

**TITLE:** CTD casts, BEST late Winter Cruise 2010, Polar Sea 10-01 (psea1001)

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SAME AS ABOVE and

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Data Files: Dave Kachel [dave.kachel@noaa.gov](mailto:dave.kachel@noaa.gov)

**FUNDING SOURCE AND GRANT NUMBER:**

National Science Foundation through BEST (Bering Sea Ecosystem Study)

Award Numbers 0732430

**DATA SET OVERVIEW:**

**-Introduction or abstract**

This CTD data set, consisting of 85 casts, was collected during a multi-disciplinary Bering Sea cruise on USCGC Polar Sea (psea1001, March 7 – April 1, 2010). The cruise was funded by NSF for the BEST (Bering Sea Ecosystem Study) program, and supported by numerous agencies and institutions. The 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” in text data files, and as 1.0e-35 in NetCDF files. CTD data contacts: Phyllis Stabeno, Peggy Sullivan.

Nutrient and bottle data contact: Calvin Mordy.

**-Time period covered by the data:** March 7- April 7, 2010

**-Physical location of the measurement or platform (latitude/longitude/elevation)**

85 CTD casts deployed within latitude 56.5N to 63.3N and longitude 164.5W to 175.3W

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

BEST/BSIERP Site: <http://bsierp.nprb.org/>

BEST Data Management: [http://bsierp.nprb.org/data\\_mgt/](http://bsierp.nprb.org/data_mgt/)

NSF Award: <http://www.nsf.gov/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](http://www.seabird.com/products/profilers.htm)):

Conductivity S/N 2361

Conductivity S/N 2863

Temperature S/N 2498

Temperature S/N 4353

Pressure Digiquartz with TC S/N 0416

PAR /Irradiance, Biospherical/Licor S/N QSR-2300 No. 70112

SPAR/Surface Irradiance S/N QSR-2300

Transmissometer, Chelsea/Seatech/Wetlab CStar S/N CST-436DR

Fluorometer, Chelsea Aqua 3 S/N 088234

Oxygen sensor, SBE-43 S/N 0501

Altimeter S/N PSA-916 No. 1062

**-Figures (or links), if applicable**

Web reference to instrument:

[http://www.seabird.com/products/spec\\_sheets/911data.htm](http://www.seabird.com/products/spec_sheets/911data.htm)

Figure showing CTD transect map: [ps1001\\_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 psea1001\_CTDCaFile.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, and some frozen for later 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/>

The text format is a tab-delimited file with 1-line header and .odv suffix, formatted for use with Ocean Data View and other ASCII-friendly software. Missing data are designated using -1.0e+10.

#### **-Data format and layout (i.e. description of header/data records, NetCDF format)**

##### **List of Variables with Short Name and Units (included in header) and grid definition**

Axes:

| code  | name | type | lower corner      | upper corner | units           |
|-------|------|------|-------------------|--------------|-----------------|
| 501 x | lon  | EVEN | 172.7227 W        |              | degree_west     |
| 500 y | lat  | EVEN | 59.9622 N         |              | degree_north    |
| 1 z   | dep  | EVEN | 0.00              | 61.00        | dbar            |
| 624 t | time | EVEN | 01-Apr-2010 21:13 |              | 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   |



```

7.00 -1.7049 -1.7036 31.6003 31.6043 25.4153 0.17812E-01 370.4406 96.2833 3.7512
74.6238 1.1709 3.1319 131.3600 932.2800 1e+35 1e+35 1e+35 1e+35 1e+35
1e+35 1.3863 0.3516 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35
8.00 -1.7060 -1.7047 31.5984 31.6020 25.4137 0.20365E-01 370.3354 96.2578 3.7488
74.5747 1.1735 3.0338 105.0800 932.2800 1e+35 1e+35 1e+35 1e+35 1e+35
1e+35 1.3940 0.3859 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35
9.00 -1.7059 -1.7039 31.5980 31.6005 25.4134 0.22918E-01 370.3262 96.2450 3.7484
74.5670 1.1739 2.9385 84.1430 929.8100 1e+35 1e+35 1e+35 1e+35 1e+35
1e+35 1.3660 0.2631 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35
10.000 -1.7051 -1.7039 31.5963 31.5991 25.4120 0.25472E-01 370.3313 96.2456 3.7468
74.5345 1.1756 2.8459 67.9040 928.1800 0.60000E+01 0.12570E+01 0.24222E+02 0.62446E+01
0.99058E-01 0.33846E+01 1.3874 0.3556 0.18099E+00 0.37034E+00 0.12910E+00 0.31026E+00
0.38443E+00 0.13305E+00 0.21908E+00 0.25785E+00 0.25785E+00 0.25785E+00

