

TITLE: CTD casts, BEST Spring Cruise 2009, USCGC Healy (HLY0902)

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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 0732430

DATA SET OVERVIEW:

-Introduction or abstract

This CTD data set, consisting of 233 casts, was collected during a multi-disciplinary Bering Sea ice cruise on the USCGC Healy (HI0902, April 3- May 12, 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, 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 contact people: Phyllis Stabeno, Peggy Sullivan. Nutrient and bottle data contact: Calvin Mordy.

-Time period covered by the data: April 3-May 12, 2009

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

233 CTD casts deployed within latitude 54.30N to 62.22N and longitude 163.13W to 179.39W

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

Cruise Site: <http://www.ecofoci.noaa.gov/cruiseWeb/ice09/>

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=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 2575

Conductivity S/N 2619

Temperature S/N 2841

Temperature S/N 2824

Pressure Digiquartz with TC S/N 0639

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: hly0902_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 hly0902_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	169.2280 W		degree_west
500 y	lat	EVEN	58.0380 N		degree_north
1 z	dep	EVEN	0.00	65.00	dbar
624 t	time	EVEN	05-Apr-2009 09:13		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
70 ST	SIGMA-T (KG/M**3)	kg m-3

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
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
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
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
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
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
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	0.25785E+00	0.25785E+00	0.25785E+00	0.25785E+00	0.25785E+00	0.25785E+00	0.25785E+00

Sample Attributes (Metadata) in NetCDF files

Attribute(s):

Number of attributes listed: 22 Number of attributes in file: 22

CRUISE = H10902

CAST = 081

INST_TYPE = Sea-Bird CTD SBE 9

DATA_TYPE = CTD

DATA_CMNT = Data from Seasoft File 052081.cnv

COORD_SYSTEM = GEOGRAPHICAL

WATER_MASS = B

BAROMETER = 1024

WIND_DIR = 111

WIND_SPEED = 22

AIR_TEMP = -3.4000001

WATER_DEPTH = 46

PROG_CMNT1 = cat_ctd v1.36 06Aug2010

STATION_NAME = np3

EPIC_FILE_GENERATOR = SEASOFT2EPIC_CTD (Version 1.35, 01-May-2003)

CREATION_DATE = 12:00 15-MAR-11

PROG_CMNT2 = cat_ctd v1.36 06Aug2010

EDIT_COMMENT_01 = eps65: depth(0:10000) mod_coefs(a,b)= 1.030800 -0.710290

EDIT_COMMENT_02 = eps41: depth(0:10000) mod_coefs(a,b)= 1.000000 0.003000

EDIT_COMMENT_03 = eps42: depth(0:10000) mod_coefs(a,b)= 1.000000 0.000700

PROG_CMNT3 = cat_ctd v1.35 02Dec2008

PROG_CMNT4 = EDIT_CTD (v1.03, rev 01Aug07)

Sample Data Records with Column Headers (text format):

cruise	cast	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 %SAT [%]	TRANSMISSOMETER VOLTAGE 7 [Volts]	Transmissometry	ATTENUATION [m-1]	Photosynthetically Active Radiation [Volts]	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]	raw fluorometer Volts [Volts]	CTD Chlorophyll-a factory calibration				
	[ugrams/l]	ctd bottle chlorophyll [ugrams/l]	Chlorophyll-a total [ugrams/l]	Chlorophyll-a Large Size			
	Fraction [ugrams/l]	Chlorophyll-a Small Size Fraction [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]	Phaeopigments Large Size Fraction [ugrams/l]				
	Phaeopigments Small Size Fraction [ugrams/l]						
h10902 001 C	2009-04-05 03:02	190.683	57.90267	66.0	0.000	-1.700400	-1.693400
	31.68580	31.68430	25.48463	0.000000	372.1682	96.81375	
	3.950400	78.64860	0.9607000	3.529000	319.2700	661.2900	-
1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	101.376800	0.3077000	-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
h10902 001 C	2009-04-05 03:02	190.683	57.90267	66.0	1.000	-1.700400	-1.693400
	31.68580	31.68430	25.48463	0.2486608E-02	372.1682	96.81375	
	3.950400	78.64860	0.9607000	3.529000	319.2700	661.2900	
	7.000000	1.291181	26.92586	9.630375	0.7990203E-01	2.245051	
	1.376800	0.3077000	0.1913728	0.3351320	-1.0e+10	-1.0e+100.3541202	-
1.0e+10	-1.0e+100.2560188		-1.0e+10	-1.0e+10			
h10902 001 C	2009-04-05 03:02	190.683	57.90267	66.0	2.000	-1.700400	-1.693400
	31.68580	31.68430	25.48463	0.4973116E-02	372.1682	96.81375	
	3.950400	78.64860	0.9607000	3.529000	319.2700	661.2900	-
1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	101.376800	0.3077000	-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
h10902 001 C	2009-04-05 03:02	190.683	57.90267	66.0	3.000	-1.699300	-1.699300
	31.68370	31.68220	25.48290	0.7460345E-02	372.1167	96.80490	
	3.967500	78.99400	0.9432000	3.374900	231.2800	661.2900	-
1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	101.366600	0.2674000	-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
h10902 001 C	2009-04-05 03:02	190.683	57.90267	66.0	4.000	-1.699600	-1.698300
	31.68580	31.68360	25.48462	0.9947482E-02	372.1806	96.86945	
	3.941500	78.46880	0.9702000	3.184100	150.1400	663.2000	-
1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	101.326600	0.1042000	-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
h10902 001 C	2009-04-05 03:02	190.683	57.90267	66.0	5.000	-1.697300	-1.696700
	31.68590	31.68400	25.48465	0.1243369E-01	372.3043	96.94962	
	3.969300	79.02910	0.9414000	3.022300	102.2900	666.3100	-
1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	-1.0e+10	101.385000	0.3513000	-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

-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: hly0902_PMEL_CTDmap.gif
- CTD Calibration file: hly0902_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>