TITLE: CTD casts, BEST Spring Cruise 2008, USCGC Healy (HLY0802)

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SAME AS ABOVE and
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National Science Foundation through BEST (Bering Sea Ecosystem Study)
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DATA SET OVERVIEW:

-Introduction or abstract
This CTD data set, consisting of 236 casts, was collected during a multi-disciplinary Bering Sea ice cruise on the USCGC Healy (HI0802, March 29 - May 6, 2008). The cruise was funded by NSF for the BEST (Bering Sea Ecosystem Study) program, and supported by numerous agencies and institutions. CTD operations on this cruise were managed by personnel from NOAA/PMEL in the EcoFOCI program, with technical expertise from SCRIPPS, and deployment assistance from Healy personnel. Water samples from casts were collected by various parties relative to their research needs. Profile data from CTD instruments were processed at NOAA/PMEL/EcoFOCI using standard techniques. Data from bottle samples include phosphate, silicate, nitrate, nitrite, ammonium, and chlorophyll. Data files are an array on a 1-meter grid and combine both averaged CTD profile data, and bottle samples where depths with no data are listed "-1E+10" in text data files, and as 1.0e-35 in NetCDF files. CTD data contact people: Phyllis Stabeno, Peggy Sullivan. Nutrient and bottle data contact: Calvin Mordy.

-Time period covered by the data: March 30, 2008 - May 6, 2008

-Physical location of the measurement or platform (latitude/longitude/elevation)
236 CTD casts deployed within latitude 55.80N to 62.79N and longitude 163.52W to 179.43W

-Any World Wide Web address references (i.e. additional documentation such as Project WWW site)

Cruise Site: http://www.ecofoci.noaa.gov/cruiseWeb/ice08/
BEST/BSIERP Site: http://bsierp.nprb.org/
BEST Data Management: http://bsierp.nprb.org/data_mgt/
NSF Award: http://www.checkout.org.cn/awardsearch/showAward.do?AwardNumber=0732430

INSTRUMENT DESCRIPTION:

-Brief text describing the instrument with references
SeaBird SBE-911plus CTD unit with dual temperature and conductivity sensors, and added instruments as listed (www.seabird.com/products/profilers.htm):
Conductivity S/N 2568
Conductivity S/N 2561
Temperature S/N 2855
Temperature S/N 2796
Pressure S/N CTD-639 sensor-83012
PAR /Irradiance, Biospherical/Licor S/N QSP2300-70115
SPAR/Surface Irradiance S/N QSR2200-20270
Transmissometer, Chelsea/Seatech/Wetlab CStar S/N CST-390DR
Fluorometer, Chelsea Aqua 3 S/N 088234
Oxygen sensor, SBE-43 S/N 458

-Figures (or links), if applicable
Web reference to instrument:
http://www.seabird.com/products/spec_sheets/911data.htm
Figure showing CTD transect map: HLY0802_PMEL_CTDmap.gif

-Table of specifications (i.e. accuracy, precision, frequency, etc.)
Page 10 of Seabird instrument reference (above)

DATA COLLECTION and PROCESSING:

-Description of data collection
Data were collected via CTD platform operated by Scripps Institution of Oceanography technicians. At each CTD location, the CTD rosette was lowered to 10 meters to equilibrate, brought to surface, then lowered to within 5m of the bottom, at ~30m/minute down to 150 m (on average) and ~50m/minute below that. Water bottles were fired at desired depths on the upcast. Once on board, numerous water samples were taken from Niskin bottles by members of the interdisciplinary science team.

-Description of derived parameters and processing techniques used
All data are either instrument variables, calculated variables, or measured from bottle samples.
Instrument variables: pressure, temperature (primary, secondary), oxygen, transmissivity, attenuation, PAR, fluorometer.
Calculated values: salinity (primary and secondary, derived from conductivity and temperature, corrected by calibration with salt samples), chlorophyll-a (factory calibration), sigma-t, and dynamic height.

