CTD cast profile data from R/V Endeavor cruise EN416 from the Mediterranean Sea (MedFlux project)

Website: https://www.bco-dmo.org/dataset/3388
Version: 12 February 2007
Version Date: 2007-02-12

Project
» MedFlux collaborative research project (MedFlux)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
Lee, Cindy	Stony Brook University (SUNY Stony Brook)	Principal Investigator
Chandler, Cynthia L.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	Data Manager, BCO-DMO Data Manager

Table of Contents

Dataset Description

CTD profile data including: pressure, temperature, salinity, potential temperature, density, dissolved oxygen, beam attenuation, transmissometry, fluorometric chlorophyll a, sound velocity and PAR

```
Change history: YYMMDD
   060724: original CTD data files via email from Joan Fabres (SUNY SB);
   070213: data prepared by Terry McKee (PO Dept., WHOI)
         and added to database by Cyndy Chandler, OCB DMO

 PI-notes:
   sta  1: First cast of EN416, water for traps
   sta  3: First FGP Pressure cast of EN416, First day of cruise.
   sta 12: morning FGP cast

 DMO Notes: Data were recovered from Seabird-processed .asc data files and are
   reported as 0.5 dbar pressure sorted profiles. CTD sensors corrected using
   pre-cruise calibrations; only preliminary comparison has been done with
   in-situ data, e.g. no post-cruise calibration work has been done. Station 19
   data is from the uptrace portion of the cast.  Use with caution.
```

Data Processing Description

MedFlux cruise: EN416 April 2006
CTD profile data processing notes

13 February 2007: Prepared for OCB data system by Terry McKee (PO Dept, WHOI) and Cyndy Chandler, OCB DMO (WHOI).

Details of CTD data processing steps:

The shipboard SeaBird CTD processing was done by Lynne Butler (URI), and she authored several documents providing details about the CTD and Niskin bottle data processing steps. The original MS Word documents have been converted to PDF files, but are otherwise identical to her original files.

Cast Log and Information (PDF file)
R/V *Endeavor* CTD station shipboard procedures (PDF file)
CTD system configuration details (PDF file)

Processing configurations/variables used for EN416 Cindy Lee,
contributed by Lynne Butler,
Ship's Oceanographic Technician, R/V Endeavor.

Original set up of CTD: V0=Xmiss, V2=Altimeter, V3=PAR, V4=DO1, V5=DO2, V7=ECOFluor, V9=SPAR

Before CTD001 PAR removed from V3
Before CTD002 ECO Fluor moved from V7 to V3. Alt moved from V2 to V6, PAR moved from V3 to V7.
Before CTD003, 8, 12, 17, 18 & 19 - Alt & PAR removed. Niskins in positions 8-12 removed. HPSS canisters installed in their place. After cast, restored to normal w/ HPSS canisters removed & all Niskins reinstalled. See EN416/CTD/CTDLog416.xls or copies of Logsheets
Before CTD004 & 14 PAR installed on V6. After cast PAR removed.

Confile A CTD001 V0=Xmiss, V1=nothing, V2=Altimeter?, V3=nothing=blank PAR cable,V4=DO1, V5=DO2, V6=part of ECO Fluorometer, V7=ECOFluor, V9=SPAR

Confile B CTD002 V0=Xmiss, V1=nothing, V2= part of ECO Fluorometer, V3= ECOFluor, V4=DO1, V5=DO2, V6=Altimeter, V7=PAR, V9=SPAR

Confile HPSS CTD003, 8, 12, 17, 18, 19: V0=Xmiss, V1=nothing, V2= part of ECO Fluorometer, V3= ECOFluor, V4=DO1, V5=DO2, V6=FGP Pressure0, V7=FGP Pressure1, V9=SPAR

Confile C CTD004 V0=Xmiss, V1=nothing, V2= part of ECO Fluorometer, V3= ECOFluor, V4=DO1, V5=DO2, V6=PAR, V7=nothing, V9=SPAR

Xmiss= WET Labs C-Star Transmissometer
Fluor= WET Labs ECO Fluorometer
PAR=Biopherical PAR
Alt=Benthos Altimeter
DO1=SBE43 Oxygen1
DO2= SBE43 Oxygen 2
Due to the nature of the sensors, DO1 & DO2 do not track exactly although they are comparable.
SPAR=Biospherical Surface PAR Temperature and Conductivity as well as all other SBE CTD sensors are calibrated w/in the last year.

