iron fertilization.

*VERTIGO Acknowledgments:* (from K.O. Buesseler, et al / Deep-Sea Research II 55 (2008) 1522-1539) We thank the officers, crew and shore-based support teams for the R/V Kilo Moana (2004) and R/V Roger Revelle (2005). Funding for VERTIGO was provided primarily by research grants from the US National Science Foundation Programs in Chemical and Biological Oceanography (KOB, CHL, MWS, DKS, DAS). Additional US and non-US grants included: US Department of Energy, Office of Science, Biological and Environmental Research Program (JKBB); the Gordon and Betty Moore Foundation (DMK); the Australian Cooperative Research Centre program and Australian Antarctic Division (TWT); Chinese NSFC and MOST programs (NZJ); Research Foundation Flanders and Vrije Universiteit Brussel (FD, ME); JAMSTEC (MCH); New Zealand Public Good Science Foundation (PWB); and internal WHOI sources and a contribution from the John Aure and Cathryn Ann Hansen Buesseler Foundation (KOB). A number of individuals at sea and on shore, helped make the VERTIGO project a success, including: J. Andrews, C. Bertrand, R. Bidigare III, S. Bray, K. Casciotti, M. Charette, R. Condon, J. Cope, E. Fields, M. Gall, M. Gonnera, P. Henderson, T. Kobari, D. Kunz, S. Saitoh, S. Manganini, C. Moy, S. Okamoto, S. Pike, L. Robertson, D. Ruddick and Y. Zhang. Suggestions by three anonymous reviewers and help by the editor, R. Lampitt, are also greatly appreciated.

## Program Information

### Ocean Carbon and Biogeochemistry (OCB)

**Website:** <http://us-ocb.org/>

**Coverage:** Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO<sub>2</sub> and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-0327318</a>