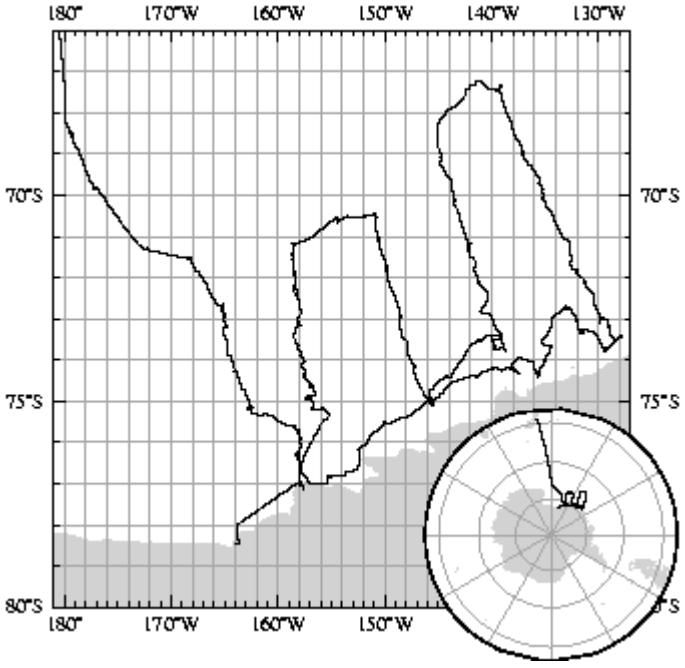
NBP9909 Data Report

APIS
ANTARCTIC PACK ICE SEALS
An international research program coordinated by the SCAR Group of Specialists on Seals



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Introduction

The NBP data acquisition systems continuously log data from several instruments throughout the cruise. This document describes the format of that data and its location on the distribution DAT tapes. It also contains important information which may affect how this data is processed such as instrument failures or other known problems with acquisition.

The data collected during this cruise is distributed on CD-ROMs written in ISO9660 level-1 format. This data format has very strict requirements on filenames and organization. However, it is readable by virtually every computing platform.

The data is contained in a Unix tar archive. All of the data has been compressed using Unix "gzip" compression. Gzipped files have a ".gz" extension. Tools are available on all platforms for uncompressing and de-archiving these formats. On Mac OS, Stuffit Expander will open a tar archive and uncompress gzipped and Unix compressed files. For Windows9X, WinZip will open these files.

IMPORTANT: Read the last section in this document, Acquisition Problems and Events, for important information that may affect the processing of this data.

Archive Data Extraction

It is often useful to know exactly how an archive was produced when expanding its contents. NBP9909.tar was created on an SGI using the following commands:

```
tar cvLf archive-file files-to-be-archived
```

To create a list of the files in the archive:

```
tar tvf  archive-file  > contents.list
```

To extract the files from the archive:

```
tar xvf  archive-file file(s)-to-extract
```

G-zipped files will have a ".gz" extension on the filename. These files can be decompressed after de-archiving, using:

```
gunzip filename.gz
```

The directories in the archive are structured in the following manner:

CD1
adcp/9909adcp.tar
apis/ *APIS science data and photos*
ctd/9909ctd.tar
NBP9909.ps
NBP9909.trk
NBP9909.mgd
NBP9909.gmt
ocean/9909pcoM.tar
9909xbt.tar
report/9909data.doc (this doc Word format)
9909data.htm (this doc html format)
9909data.txt (this doc text format)
rvdas/nav/9909ngl1.tar
rvdas/uw/9909bat1.tar
9909flr1.tar
9909met1.tar
9909oxyg.tar
9909pco2.tar
9909sim1.tar
9909tsg1.tar
TSGcal

CD2
geopdata/9909jg.tar
9909mgd.tar
imagery/*TeraScan satellite images*
rvdas/nav/99093df1.tar
9909adcp.tar
9909gyr1.tar
9909pcod.tar

Distribution Contents

ADCP

The ADCP data set is broken up into files representing 24 hours of data collection. The files are named pingdata.xxx (xxx representing a day number). Note that these extensions do NOT represent Julian day numbers. Please refer to the file's creation date.