416Datcnv_a casts w/ altimeter on V2 (CTD001)

X Process scans to end of file. Scans to skip over 0. Binary output, up & down, Both bottle & data to list. Scans marked with bottle confirm bit. Scan range offset 0. Scan range duration 2. Do not merge separate header file.
Scan Count, Time Elapsed (s), Pressure Digiquartz (db), Depth seawater (m), Temp 1, Temp 2, Temp Diff, Cond 1, Cond 2, Cond Diff, V0 Xmiss V, Beam Attenuation C-Star, Beam Transmission C-Star, V2 Altimeter V, Altimeter, V4, Oxygen V SBE43 1, V5, Oxygen V SBE43 2, V7, Fluorescence WETLab ECOFL, Pump Status, Latitude, Longitude, Bottles Fired.

416Datcnv_b casts w/ altimeter & PAR sensor

X Process scans to end of file. Scans to skip over 0. Binary output, up& down, Both bottle & data to list. Scans marked with bottle confirm bit. Scan range offset 0. Scan range duration 2. Do not merge separate header file.
Scan Count, Time Elapsed (s), Pressure Digiquartz (db), Depth seawater (m), Temp 1, Temp 2, Temp Diff, Cond 1, Cond 2, Cond Diff, V0, Beam Attenuation C-Star, Beam Transmission C-Star, V3, Fluorescence WETLab ECOFL, V4, Oxygen V SBE43 1, V5, Oxygen V SBE43 2, V6 Altimeter V, Altimeter, V7 PAR V, Irradiance, Pump

Status, Latitude, Longitude, Bottles Fired.

416Datcnv_c

X Process scans to end of file. Scans to skip over 0. Binary output, up& down, Both bottle & data to list. Scans marked with bottle confirm bit. Scan range offset 0. Scan range duration 2. Do not merge separate header file. Scan Count, Time Elapsed (s), Pressure Digiquartz (db), Depth seawater (m), Temp 1, Temp 2, Temp Diff, Cond 1, Cond 2, Cond Diff, V0, V3, Beam Attenuation C-Star, Beam Transmission C-Star, Fluorescence WETLab ECOFL, V4, Oxygen V SBE43 1, V5, Oxygen V SBE43 2, Pump Status, Latitude, Longitude, Bottles Fired.

416Datcnv_hpss casts w/ altimeter & PAR sensor

X Process scans to end of file. Scans to skip over 0. Binary output, up& down, Both bottle & data to list. Scans marked with bottle confirm bit. Scan range offset 0. Scan range duration 2.

X Merge separate header file. Scan Count, Time Elapsed (s), Pressure Digiquartz (db), Depth (seawater, m), Temp 1, Temp 2, Temp Diff, Cond 1, Cond 2, Cond Diff, V0, Beam Attenuation C-Star, Beam Transmission C-Star, V3, Fluorescence WETLab ECOFL, V4, Oxygen V SBE43 1, V5, Oxygen V SBE43 2, V6, Pressure FGP0, V7, Pressure FGP1, Pump Status, Latitude, Longitude, Bottles Fired.

416Filter_*
From SBE manual, "FILTER can be run before CELLTM to remove any residual response time between the temperature and conductivity sensors and to minimize digitization noise. On average, a low pass filter with a time constant of 0.03 sec reduces the noise in computed salinity slightly."
for SBE9/11 SBE9plus, older manualSBE4249.txt suggests
Low pass filter B = 0.15s for pressure
Low pass filter A = 0.03s for conductivity
New SBEDataProcessing_5.32a.pdf suggests only .15 for pressure
Used: B=0.15 for Press, Depth. A=0.03 for Cond 1 & 2 & Diff

SBE Processing configurations used for EN416 Cindy Lee (continued):

416AlignCTD_*
Cond 0.073s (secondary only)
Temp 0
DO 4 (2 at 25C, 5 at 0C) V4, Oxy V pri, V5, OxyV sec

416CellTM_*
for 9+ w/TC duct & pump running at 3000rpm.
Correct both pri & sec conductivity values
alpha = 0.03 1/
beta = 7

LoopEdit (not done for EN416)
Fixed minimum velocity of 0.25m/s.

X Exclude scans marked bad.

416Derive_*
Depth (sw m 43.35Deg N), Salinity 1 & 2 (PSU), Density 1 & 2 (sigma-t, Kg/m^3), Oxygen 1 & 2 (ml/l), Pot Temp 1 & 2 (deg C), Sound Velocity (Chen-Millero m/s), Descent Rate (m/s)

416BinAvg_*
Pressure, 0.5, X Incl #scans/bin, X exclude scans marked bad, skip over 0, Process Downcast only,X Incl surface bin 0, 0, 0

416ASCII_Out_*
Output header & data files, 60 lines/pg, label columns top of file, Semicolon, Julian days, all variables.

