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
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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)

BEST/BSIERP Site: http://bsierp.nprb.org/
BEST Data Management: http://bsierp.nprb.org/data_mgt/
NSF Award: http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0732640

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
Axes:

code	name	type	lower corner	upper corner	units
501	x lon	EVEN	163.1382 W		degree_west
500	y lat	EVEN	55.9613 N		degree_north
1	z dep	EVEN	0.00	82.00	dbar
624	t time	EVEN	16-Jun-2009 13:29		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
65	O	OXYGEN (UMOL/KG)	umol/kg
60	O	OXYGEN (ML/L)	ml/l
62	OST	OXYGEN, %SAT	%
107	TRN	TRANSMISSOMETER VOLTAGE 7	volts
904	Tr	Transmissometry (CTD)	%
55	ATTN	ATTENUATION	m-1
916	PAR	Photosynthetically Active Radiation(volts)	V
905	PAR	Photosynthetic Active Radiation	uEin m-2 s-1
918	SPAR	Surface Photosynthetically Act	uEin m-2 s-1
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)	uM/kg
971	rFv	raw fluorometer Volts(CTD)	Volts
2930	Cla	CTD Chlorophyll-a factory calibration	ugrams/l
2931	Cla	CTD Chlorophyll-a laboratory calibration	ugrams/l
2932	Cla	CTD upcast Chlorophyll-a laboratory calibration	ugrams/l
933	Cla	Chlorophyll	ugrams/l
2933	Cla	Chlorophyll-a total	ugrams/l
2934	Cla	Chlorophyll-a Large Size Fraction	ugrams/l
2935	Cla	Chlorophyll-a Small Size Fraction	ugrams/l
2936	Cla	Welschmeyer Chlorophyll-a Total	ugrams/l
2937	Cla	Welschmeyer Chlorophyll-a Large Size Fraction	ugrams/l
2938	Cla	Welschmeyer Chlorophyll-a Small Size Fraction	ugrams/l
907	Fph	Phaeopigments	ugrams/l
2907	Fph	Phaeopigments Large Size Fraction	ugrams/l
2908	Fph	Phaeopigments Small Size Fraction	ugrams/l

Sample Data Records with Column Headers (NetCDF format):

Variables

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,Cla,Fph,Fph,Fph

Epic codes

28,35,41,42,70,10,65,62,107,904,55,916,905,918,103,286,288,282,284,289,971,2930,933,2933,2934,2935,2936,2937,2938,907,2907,2908

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	Cla	Fph	Fph	Fph		
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		
1e+35	1.2811	-0.0649	1e+35	1e+35	1e+35	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		
1e+35	1.2811	-0.0649	1e+35	1e+35	1e+35	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									

3.00 -1.6976 -1.6996 31.6135 31.6219 25.4258 0.76204E-02 369.2490 95.9914 3.7441
74.4813 1.1785 3.5457 341.3700 932.3900 1e+35 1e+35 1e+35 1e+35 1e+35
1e+35 1.2635 -0.1241 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35
4.00 -1.7002 -1.6995 31.6091 31.6155 25.4223 0.10164E-01 369.5974 96.0763 3.7510
74.6194 1.1711 3.4366 265.4000 932.2800 1e+35 1e+35 1e+35 1e+35 1e+35
1e+35 1.3054 0.0251 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35
5.00 -1.7024 -1.7013 31.6054 31.6109 25.4193 0.12711E-01 369.8159 96.1282 3.7473
74.5444 1.1751 3.3289 206.7900 932.2800 1e+35 1e+35 1e+35 1e+35 1e+35
1e+35 1.3203 0.0810 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35
6.00 -1.7036 -1.7042 31.6020 31.6071 25.4166 0.15261E-01 369.9674 96.1622 3.7451
74.4997 1.1775 3.2295 164.1700 932.2800 1e+35 1e+35 1e+35 1e+35 1e+35
1e+35 1.3504 0.1974 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35 1e+35
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: 25 Number of attributes in file: 25
CREATION_DATE = 12:03 15-MAR-11
CRUISE = 19510
CAST = 011
INST_TYPE = Sea-Bird CTD SBE911/917+
DATA_TYPE = CTD
DATA_CMNT = Data from Seasoft File 19510011.cnv
COORD_SYSTEM = GEOGRAPHICAL
WATER_MASS = B
BAROMETER = 1001
WIND_DIR = 27
WIND_SPEED = 4
CLOUD_TYPE = 3
AIR_TEMP = 5.9000001
WET_BULB = 4.80000019
WATER_DEPTH = 90
PROG_CMNT1 = CTDVAR added 1 var
STATION_NAME = UAP3
EPIC_FILE_GENERATOR = SEASOFT2EPIC_CTD (Version 1.35, 01-May-2003)
PROG_CMNT2 = cat_ctd v1.35 02Dec2008
PROG_CMNT3 = trim_epic_unix (v1.30, rev 24Nov2008)
EDIT_COMMENT_01 = eps65: depth(0:10000) mod_coefs(a,b)= 1.027400 0.000000
EDIT_COMMENT_02 = eps41: depth(0:10000) mod_coefs(a,b)= 1.000000 0.003100
EDIT_COMMENT_03 = eps42: depth(0:10000) mod_coefs(a,b)= 1.000000 0.005400
EDIT_COMMENT_04 = eps60: depth(0:10000) mod_coefs(a,b)= 1.027400 0.000000
PROG_CMNT4 = cat_ctd v1.35 02Dec2008