Some ADCP data is also transmitted to RVDAS. East and North vectors for ship's speed relative to the reference layer and ship's heading are archived in the navigational data section of RVDAS.

CTD

The ctd data and report have been placed in the tar file 9909ctd.tar, which contains the fllowing structure:

ctd.list (list of all ctd stations)
ctdsetup/ (batch files, cfg & con files)
data/ (raw datafiles)
plots/ (up & down trace postscript plots)
seasoft4.234/ (application for processing ctd data)
report/section/ (section plots)
casts/ (plots of individual casts)
text/ (ctd data report)
seacat/ (data strucutre for SeaCat ctd)

Individual CTD casts are represented by a set of four files containing a bottle-firing file (.bl), a configuration file (.con), a data file (.dat) and a header file (.hdr). Casts are numbered according to the cruise id number (9909) followed by the number of the cast. For example; the raw files associated with the third cast on this cruise are: 9909003.bl, 9909003.con, 9909003.dat, 9909003.hdr. The raw and processed data files are in binary format. The 1 db bin averaged up and down traces have been converted to ascii (.asc files).

SeaBird's SeaSoft software used to acquire the data is included in the CTD data distribution in the "Seasoft" directory. SeaSoft is a DOS-based software package, but can be run in a DOS window under the Windows9X operating systems for cast playback and data analysis. The software package used to process this data (version 4.234) is included on this CD in the directory **Seasoft**. The configuration files and processing scripts (written by Suzanne O'Hara for the standard processing of the SBE 9/11*plus*) are also included in the **Seasoft** directory under in the **ctdsetup** directory. The directory **report** contains the CTD data report with folder for all plots produced during the cruise. The directory **seacat** gas a strucutre similar to the ctd directory and conatins the data from the SeaCat CTD unit.

File extension definitions:

EXT	Description
ASC	The data portion of a .CNV converted data file written in ASCII by ASCIIOUT, or files written by TERM37.
BL	Created by SEASAVE when a bottle fire confirmation is received. Contains bottle sequence number, position, date, time, beginning and ending scan numbers.
BTL	Created by ROSSUM. This is a summary of the data in a .ROS file.
BSR	Bottle scan range file, used by DATCNV to create a .ROS file.
CFG	Used by SEASOFT modules to store the input filename, input data path, output data path, and other miscellaneous module specific parameters.
CTR	Density contour file generated by CONTOUR.
CNV	'Converted' engineering unit data file. An ASCII header precedes the data.
CON	Contains instrument configuration and calibration coefficients, used by SEACON, SEASAVE, and DATCNV
DAT	Raw binary data, optionally with header information (SBE 9/11, 11X, 9/11*plus*, and data files created with previous versions of SEASOFT).
DSP	Used by SEASAVE to store data acquisition and display parameters.
HDR	R. Header portion of a .CNV converted data file written by ASCIIOUT. 2) Header recorded when acquiring real time data or uploading archived data.
HEX	Raw HEX data with header information (SBE 16, 17, 19, 21, and 25)
MRK	Marker file created by SEASAVE during real time data acquisition.

PLT	Used by SEAPLOT to store display parameters
ROS	Scans marked with the bottle fire confirmation bit, or defined by a .BSR file, written by DATCNV.

*Note: This is a complete list of all file extensions. This data set may not contain ALL of the above extension files.

SEASOFT modules search the current directory for DSP, PLT, and CFG files. SEASOFT modules search the 'input data path' for CON, HEX, DAT, and CNV files. One exception is SEACON which searches the current directory for CON files.

For more information and updated software visit the web site at www.seabird.com; or contact (206) 643-9866, seabird@seabird.com, Sea-Bird Electronics 1808 – 136th Place NE Bellevue, WA 98005

Cruise Track

PostScript cruise track files have been produced for this cruise. NBP9909.ps is poster-sized (36" x 40") and other cruise track plots are located in the apis/maps directory. A GMT cruise track file (NBP9909.trk) is also included, which contains the longitude and latitude at one-minute intervals extracted from the NBP9909.gmt file.