416BottleSum_*
Show Min/Max for Avg?d variables, all. Derive: Salinity 1 & 2 (PSU), Density 1 & 2 (sigma-t, Kg/m^3), Oxygen 1 & 2 (ml/l), Pot Temp 1 & 2 (deg C)

OCB DMO processing note:

The OCB DMO used perl scripts to reformat semi-colon delimited (Seabird-processed .asc) files with Seabird parameter names to space-delimited files with OCB ontology parameter names. All data are from primary (T0 and C0) sensors; and a text file recorded the Seabird/OCB parameter name translation, see: ctd_EN416_params.txt

Important: station 19 is an uptrace (no downtrace data reported); These comments regarding stations 18 and 19 were recorded in the CTDCastLogandInfo416.xls file PDF version):

Station 18: "HPSS cast. Trip HPBottles then wait for 10min before ascending. FGP P0 = V6 went from 0 to ~0.77 at ~1300m to 2400m downcast then to 2.2 when tripped at 2400m. V6 decreased during upcast - leak in system for FGP Pressure 0. FGP P1 = V7. Fluorometer has high voltage values during downcast ~1600m+ then also on upcast to ~800m. Tripped carousel positions 9-13 two times because FGP1 didn't change when bottle should have tripped. Stopped acquisition at 500m bottle stop. The maximum of 24 positions had been tripped with still 5 bottles to trip. Those remaining 5 were tripped during CTD019."

Station 19: "HPSS cast. This cast started at 500m after ending CTD018 at 500m bottle-tripping stop during the upcast. The maximum of 24 bottle positions were fired during CTD018 to double check that High Pressure bottle tripped. Thus acquisition had to be restarted to trip remaining bottles. Niskin bottle GOEX109 bottom cap broke before CTD017, replaced w/OTE112."

[table of contents | back to top]

Data Files

File
ctd.csv(Comma Separated Values (.csv), 9.55 MB) MD5:97cd7e361a5b31466685f803582b072a Primary data file for dataset ID 3388

[table of contents | back to top]

Parameters

Parameter	Description	Units
event	unique sampling event number	YYYYMMDDhhmm
date	start date of event (GMT)	YYYYMMDD
time	start time of event (GMT)	hhmm
lon	longitude; negative denotes West	decimal degrees
lat	latitude; negative denotes South	decimal degrees
Pmax	pressure; maximum recorded	decibars
sta	station number	integer

press	pressure; from CTD	decibars
depth	depth; calculated from CTD pressure	meters
temp	temperature; from CTD; ITS-90; from primary T0 sensor	degrees Celsius
sal	salinity; from CTD; PSS-78 (PSU);from primary T0 & C0 sensors	dimensionless
potemp	potential temperature; ITS-90; from primary T0& C0 sensors	degrees Celsius
sigma_t	sigma T (density); from primary T0& C0 sensors	kilograms/meter^3
O2_ml_L	oxygen; dissolved from SBE CTD	milliliters/liter
trans	light transmission	percent
fluor_ECO	fluorescence from CTD profiler rescaled; units are numerically equivalent to chlorophyll-a concentrations	micrograms/meter^3
cond	conductivity from CTD; from primary C0 sensor	Siemens/meter
beam_att	Beam attenuation Chelsea/Seatech	1/meter
Pumps	status indicator (1=on; 0=off)	integer
depth_lat	depth from CTD with latitude correction	meters
sndvel_CM	Sound velocity Chen-Millero	meters/second
desc_rate	dz/dtM: Descent Rate	meters/second
PAR	irradiance Biospherical/Licor	microEinstiens/meter^2 sec
press_fgp0	pressure; FGP 0 voltage output	Kpa
press_fgp1	pressure; FGP 1 voltage output	Kpa

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	CTD Sea-Bird 9
Generic Instrument Name	CTD Sea-Bird 9
Generic Instrument Description	The Sea-Bird SBE 9 is a type of CTD instrument package. The SBE 9 is the Underwater Unit and is most often combined with the SBE 11 Deck Unit (for real-time readout using conductive wire) when deployed from a research vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorometer, altimeter, etc.). Note that in most cases, it is more accurate to specify SBE 911 than SBE 9 since it is likely a SBE 11 deck unit was used. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Sea Tech Fluorometer
Generic Instrument Name	Sea Tech Fluorometer
Generic Instrument Description	The Sea Tech chlorophyll-a fluorometer has internally selectable settings to adjust for different ranges of chlorophyll concentration, and is designed to measure chlorophyll-a fluorescence in situ. The instrument is stable with time and temperature and uses specially selected optical filters enabling accurate measurements of chlorophyll a. It can be deployed in moored or profiling mode. This instrument designation is used when specific make and model are not known. The Sea Tech Fluorometer was manufactured by Sea Tech, Inc. (Corvalis, OR, USA).