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] OXYGEN [umol/kg] OXYGEN [ml/l] OXYGEN %SAT [%] TRANSMISSOMETER VOLTAGE 7 [Volts] Transmissometry [%] ATTENUATION [m-1] Photosynthetic 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] raw fluorometer Volts [Volts] CTD Chlorophyll-a factory calibration [ugrams/l] ctd bottle upcast chlorophyll factory cal [ugrams/l] Chlorophyll-a total [ugrams/l] Welschmeyer Chlorophyll-a total [ugrams/l] Welschmeyer Chlorophyll-a Large Size Fraction [ugrams/l] Welschmeyer Chlorophyll-a Small Size Fraction [ugrams/l] Phaeopigments [ugrams/l]

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 0.000 5.609400 5.605900 -1.0e+1032.43260 -1.0e+10-1.0e+10-1.0e+10
7.373188 -1.0e+104.429900 93.38590 0.2738000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1069000 0.3582000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 1.000 5.609400 5.605900 -1.0e+1032.43260 -1.0e+10-1.0e+10-1.0e+10
7.373188 -1.0e+104.429900 93.38590 0.2738000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1069000 0.3582000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 2.000 5.609400 5.605900 -1.0e+1032.43260 -1.0e+10-1.0e+10-1.0e+10
7.373188 -1.0e+104.429900 93.38590 0.2738000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1069000 0.3582000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 3.000 5.609400 5.605900 -1.0e+1032.43260 -1.0e+10-1.0e+10-1.0e+10
7.373188 -1.0e+104.429900 93.38590 0.2738000 0.1000000E-11
0.1823203E+14 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+100.1069000 0.3582000 0.3292143
-1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 4.000 5.613000 5.612000 -1.0e+1032.43190 -1.0e+10-1.0e+10-1.0e+10
7.310115 -1.0e+104.438700 93.57400 0.2657000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.9670000E-01 0.2576000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 5.000 5.613400 5.616100 -1.0e+1032.43170 -1.0e+10-1.0e+10-1.0e+10
7.305872 -1.0e+104.387000 92.46800 0.3133000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1018000 0.3079000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 6.000 5.638100 5.640600 -1.0e+1032.43020 -1.0e+10-1.0e+10-1.0e+10
7.301023 -1.0e+104.426500 93.31260 0.2769000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.9810000E-01 0.2707000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 7.000 5.639400 5.637900 -1.0e+1032.43030 -1.0e+10-1.0e+10-1.0e+10
7.300242 -1.0e+104.432400 93.43970 0.2715000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1095000 0.3841000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 8.000 5.631900 5.611300 -1.0e+1032.43180 -1.0e+10-1.0e+10-1.0e+10
7.299092 -1.0e+104.444800 93.70360 0.2602000 0.1000000E-11 -1.0e+10-1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1078000 0.3679000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-1.0e+10 -1.0e+10

6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 9.000 5.585500 5.578700 -1.0e+1032.43530 -1.0e+10-1.0e+10-1.0e+10
7.305174 -1.0e+104.418100 93.13290 0.2846000 0.1000000E-11 -1.0e+10-
1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1333000 0.6263000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-
1.0e+10 -1.0e+10
6n195j 001 C 1 U1 Standard 2009-06-14 22:41 193.4493 54.24400
1224.0 10.000 5.582100 5.568300 -1.0e+1032.43440 -1.0e+10-1.0e+10-1.0e+10
7.306222 -1.0e+104.421400 93.20320 0.2816000 0.1000000E-11 -1.0e+10-
1.0e+10 -1.0e+10-1.0e+10-1.0e+10-1.0e+100.1372000 0.6656000 -1.0e+10-1.0e+10-1.0e+10-1.0e+10-
1.0e+10 -1.0e+10

-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: knorr19510_PMEL_CTDmap.gif
- CTD Calibration file: knorr19510_CTDCalFile.txt
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