Satellite Images

Satellite Images processed for this cruise were organized into three folders cwifs, ice and wx for the different types of teraScan products. Files were named in the following convetion:

IDJJJYYA.jpg where:

ID = imge type (is = ice ssmi, iv = ice visible, cw = seawifs, wx = weather)
JJJ = Julian day
YY = year
A = used to allow for multiple images of type for that day

NBP Data Products: MGD77 & JGOFS

NBP9909.mgd
NBP9909.gmt
/geopdata/9909mgd.tar
/geopdata/9909jgof.tar

Two data products are created on each cruise of the NBP: JGOFS and MGD77.

JGOFS

The JGOFS data set consists of a single file produced each day named jgDDD.dat.gz where DDD is the Julian day the data was acquired. The ".gz" extension indicates that the individual files are compressed before archiving. The daily file consists of 20 separate columnar fields in text format, which are described below. The JGOFS data set is obtained primarily by applying calibrations to raw data and decimating to whole minute intervals. However, several fields are derived measurements from more than a single raw input. For example, Course Made Good (CMG) and Speed Over Ground (SOG) are calculated from gyro and GPS inputs by the NGL software package. Similarly, the wind direction field is the vector sum of the separate X and Y inputs received from the wind instrument. The JGOFS data set was used to produce the daily data plots during the cruise. *Note: Null, unused, or unknown fields are filled with 9's in the JGOFS data. TSG data is processed by RVDAS.*

Field	Data	Units
01	GMT date	dd/mm/yy
02	GMT time	hh:mm:ss
03	NGL latitude (negative is South)	dd.dddd
04	NGL longitude (negative is West)	ddd.dddd
05	speed over ground	Knots
06	GPS HDOP	-
07	Gyro Heading	Degrees
08	course made good	Degrees

Field	Data	Units
09	mast PAR	microEinsteins/(meter x sec^2)
10	sea surface temperature	degrees C
11	sea surface conductivity	siemens/meter
12	sea surface salinity	PSU
13	sea depth (uncorrected, calc. sw sound vel. 1500 m/s)	meters
14	true wind speed (port windbird)	meters/sec
15	true wind direction (port windbird)	degrees
16	ambient air temperature	degrees C
17	relative humidity	%
18	barometric pressure	mBars
19	sea surface fluorometry	volts (0-5 FSO)
20	not used	-

MGD77

The MGD77 data set is contained in a single file for the entire cruise named NBP9909.mgd, There is also a file named NBP9909.gmt. This file is the output of the mgd77togmt utility using NBP9909.mgd as input. The "gmt" file can be useful for plotting data using the GMT plotting package. The directory geopdata contains a file from each day of data acquisition named: Dddd.mgd.gz, where ddd is the Julian day. These are the daily mgd files. Below is a detailed description of the MGD77 data set format.

All decimal points are implied. Leading zeros and blanks are equivalent. Unknown or unused fields are to be filled with 9's. All "corrections", such as time zone, diurnal magnetics, and Eotvos, are understood to be added.

