**TITLE:** CTD casts, BEST Spring Cruise 2007, USCGC Healy (HLY0701)

**AUTHOR(S):** Phyllis Stabeno, Dave Kachel
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- Similar contact information for data questions (if different than above)
  Same as above
  Data/documentation/metadata: Peggy Sullivan peggy.sullivan@noaa.gov
  Data Files: Dave Kachel dave.kachel@noaa.gov

**FUNDING SOURCE AND GRANT NUMBER:**
National Science Foundation through BEST (Bering Sea Ecosystem Study)
Grant Number NSF 07-533

**DATA SET OVERVIEW:**

- Introduction or abstract
  This CTD data set, consisting of 231 casts, was collected during a multi-disciplinary Bering Sea ice cruise on the USCGC Healy (H0701, April 10 - May 12, 2007). 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 as “-1E+10”. CTD data contact people: Phyllis Stabeno, Peggy Sullivan. Nutrient and bottle data contact: Calvin Mordy.

- Time period covered by the data: April 11, 2007 - May 11, 2007

- Physical location of the measurement or platform (latitude/longitude/elevation)
  231 CTD casts deployed within latitude 54.24N to 62.85N and longitude 163.93W to 179.44W

- Any World Wide Web address references (i.e. additional documentation such as Project WWW site)
INISTRUCTION 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 2545
- Conductivity  S/N 2619
- Temperature  S/N 2841
- Temperature  S/N 2824
- Pressure Digiquartz with TC  S/N 638 (83009)
- PAR /Irradiance, Biosphere/Licor  S/N QSP2300-70115
- SPAR/Surface Irradiance, Biospherical Instruments  S/N QSR2200-20270
- Optical Transmissometer, Chelsea/Seatech/Wetlab CStar  S/N CST-390DR
- Fluorometer, Chelsea UV Aquatracek  S/N QSP2300
- Oxygen sensor, SBE-43 S/N 0904
- Oxygen sensor, SBE-43 S/N 458
- Altimeter  S/N PSA916 – 1062

-Figures (or links), if applicable
Web reference to instrument:  
http://www.seabird.com/products/spec_sheets/911data.htm
Figure showing CTD transect map:  hly0701_PMEL_CTDmaplabels.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 Phaeopigments (total) were obtained from Chlorophyll-a samples. Not all variables were sampled from all bottles or on all casts. Selected variables have dual-unit listings. Chlorophyll method used: acidification technique (Holm-Hansen, O., et al, 1965). Calibration coefficients for instruments are available in the attached file hly0701_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 3-4m 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 files are in two formats. The first is a comma-separated text file with 1-line header and .odv suffix, formatted for use with Ocean Data View software. Along with profile data, discreet bottle samples are included at sampled depths, with other depths in those columns designated as non-data using -1.0e+10. The second file format is NetCDF (EPIC standard) format with meteorological and other metadata bundled in the file. “code” is an EPIC-NetCDF-specific key code and is self-explanatory. This 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)
Axes:
code name type lower corner upper corner units
501 x lon EVEN 165.3775 W degree_west
500 y lat EVEN 56.9935 N degree_north
1 z dep EVEN 0.00 67.00 dbar
624 t time EVEN 13-Apr-2007 04:18 True Julian Day

Variable(s): 
code name units
28 T TEMPERATURE (C) C
35 T2 Secondary Temperature C
41 S SALINITY (PSU) PSU
42 S SALINITY (PSU) PSU
70 ST SIGMA-T (KG/M**3) kg m-3
10 DYN DYNAMIC METERS dyn-m
971 rFv raw fluorometer Volts(CTD) Volts
2930 Cla CTD Chlorophyll-a factory cali ugrams/l
916 PAR Photosynthetically Active Radi V
905  PAR  Photosynthetic Active Radiation  uEin/m²/s
904  Tr Transmissometry (CTD)  %
55  ATTN ATTENUATION  m⁻¹
65  O  OXYGEN (UMOL/KG)  umol/kg
62  OST OXYGEN, %SAT  %
103  BTL  NISKIN BOTTLE NUMBER
286  PO4 PHOSPHATE (micromoles/kg)  uM/kg
288  SI  SILICATE (micromoles/kg)  uM/kg
282  NO3  NITRATE (micromoles/kg)  uM/kg
284  NO2  NITRITE (micromoles/kg)  uM/kg
289  NH4  AMMONIUM (micromoles/kg)  umol/kg
933  Cla  Chlorophyll  ugrams/l
2933  Cla  Chlorophyll-a total  ugrams/l
907  Fph  Phaeopigments  ugrams/l