Dataset-specific Instrument Name	Sea Tech Transmissometer
Generic Instrument Name	Sea Tech Transmissometer
Generic Instrument Description	The Sea Tech Transmissometer can be deployed in either moored or profiling mode to estimate the concentration of suspended or particulate matter in seawater. The transmissometer measures the beam attenuation coefficient in the red spectral band (660 nm) of the laser lightsource over the instrument's path-length (e.g. 20 or 25 cm). This instrument designation is used when specific make and model are not known. The Sea Tech Transmissometer was manufactured by Sea Tech, Inc. (Corvalis, OR, USA).

Dataset-specific Instrument Name	SBE 43 Dissolved Oxygen Sensor
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Generic Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Generic Instrument Description	The Environmental Characterization Optics (ECO) series of single channel fluorometers delivers both high resolution and wide ranges across the entire line of parameters using 14 bit digital processing. The ECO series excels in biological monitoring and dye trace studies. The potted optics block results in long term stability of the instrument and the optional anti-biofouling technology delivers truly long term field measurements. more information from Wet Labs

[table of contents | back to top]

Deployments

EN416

Website	https://www.bco-dmo.org/deployment/58156
Platform	R/V Endeavor
Report	http://ocb.whoi.edu/MedFlux/CRUISES/cruisePlan_EN416_April2006.pdf
Start Date	2006-04-09
End Date	2006-04-15
Description	MedFlux April 2006 cruise

[table of contents | back to top]

Project Information

MedFlux collaborative research project (MedFlux)

Website: http://www.msrc.sunysb.edu/MedFlux/

Coverage: Mediterranean Sea

The MedFlux collaborative research project will test two hypotheses of the influence of "ballast" on the flux of particulate matter through the water column. It either 1) acts as a physical shielding of the organic matter protecting it as it falls through the water column, or 2) is the ratio of mineral ballast to organic carbon that controls the sinking velocity and consequently the organic carbon flux to the deep sea. The project has two major objectives:

1. To assess the extent to which settling velocity separation techniques accurately and reliably measure in-situ settling velocities and to devise mechanical improvements and/or statistical correction procedures to overcome any deficiencies.
2. To develop perspectives and protocols that take advantage of the different sampling characteristics of in-situ pumps, sediment traps, and optical instruments, combined with radiochemical analysis, to assess the dependence of settling velocity and remineralization on particle size and the organic and inorganic composition of particles.

Project description from the NSF award page:

Collaborative Research: Mineral Ballast and Organic Matter Compositions as Determinants of Particle Settling Velocities and Fluxes in the Sea (MedFlux)

Sinking particulate matter is the major vehicle for exporting carbon from the sea surface to the ocean interior. During its transit towards the sea floor, most (>90%) particulate organic carbon (POC) is returned to inorganic form and redistributed in the water column. This redistribution determines the depth profile of dissolved CO_2, which in turn determines the concentration of CO2 in the surface mixed layer, and hence the rate at which the ocean can absorb CO_2 from the atmosphere. It also determines the depth profile of nutrient regeneration, which determines the time scale of return of mineral nutrients to the photic zone. The ability to predict quantitatively and mechanistically the depth profile of remineralization is therefore critical to predicting the response of the global carbon cycle to environmental change.

Minerals typically constitute more than half the mass of particles sinking out of the ocean surface, and this fraction increases dramatically with depth. Marine plankton contribute biominerals, e.g., opal by diatoms and radiolarians, and $CaCO_3$ by coccolithophorids and foraminifera. Detrital minerals (largely quartz and aluminosilicates) introduced from land by rivers and wind also can become associated with marine plankton (or their remains) through sorption and aggregation processes. Minerals are important for making less dense organic matter (OM) sink, and may also protect OM from degradation, allowing it to penetrate deeper into the ocean.