Col	Len	Type	Description
1	1	int	DATA RECORD TYPE Set to "3" for data record.
2-9	8	char	SURVEY IDENTIFIER
10-14	5	int	TIME-ZONE CORRECTION: In hundredths of hours. Corrects time (in characters 13-27) to GMT when added: equals zero when time is GMT.
15-16	2	int	YEAR 2 digit year
17-18	2	int	MONTH (e.g. May is represented as 05)
19-20	2	int	DAY Day of month
21-22	2	int	HOUR
23-27	5	real	MINUTES X 1000
28-35	8	real	LATITUDE X 100000 + = North; - = South. (–9000000 to 9000000)
36-44	9	real	LONGITUDE X 100000 + = East; - = West. (–18000000 to 18000000)
45	1	int	POSITION TYPE CODE: 1=Observed fix; 3=Interpolated; 9=Unspecified
46-51	6	real	BATHYMETRY, 2- WAY TRAVELTIME: In 10,000th of seconds. Corrected for transducer depth and other such corrections
52-57	6	real	BATHYMETRY, CORRECTED DEPTH: In tenths of meters.
58-59	2	int	BATHYMETRIC CORRECTION CODE: This code details the procedure used for determining the sound velocity correction to depth
60	1	int	BATHYMETRIC TYPE CODE: 1 = Observed; 3 = Interpolated (Header Seq. 12); 9 = Unspecified
61-66	6	real	MAGNETICS TOTAL FIELD, 1ST SENSOR: In tenths of nanoteslas (gammas).
67-72	6	real	MAGNETICS TOTAL FIELD, 2ND SENSOR: In tenths of nanoteslas (gammas). For trailing sensor.
73-78	6	real	MAGNETICS RESIDUAL FIELD: In tenths of nanoteslas (gammas). The reference field used is in Header Seq. 13.
79	1	int	SENSOR FOR RESIDUAL FIELD 1 = 1st or leading sensor; 2 = 2nd or trailing sensor; 9 = Unspecified
80-84	5	real	MAGNETICS DIURNAL CORRECTION: In tenths of nanoteslas (gammas). (In nanoteslas) if 9-filled (i.e., set to "+9999"), total and residual fields are assumed to be uncorrected; if used, total and residuals are assumed to

Col	Len	Type	Description
			have been already corrected.
85-90	6	F6.0	DEPTH OR ALTITUDE OF MAGNETICS SENSOR: In meters. + = Below sea level 3 = Above sea level
91-9	7	real	OBSERVED GRAVITY: In 10^{th} of mgals. Corrected for Eotvos, drift, tares.
98-10	6	real	EOTVOS CORRECTION: In tenths of mgals. E = 7.5 V cos phi sin alpha + 0.0042 V*V
104-108	5	real	FREE-AIR ANOMALY In tenths of milligals Free-air Anomaly = G(observed) – G(theoretical)
109-113	5	char	SEISMIC LINE NUMBER: Used for cross-referencing with seismic data.
114-119	6	char	SEISMIC SHOT-POINT NUMBER
120	1	int	QUALITY CODE FOR NAVIGATION: 5=Suspected, by the originating institution;6=Suspected, by the data center, 9=No identifiable problem found

RVDAS

rvdas/uw
rvdas/nav

RVDAS (Research Vessel Data Acquisition System) was developed at Lamont-Doherty Earth Observatory of Columbia University and has been used on the R/V Maurice Ewing for several years. It was adapted for use on the Nathaniel B. Palmer and her sister ship, the R/V Laurence M. Gould.

Daily data processing of the RVDAS data is performed to convert values into uasable units and as a check of the proper operation of the DAS. Both the raw and processed data sets from RVDAS are included in the data distribution. Below you will find detailed information on the data included. Be sure to read the “Significant Acquisition Events” section below for important information about data acquisition during this cruise.

Meteorological and Light Data

Measurement	File ID	Collect. Status	Rate	Instrument
Air Temperature	met1	continuous	0.5 sec	R. M. young 41342C
Relative Humidity	met1	continuous	0.5 sec	Rotonics MP-101A-C4
Wind Speed/Direction	met1	continuous	0.5 sec	Belfort Model 5-122AHD
PIR (LW radiation)	met1	continuous	0.5 sec	Eppley PIR
PSP (SW radiation)	met1	continuous	0.5 sec	Eppley PSP
PhotoActive Radiation	met1	continuous	0.5 sec	BSI QSR-240
Barometer	bar1	continuous	9 sec	AIR-DB-3A

Navigational Data

Measurement	File ID	Collect. Status	Rate	Instrument
Attitude GPS	3df1	continuous	1 sec	Ashtec 12
P-Code GPS	PCOD	continuous	1 sec	Trimble 20636-00SM
Gyro	gyr1	continuous	0.2 sec	Yokogawa Gyro
NGL	ngl1	continuous	1 sec	NGL Processed Nav Data