Sample Data Records with Column Headers (NetCDF format):
Variables
  scan, T, T2, S, ST, DYN, rFv, Cla, PAR, PAR, Tr, ATTN, O, OST, BTL, PO4, SI, NO3, NO2, NH4,
Epic codes 28,35,41,42,70,10,971, 2930, 916, 905, 904, 55, 65, 62,103, 286, 288, 284, 289
Pres(db)        T            T2           S            S            ST           DYN          O            OST          TRN          Tr           ATTN
PAR          PAR          SPAR         BTL          PO4          SI           NO3          NO2          NH4          rFv          Cla
Chl          Cla          Cla          Cla          Cla          Cla
1,    0.00,-0.59310 , -0.59400  31.820 31.820 25.563 0.0000 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36,
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0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36
2,  1.00,-0.59310 , -0.59400 , 31.820 31.820 25.563, 0.24122E-02, 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36
3,  2.00,-0.59310 , -0.59400 , 31.820 31.820 25.563, 0.48243E-02, 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36
4,  3.00,-0.59310 , -0.59400 , 31.820 31.820 25.563, 0.72364E-02, 2.7064, 3.9592, 3.0897, 115.19,
2.7064, 3.9592, 3.0897, 115.19, 62.194, 1.8997, 459.45, 126.8, 8.0000, 0.49800, 13.60, 0.90000, 0.30000E-01,
0.90000, 10000E+36, 0.10000E+36, 0.10000E+36
5,  4.00,-0.59450,-0.59480, 31.820, 31.821, 25.563, 0.96484E-02, 2.7273, 4.1766,
2.8836, 68.250, 62.194, 1.8996, 460.39, 127.08, 0.10000E+36, 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36
6,  5.00,-0.59140,-0.59180, 31.820, 31.821, 25.563, 0.12060E-01, 2.7321, 4.1731, 2.6849, 44.295, 62.120,
1.9044, 460.93, 127.24, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36, 0.10000E+36,
0.10000E+36, 0.10000E+36, 0.10000E+36

Sample Attributes (Metadata) in NetCDF files
Attribute(s):
Number of attributes listed:  24 Number of attributes in file:  24
CREATION_DATE        = 11:48 15-MAR-11
CRUISE               = H10701
CAST                 = 016
INST_TYPE            = Sea-Bird CTD SBE 9
DATA_TYPE            = CTD
DATA_CMNT            = Data from Seasoft File 016.cnv:using vars,sal41
COORD_SYSTEM         = GEOGRAPHICAL
WATER_MASS           = B
BAROMETER            = 1002
WIND_DIR             = 354
WIND_SPEED           = 16
AIR_TEMP             = -2.70000005
Sample Data Records with Column Headers (text format):

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WATER_DEPTH = 73
PROG_CMNT1 = cat_ctd v1.36 06Aug2010
STATION_NAME = 70m7
EPIC_FILE_GENERATOR = SEASOFT2EPIC_CTD (Version 1.35, 01-May-2003)
EDIT COMMENT_01 = eps41: depth(0:10000) mod_coeff(a,b)= 1.000000 0.002800
EDIT COMMENT_02 = eps42: depth(0:10000) mod_coeff(a,b)= 1.000000 0.002600
EDIT COMMENT_03 = eps70 recalculated using new eps41
PROG_CMNT2 = CTDVAR added 3 vars
PROG_CMNT3 = trim_epic_unix (v1.30, rev 24Nov2008)
PROG_CMNT4 = cat_ctd v1.35 02Dec2008
EDIT COMMENT_04 = eps65: depth(0:10000) mod_coeff(a,b)= 1.070880 -0.473000
CTD_EXTEND_DEPTH = 3
Description of flags, codes used in the data, and definitions (i.e. good, questionable, missing, estimated, etc.) Missing data are denoted by 1.0e-35 (NetCDF) or -1.0e+10 (text files). All data points are either accepted (retained) or rejected (deleted) during processing, so data are all defined as good. Data values above 5-10 meters depth may have been 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: hly0701_PMEL_CTDmap.gif
- CTD Calibration file: hly0701_CTDcalFile.txt
- NSF Award: NSF07-533