Prior to the inception of MedFlux, investigators demonstrated that ratios of particulate organic carbon to mineral ballast converge to a nearly constant value (~3-7 wt% POC) at depths >1800 m (Armstrong et al. 2002), and Klaas & Archer (2002) demonstrated that the variability in the data can largely be explained by the chemical composition of the ballast (opal vs. carbonate vs. dust). The focus of MedFlux is to develop a better mechanistic understanding of this “ballast hypothesis”. In particular, given the many processes that could cause large deviations from this ratio, a fundamental goal is to understand why POC:mass ratios seem to be well-delimited, and to use this understanding to create, as fully as possible, a new mathematical description of remineralization to replace those currently in use. This last goal is of utmost significance if, for example, lowered pH causes carbonate minerals to dissolve preferentially, affecting both ballasting and the average remineralization depth of POC in the ocean.

MedFlux is a collaborative research project that includes investigators from the U.S. and Europe.
Robert Armstrong, Stony Brook University, Stony Brook, NY
Kirk Cochran, Stony Brook University, Stony Brook, NY
Anja Engel, Alfred Wegener Institute, Bremerhaven, Germany
Scott Fowler, Stony Brook University, Stony Brook, NY
Madeleine Goutx, CNRS/Université de la Mediterranee (aix-Marseille) Marine Microbiology Laboratory, France
Cindy Lee, Stony Brook University , Stony Brook, NY
Pere Masqué, Universitat Autonoma de Barcelona, Spain
Juan Carlos Miquel, IAEA Marine Environment Laboratories, Monaco
Michael Peterson, University of Washington, Seattle, WA
Olivier Rageneau, Institute Universitaire Europeen de la Mer, Brest, France
Richard Sempéré, CNRS/Université de la Mediterranee (aix-Marseille) Marine Microbiology Laboratory, France
Gillian Stewart, Queens College, NYC, NY
Christian Tamburini, CNRS/Université de la Mediterranee (aix-Marseille) Marine Microbiology Laboratory, France
Stuart Wakeham, Skidaway Institute of Oceanography, Savannah, GA

Publications:

Goutx, M., Wakeham, S.G., Lee, C., Duflos, M., Guigue, C., Liu, Z., Moriceau, B., Sempéré, R., Tedetti, M., and Xue, J.. "Composition and degradation of marine particles with different settling velocities in the northwest Mediterranean Sea," *Limnology and Oceanography*, v.52, 2007, p. 1645.

Liu, Z. and Lee, C.. "The role of organic matter in the sorption capacity of marine sediments," *Marine Chemistry*, v.105, 2007, p. 240.

Liu, ZF; Lee, C; Wakeham, SG. "Effects of mercuric chloride and protease inhibitors on degradation of particulate organic matter from the diatom Thalassiosira pseudonana," *ORGANIC GEOCHEMISTRY*, v.37, 2006, p. 1003-1018.

McCarthy, M.D., Benner, R., Lee, C., and Fogel, M.L.. "Amino acid nitrogen isotopic fractionation patterns as indicators of heterotrophy in plankton, particulate, and dissolved organic matter," *Geochim. Cosmochim. Acta*, v.71, 2007, p. 4727.

Rodriguez y Baena, A.M., Fowler, S.W., and Warnau, M. "Could krill schools significantly bias 234Th-based carbon flux models?," *Limnology and Oceanography*, v.53, 2008, p. 1186.

Rodriguez y Baena, A.M., S.W. Fowler and J.C. Miquel. "Particulate organic carbon: natural radionuclide ratios in zooplankton and their freshly produced fecal pellets from the NW Mediterranean (MedFlux 2005)," *Limnology and Oceanography*, v.52, 2007, p. 966.

Stewart, G., Cochran, J.K., Xue, J., Lee, C., Wakeham, S.G., Armstrong, R.A., Masqué, P., and J.C. Miquel. "Exploring the connection between 210Po and organic matter in the northwestern Mediterranean," *Deep-Sea Research I*, v.54, 2007, p. 415.

Stewart, G., J. K. Cochran, J.C. Miquel, P. Masqué, J. Szlosek, A.M. Rodriguez yBaena, S.W. Fowler, B. Gasser and D.J. Hirschberg. "Comparing POC export from 234Th/238U and 210Po/210Pb disequilibria with estimates from sediment traps in the northwest Mediterranean," *Deep-Sea Research I*, v.54, 2007, p. 154.

[table of contents | back to top]

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 CO2 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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0622754

[table of contents | back to top]