Geophysical Data

Measurement	File ID	Collect. Status	Rate	Instrument
Gravimeter	grv1	not collected		Lacoste & Romberg Gravity
Magnetometer	mag1	not collected		EG&G G-866
Bathymetry	bat1	continuous	10 sec	ODEC Bathy 2000
Bathymetry	sim1	depth < 2500 m	1 sec	Simrad EK200 Sonar

Oceanographic Data

Measurement	File ID	Collect. Status	Rate	Instrument
Conductivty	tsg1	continuous	15 sec	SeaBird 21
Salinity	tsgfl	continuous	15 sec	calculated from conductivity

Sea S Temperature	tsg1	continuous	15 sec	SeaBird 3-01/S
Fluorometry	flr1 & tsg1	continuous	15 sec	Turner 10-AU-005
pCO_2	pco2	continuous	70 sec	
ADCP	adcp	continuous	1 sec	RD Instruments

Data File Names and Structures

RVDAS data is divided into two broad categories, ***Underway*** and ***Navigation***. The groups are abbreviated "uw" and "nav". Thus, these two subdirectories exist under the top-level rvdas directory. The instruments are broken down as shown. Each data file is g-zipped to save space on the distribution. Not all data types are collected everyday or on every cruise.

RVDAS data files are named following the convention: NBP[CruiseID][ChannelID].dDDD.

- The CruiseID is the numeric name of the cruise, for example: NBP9909.
- The FileID (aka Channel ID) is a 4-character code representing the system being logged, for example: met1 (for meteorology)
- DDD is the Julian day of the data collection

Underway Data	**Channel ID**
Barometer	bar1
Bethy 2000	bat1
Fluorometer	flr1
Gravimeter	grv1
Magnetometer	mag1
Meteorological	met1
Simrad	sim1
Thermosalinograph	tsg1
pCO_2	pco2

Navigation Data	**Channel ID**
Ashtech GPS	3df1
Trimble GPS (P-Code)	PCOD
Gyro Compass	gyr1
Furuno GPS	gp02
NGL	ngl1
ADCP course	adcp

Data is received by the RVDAS system via RS-232 serial connections. The data files that comprise the rvdas data set are described below. A time tag is added to each line of data received and the data is written to disk.

```
YY+DDD:HH:MM:SS.SSS [data stream from instrument]
```

Where, YY: two-digit year, DDD: Julian Day, HH: 2 digit hours, MM: 2 digit minutes SS.SSS: seconds. All times are UTC.

The delimters used to separate fields in the raw data files are usually spaces and commas, but other delimiters are used (::, =, @) and occasionaly there is no delimiter. Care should be taken when reprocessing the data that the fields separations are clearly understood. An example data

bar1

```
00+019:23:59:57.441  963.25
```

Field	**Data**	**Units**
1	Time Tag	
2	Pressure	mBar

bat1

```
00+019:23:59:53.901 ;I04485.3ME-23.0,I00000.0,-99.9, 0000@01/11/00,23:59:52.08 PW2 PF1 SF1 PL3
MO4 SB3 PO0 TX1 TR: GM5 1500 06.7 -72.1
```

Field	**Data**	**Units**
1	RVDAS Time Tag	
2	Flagged Low Freq. Chn. Depth w/ units ;FDDDDD.DUN F= V valid, I invalid	meters
3	Low Freq. Echo Strength EEE.EE	dB
4	Flagged High Freq. Chn. Depth – unused	
5	High Freq. Echo Strength – unused	