Bottle samples: nutrients (phosphate, silicate, nitrate, nitrite, ammonium), chlorophyll-a (total and size fractionated using two methods; acidification and Welschmeyer). Phaeopigments (total and size fractionated) were obtained from Chlorophyll-a samples.
Not all variables were sampled from all bottles or on all casts. Selected variables have dual-unit listings. Two chlorophyll methods were used: the acidification technique (Holm-Hansen, O., et al, 1965), and the Welschmeyer method (Welschmeyer, 1985). Calibration coefficients for instruments are available in the attached file hly0802_CTDCalFile.txt

-Description of quality control procedures and Processing
Data are processed using Seabird CTD software and calibration file. Post-processing at the Pacific Marine Environmental Laboratory includes filtering extreme outliers, extrapolation of values from the top value collected at ~3-5m to the surface. Each cast is visually reviewed for reasonableness and density inversions (greater than 0.02 sigma-t) caused by spurious measurements. This process is facilitated by comparison of the outputs of the 2 temperature and conductivity sensors. Profile data are bin-averaged to 1 meter. Nutrient samples were analyzed according to the methods of Gordon, et al (see reference below). Samples were collected in 50 ml high-density polyethylene bottles that were rinsed first with 10% HCl prior to each station, and rinsed at least three times with sample before filling. Some samples were refrigerated for 3-12 hours prior to analysis.

DATA FORMAT:

-Data file structure, format and file naming conventions (e.g. column delimited ASCII, NetCDF, GIF, JPEG, etc.)
Data sets include continuous profile data and bottle samples from discrete depths. Data files are provided in two formats: NetCDF, and tab-delimited ASCII text.
NetCDF (EPIC standard) format includes meteorological and other metadata. "Code" is an EPIC-NetCDF-specific key code defining variables and units (see list below). Missing data are denoted by 1.0e-35. The format is defined at Unidata and PMEL-EPIC Web Sites.http://www.epic.noaa.gov/epic/software/
http://www.unidata.ucar.edu/software/netcdf/

-Data format and layout (i.e. description of header/data records, sample records)
List of Variables with Short Name and Units (included in header) and grid definition
Axes:

code	name	type	lower corner	upper corner	spacing	units	npts
501	x lon	EVEN	169.7615 W			degree_west	1 i
500	y lat	EVEN	57.4455 N			degree_north	1 j
1	z dep	EVEN	0.00	63.00		dbar	64 k
624	t time	EVEN	02-Apr-2008 00:26			True Julian Day	1 l

Variable(s):

code	name	units	
28	T TEMPERATURE (C)	C	4
35	T2 Secondary Temperature	C	4
971	rFv raw fluorometer Volts(CTD)	Volts	4
906	Fch Chlorophyll A	ugrams/l	4
916	PAR Photosynthetically Active Radi	V	4
905	PAR Photosynthetic Active Radiatio	uEin m-2 s-1	4
918	SPAR Surface Photosynthetically Act	uEin m-2 s-1	4

```
 65  O     OXYGEN (UMOL/KG)            umol/kg             4
 62  OST   OXYGEN, %SAT               %                   4
904  Tr    Transmissometry (CTD)       %                   4
 55  ATTN  ATTENUATION                 m-1                 4
 41  S     SALINITY (PSU)              PSU                 4
 42  S     SALINITY (PSU)              PSU                 4
 70  ST    SIGMA-T (KG/M**3)           kg m-3              4
 10  DYN   DYNAMIC METERS              dyn-m               4
103  BTL   NISKIN BOTTLE NUMBER                           4
286  PO4   PHOSPHATE (micromoles/kg)   uM/kg               4
288  SI    SILICATE (micromoles/kg)    uM/kg               4
282  NO3   NITRATE (micromoles/kg)    uM/kg               4
284  NO2   NITRITE (micromoles/kg)    uM/kg               4
Number of columns of data:      17  Number of rows of data:      64  Number of lines per row:      3
```

