TITLE: CTD casts, BEST Summer Cruise 2009, Knorr 195-10 (6n195j)

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-Similar contact information for data questions (if different than above)
  SAME AS ABOVE and
  This documentation/data/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)
  Award Numbers 0732640

DATA SET OVERVIEW:

-Introduction or abstract
  This CTD data set, consisting of 247 casts, was collected during a multi-disciplinary Bering Sea cruise on the UNOLS ship R/V Knorr (6n195j, 2009). 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, and deployment assistance from Knorr 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 contact people: Phyllis Stabeno, Peggy Sullivan. Nutrient and bottle data contact: Calvin Mordy.

-Time period covered by the data: June 14- July 13, 2009

-Physical location of the measurement or platform (latitude/longitude/elevation)
  247 CTD casts deployed within latitude 54N to 62.5N and longitude 160 W to 180W

-Any World Wide Web address references (i.e. additional documentation such as Project WWW site)
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 2186
- Conductivity S/N 2670
- Temperature S/N 4039
- Temperature S/N 4195
- Pressure Digiquartz with TC S/N 94763_SBE09785_vert_orientation
- PAR/Irradiance, Biospherical/Licor S/N QSP-200L 4550
- SPAR/Surface Irradiance S/N QSR-240 6294
- Transmissometer, Chelsea/Seatech/Wetlab CStar S/N CST-116
- Fluorometer, WET Labs ECO-AFL/FL S/N FLNTURTD-304
- Turbidity, FLNTU S/N FLNTURTD-304
- Altimeter S/N 997
- Oxygen sensor, SBE-43 S/N 0723

-Figures (or links), if applicable
Web reference to instrument:
  http://www.seabird.com/products/spec_sheets/911data.htm
Figure showing CTD transect map: knorr19510_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 personnel from NOAA/PMEL in the EcoFOCI program, with assistance from Knorr 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 knorr19510_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, 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
Axies:
<table>
<thead>
<tr>
<th>code</th>
<th>name</th>
<th>type</th>
<th>lower corner</th>
<th>upper corner</th>
<th>units</th>
</tr>
</thead>
<tbody>
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<td>EVEN</td>
<td>163.1382 W</td>
<td>degree_west</td>
<td></td>
</tr>
<tr>
<td>500</td>
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<td>EVEN</td>
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<td>degree_north</td>
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</tr>
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Variable(s):
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<th>name</th>
<th>units</th>
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<td>C</td>
</tr>
<tr>
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<td>T2 Secondary Temperature</td>
<td>C</td>
</tr>
<tr>
<td>41</td>
<td>S SALINITY (PSU)</td>
<td>PSU</td>
</tr>
<tr>
<td>42</td>
<td>S SALINITY (PSU)</td>
<td>PSU</td>
</tr>
<tr>
<td>70</td>
<td>ST SIGMA-T (KG/M**3)</td>
<td>kg m-3</td>
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Sample Data Records with Column Headers (NetCDF format):

Variables
T,T2,S,S,ST,DYN,O,OST,TRN,Tr,ATTN,PAR,PAR,PAR,SPAR,BTL,PO4,SI,NO3,NO2,NH4,rFv,Cla,Chl,Cla,Cla,Cla,Cla,Cla,Cla,Fph,Fph,Fph

Pres(dB) T T2 S S ST DYN O OST TRN Tr ATTN PAR PAR SPAR BTL PO4 SI NO3 NO2 NH4 rFv Cla
0.00 -1.6613 -1.6832 31.6179 31.6383 25.4287 0.00000E+00 368.4243 95.7834 3.7535
74.6712 1.1683 3.6463 423.4000 933.9800 1e+35 1e+35 1e+35 1e+35 1e+35
1.00 -1.6613 -1.6832 31.6179 31.6383 25.4287 0.25398E-02 368.4243 95.7834 3.7535
74.6712 1.1683 3.6463 423.4000 933.9800 1e+35 1e+35 1e+35 1e+35 1e+35
2.00 -1.6613 -1.6832 31.6179 31.6383 25.4287 0.50795E-02 368.4243 95.7834 3.7535
74.6712 1.1683 3.6463 423.4000 933.9800 0.70000E+01 0.12694E+01 0.24664E+02 0.62863E+01
0.10078E+00 0.33823E+01 1.2811 -0.0649 0.16327E+00 0.39358E+00 1e+35 1e+35 0.41150E+00
1e+35 1e+35 0.28062E+00
### Sample Attributes (Metadata) in NetCDF files

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

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<th>P (hPa)</th>
<th>Td (°C)</th>
<th>D (m)</th>
<th>P (hPa)</th>
<th>C (°C)</th>
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Sample Data Records with Column Headers (text format):
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</tr>
</tbody>
</table>

*Notes:*
- Cruise and cast numbers indicate the sequence of sampling events.
- Station number corresponds to the location of the sampling event.
- Station name is typically the name of the collection or the geographical location.
- CTD type indicates the type of measurement device used.
- Primary, secondary, and environmental measurements refer to various parameters such as temperature, salinity, oxygen, and others, which are crucial for understanding marine environments.
-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](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
  o Seabird SBE 911plus CTD manual
  o CTD map: knorr19510_PMEL_CTDmap.gif
  o CTD Calibration file: knorr19510_CTDCalFile.txt
  o Welschmeyer. 1985(1994). Fluorometric analysis of chlorophyll- a in the presence of chlorophyll b and pheopigments, Limnol.Oceanogr. 39(8), 1994-
  o NSF Award: [http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0732640](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0732640)