Field	Data	Units
6	Signed Heave Data SHHHH	cm
7	Date	mm/dd/yy
8	Time	hh:mm:ss
9	transmit pulse window type: PW1 Rectangular, PW2 Hamming, PW3 Cosine, PW4 Blackman	
10	Primary transmit frequency PF1 3.5 kHz, PF2 12.0 kHz	
11	Parametric mode secondary freq. SF1 3.5 kHz, SF2 12.0 kHz	
12	pulse length: PL1 200usec, PL2 500usec, PL3 1msec, PL4 2msec, PL5 5msec, PL6 10msec, PL7 25msec. If transmit mode is FM: PL1 25msec, PL2 50msec, PL3 100msec.	
13	Operating Mode: MO1 CW parametric, MO2 CW, MO3 FM parametric, MO4 FM	
14	Frequency sweep bandwidth: SB1 1 kHz, SB2 2 kHz, SB3 5 kHz	
15	power level: PO1 0dB, PO2 -6dB, PO3 -12dB, PO4 -18dB, PO5 -24dB, PO6 -30dB, PO6 -30 dB, PO7 -36dB, PO8 -42dB	
16	Transmit Mode: TX1 single ping active, TX2 pinger listen, TX3 multipinging TR, TX4 multipinging TR, TX5 multipinging TTRR, TX6 mulitpinging TTTTRRRR, TX7 mulitpinging TTTTTRRRRR	
17	Transmit Rate: TR3 4Hz, TR4 2Hz, TR5 1Hz, TR6 .5Hz, TR7 .33Hz, TR8 .25Hz, TR9 .20Hz, TR: = .10Hz, TR; = .05Hz	
18	System Gain Mode: GM0 hydrographic AGC, GM1 to GM9 hydrographic +3db to + 27db manual. GMA to GMD hydrographic + 30db through + 60db manual, GME to GMK sub-bottom 1 through sub-bottom 7	
19	speed of sound	m/sec
20	depth of sonar window below sea-level	meters
21	background noise level in fixed point reference	dB/V

flr1

```
00+019:23:59:58.061 0  0818 ::  1/19/00 17:23:17 = 0.983  (RAW)   1.2 (C)
```

Field	Data	Units
1	RVDAS Time Tag	
2	marker 0 to 8	
3	4-digit index	
4	date	mm/dd/yy
5	time	hh:mm:ss
6	signal	
7	signla units of measurement	
8	cell temperature (unsigned)	
9	temperature units	

grv1

```
99+099:00:18:19.775 your_line#1999 99 01818 9735.4
```

Field	Data	Units	Conversion
1	RVDAS Time Tag		
2	text string		
3	gravity device date	yyyyjjjhhmmss	
3	gravity count	count	mgal = count x 1.0047 + offset

mag1

```
99+099:00:00:23.203 %  0  98 235928    0?372453
```

Field	Data	Units
1	RVDAS Time Tag	
2	% 0 denotes G-866 magnetometer	
3	Julian Day	
4	Time	
5	0? denotes high noise condition	

Field	Data	Units
6	Magnetic Data (last digit is 10th's place)	nT

met1

```
00+019:23:59:59.761 $MET:  0.84, 1.12, 0.76, 1.06, 4.98, 0.26, 1.49, 3.93, 8.94, 0.80, 0.01,
0.01, 0.01, 0.22, 0.02, 0.1,40.11,4.96
```

Field	Data	Units	Conversion
1	RVDAS Time Tag		
2	$MET		
3	starboard windbird north rel. speed vector voltage	V	m/s = 7.553 x voltage
4	starboard windbird east rel. speed vector voltage	V	m/s = 7.553 x voltage
5	Port windbird north rel. speed vector voltage	V	m/s = 7.553 x voltage
6	Port windbird east rel. speed vector voltage	V	m/s = 7.553 x voltage
7	Air temperature	V	C = 10 x voltage - 50
8	PIR Eppley Pyrgeometer	V	W/m^2 = 923.87 x voltage
9	PSP Eppley Pyranometer	V	W/m^2 = 194.53 x voltage
10	Temperature at the Relative Humidity Sensor	V	C = 10 x voltage – 40
11	Relative Humidity	V	%RH = 10 x voltage
12	PAR Irradiance	V	□Ei/m^2 = 1506.09 x voltage
13-15	spare channels		
18	AC line voltage	V	VAC = 150 x voltage
19	uMac Temperature	C	
20	uMac DC Supply	V	

pCO_2

```
00+021:23:59:43.190 2000021.9992 2382.4 984.2 30.73 50.8 345.9 334.1 -1.70 -68.046 -144.446 Equil
```