Sample Metadata (in addition to variables above) that includes items generated both by SeaBird processing routines, and items added by in-house data processing software for EPIC NetCDF formatted output.

```
CREATION_DATE       = 17:56 10-DEC-08
CRUISE              = H10802
CAST                = 001
INST_TYPE           = Sea-Bird CTD SBE 9
DATA_TYPE           = CTD
DATA_CMNT           = Data from Seasoft File 001.cnv
COORD_SYSTEM        = GEOGRAPHICAL
WATER_MASS          = B
BAROMETER           =  1002
WIND_DIR            =  111
WIND_SPEED          =  18
AIR_TEMP            =   1.60000002
WATER_DEPTH         =  2755
PROG_CMNT1          = CTDVAR added 2 vars
STATION_NAME        = np15
EPIC_FILE_GENERATOR  = SEASOFT2EPIC_CTD (Version 1.35, 01-May-2003)
PROG_CMNT2          = trim_epic_unix (v1.30, rev 24Nov2008)
PROG_CMNT3          = cat_ctd v1.35 02Dec2008
CTD_EXTEND_DEPTH    =  2
PROG_CMNT4          = trim_epic_unix (v1.30, rev 24Nov2008)
EDIT_COMMENT_01     = eps41: depth(0:10000) mod_coefs(a,b)= 1.000000 0.004400
EDIT_COMMENT_02     = eps42: depth(0:10000) mod_coefs(a,b)= 1.000000 0.005500
EDIT_COMMENT_03     = eps65: depth(0:10000) mod_coefs(a,b)= 1.079000 -0.529400
```

-Description of flags, codes used in the data, and definitions (i.e. good, questionable, missing, estimated, etc.) Missing data are denoted by -1.0e+10. All data points are either accepted (retained) or rejected (deleted) during processing, so data are all defined as good. Surface values above 5-10 meters may be extrapolated to surface.

DATA REMARKS:

-Software compatibility (i.e. list of existing software to view/manipulate the data)
Software for viewing and manipulating NetCDF data are listed at the Unidata/UCAR site http://www.unidata.ucar.edu/software/netcdf/software.html . "ncdump" tool is suggested as a start. Ferret software (NOAA/PMEL) and Matlab can read and manipulate NetCDF files and grids.

REFERENCES:

-List of documents cited in this data set description

- Seabird SBE 911plus CTD manual
  http://www.seabird.com/products/spec_sheets/911data.htm
- CTD map: hly0802_PMEL_CTDmap.gif
- CTD Calibration file: hly0802_CTDCalFile.txt
- Gordon, L.I., Jennings, J.C., Jr., Ros, A.A. and Krest, J.M., 1993. A suggested protocol for continuous flow automated analysis of seawater nutrients (Phosphate, nitrate, nitrite and silicic acid) in the WOCE Hydrographic Program and the Joint Global Ocean fluxes Study. WOCE Operations Manual, Part 3.1.3 "WHP Operations and Methods" (WOCE Hydrographic Program Office, Methods Manual 91-1) Bundesamt für Seeschiffahrt und Hydrographie, Postfach 30 12 20, 2000 Hamburg 36 Germany. http://chemoc.coas.oregonstate.edu:16080/~lgordon/cfamanual/whpmanual.pdf--N.A.
- Welschmeyer. 1985(1994). Fluorometric analysis of chlorophyll- a in the presence of chlorophyll b and pheopigments, Limnol.Oceanogr. 39(8), 1994, 1985-1992.
- HOLM-HANSEN, O., C. J. LORENZEN, R. W. HOLMES, AND J. D. STRICKLAND. 1965. Fluorometric determination of chlorophyll. J. Cons. Int. Explor. Mer 30: 3-15.
- NSF Award: http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0732430