```

**Sample Attributes (Metadata) in NetCDF files**

Attribute(s):  
Number of attributes listed: 18 Number of attributes in file: 18  
CRUISE = PSea1001  
CAST = 065  
INST\_TYPE = Sea-Bird CTD SBE911/917+  
DATA\_TYPE = CTD  
DATA\_CMNT = Data from Seasoft File 061065.cnf  
COORD\_SYSTEM = GEOGRAPHICAL  
WATER\_MASS = B  
BAROMETER = 997  
WIND\_DIR = 330  
WIND\_SPEED = 4  
AIR\_TEMP = -10.  
WATER\_DEPTH = 69  
PROG\_CMNT1 = CTDVAR added 1 var  
STATION\_NAME = 70m42  
EPIC\_FILE\_GENERATOR = SEASOFT2EPIC\_CTD (Version 1.35, 01-May-2003)  
CREATION\_DATE = 13:17 15-MAR-11  
PROG\_CMNT2 = cat\_ctd v1.36 06Aug2010  
PROG\_CMNT3 = Variables Extrapolated from 4 db to 0

**Sample Data Records with Column Headers (text format):**

```

cruise cast type station_number station_name ctd_type yyyy-mm-dd hh:mm longitude [degrees
east] latitude [degrees north] Bot. Depth [m] PRESSURE [dbar] TEMPERATURE [C] Secondary
Temperature [C] SALINITY [PSU] SALINITY2 [PSU] SIGMA-T [kg m-3] DYNAMIC
METERS [dyn-m] raw fluorometer Volts [Volts] Chlorophyll A [ugrams/l] OXYGEN [ml/l] OXYGEN
%SAT [%] ATTENUATION [m-1] Transmissometry [%] Photosynthetic Active Radiation [uEin m-2 s-1]
Surface Photosynthetically Active Radiation [uEin m-2 s-1] NISKIN BOTTLE NUMBER []
PHOSPHATE [umol/kg] SILICATE [umol/kg] NITRATE [umol/kg] NITRITE [umol/kg]
AMMONIUM [umol/kg] ctd bottle upcast chlorophyll factory cal [ugrams/l] Chlorophyll-a total
[ugrams/l] Welschmeyer Chlorophyll-a total [ugrams/l] Phaeopigments [ugrams/l]
ps1001 001 C 001 VNG1 std 2010-03-13 14:58184.9503 62.01850 79.0
6.000 -1.720800 -1.721200 31.62180 31.62130 25.43300
0.1520662E-01 1.049100 0.6180000E-01 7.896270 91.95345 0.2810000E-01
99.29970 0.8320700E-01 0.2927400 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10-
1.0e+10 -1.0e+10-1.0e+10-1.0e+10
ps1001 001 C 001 VNG1 std 2010-03-13 14:58184.9503 62.01850 79.0
7.000 -1.721900 -1.722500 31.62290 31.62290 25.43390
0.1774127E-01 1.045200 0.6110000E-01 7.891470 92.11333 0.2970000E-01
99.26070 0.8320200E-01 2.176300 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10-
1.0e+10 -1.0e+10-1.0e+10-1.0e+10

```

```

ps1001 001 C 001 VNG1 std 2010-03-13 14:58184.9503 62.01850 79.0
8.000 -1.666300 -1.694900 31.61970 31.62160 25.43030
0.2027712E-01 1.070800 0.6620000E-01 7.915440 92.28073 0.3080000E-01
99.23360 0.8321500E-01 0.3581000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10-
1.0e+10 -1.0e+10-1.0e+10-1.0e+10
ps1001 001 C 001 VNG1 std 2010-03-13 14:58184.9503 62.01850 79.0
9.000 -1.672700 -1.678000 31.61510 31.61450 25.42670
0.2281633E-01 1.050200 0.6210000E-01 7.893280 92.04514 0.4080000E-01
98.98570 0.8320700E-01 1.515900 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10-
1.0e+10 -1.0e+10-1.0e+10-1.0e+10
ps1001 001 C 001 VNG1 std 2010-03-13 14:58184.9503 62.01850 79.0
10.000 -1.675200 -1.659300 31.61600 31.61700 25.42740
0.2535679E-01 1.049500 0.6190000E-01 7.899930 92.08359 0.3150000E-01
99.21450 0.8320700E-01 0.3576300E-01 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10-
1.0e+10 -1.0e+10-1.0e+10-1.0e+10
ps1001 001 C 001 VNG1 std 2010-03-13 14:58184.9503 62.01850 79.0
11.000 -1.679000 -1.662700 31.61610 31.61430 25.42760
0.2789671E-01 1.069100 0.6590000E-01 7.892690 92.01902 0.3130000E-01
99.22090 0.8320100E-01 3.308800 11.00000 1.349109 19.17066
6.258408 0.5669367E-01 1.124040 0.6450000E-01 0.1872997 0.1937254 -
0.8703700E-02

```

**-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](http://www.seabird.com/products/spec_sheets/911data.htm)
- CTD map: psea1001\_PMEL\_CTDmap.gif
- CTD Calibration file: psea1001\_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 Seeschifffahrt 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>