Field	Data	Units
1	RVDAS Time Tag	
2	pCO_2 Time Tag (decimal is time of day)	yyyjdd.fod
3	raw voltage	mV
4	barometer	mB
5	cell temperature	C
6	flow rate	cm^3/min
7	concentration	ppm
8	pCO_2 pressure	microAtm
9	Equilibrated temperature	C
10	Latititude	degrees
11	Longitude	degrees
12	Flow Source (Equil = pCO_2 measurement)	

sim1

```
00+005:00:00:52.388 D1,23583509,1479.6, 17,  1,  0
```

Field	Data	Units
1	RVDAS Time Tag	
2	Header	
3	Time Tag	hhmmss.sss
4	depth	m
5	bottom surface backscattering strength	dB
6	transducer number (1 = 38 kHz)	
7	dummy	

tsg1

```
00+019:23:59:46.976 15A16CFC163F8C2C100
```

Field	Data	Units

Field	Data	Units
1	RVDAS Time Tag	
2	Seabird Hex string (see notes on converting to real units)	

3df1

PBEN: Measurement Data

```
00+019:23:59:57.054 $PASHR,PBN,345609.00,-1695527.0,-1569301.4,-5925126.0,-068:49.6968,-
137:12.8448,00047.7,-000.69,000.67,-000.51,08,????,02,01,02,01*32
```

Field	Data	Units
1	RVDAS Time Tag $PASHR	
2	PBN	
3	GPS Time sec. of the week	seconds
4	Station Postion: ECEF X	meters
5	Station Postion: ECEF Y	meters
6	Station Postion: ECEF Z	meters
7	Latitude (- = South)	deg:min
8	Longitude (- = West)	deg:min
9	altitude	meters
10	velocity in ECEF X	m/sec
11	velocity in ECEF Y	m/sec
12	velofity in ECEF Z	m/sec
13	number of satellites used	
14	site name	
15	PDOP	
16	HDOP	
17	VDOP	
18	TDOP	

ATTD: Attitude Data

```
00+019:23:59:57.854 $PASHR,ATT,345610.0,252.82,+000.52,+001.95,0.0011,0.0068,0
```

Field	Data	Units
1	RVDAS Time Tag $PASHR	
2	ATT	
3	GPS Time sec. of the week	seconds
4	heading (rel. to true North)	degrees
5	pitch	degrees
6	roll	degrees
7	Measuremnet RMS error	meters
8	Baseline RMS error	meters
9	attitude reset flag	

GGA: GPS Position Fix – Geoid/Ellipsoid

```
00+019:23:59:57.134 $GPGGA,235956.00,6849.6968,S,13712.8448,W,1,08,01.0,+00048,M,,M,,
```

Field	Data	Units
1	RVDAS Time Tag $GPGGA	
2	UTC time at position	hhmmss.ss
3	Latitude	ddmm.mmm
4	North (N) or South (S)	
5	Longitude	ddmm.mmm
6	East (E) or West (W)	
7	GPS quality (1=GPS 2=DGPS)	
8	Number of GPS satellites used	
9	HDOP	
10	Antenna Height	meters

Field	Data	Units
11	M for Meters	
12	Geoidal height	meters
13	M for meters	
14	age of diff. GPS data	
15	differential reference station ID	

gyr1

```
00+019:23:59:59.952 $HEHRC25034,-020*73
```

Field	Data	Units
1	RVDAS Time Tag	
2	$HEHRC	
3	Heading XXXXX = ddd.dd	degrees
4	Rate of Change SYYY S = +/-, YYY = r.rr	
5	Checksum	

ngl1

```
00+019:23:59:59.857 -68.82822,-137.21416,1.10,279.27,251.10,0.00,0.00,0,18.2587,1,1146973
```

Field	Data	Units
1	RVDAS Time Tag	
2	Latitude (south is negative)	degrees
3	Longitude (west is negative)	degrees
4	Ship Speed	knots
5	Course made good	degrees
6	Gyro Heading	degrees
7	PDOP	
8	HDOP	
9	quality	
10	GPS up	
11	Fix Number	

PCOD

GGA: GPS Position Fix – Geoid/Ellipsoid

```
00+019:23:59:59.301 $GPGGA,235958.409,6849.6944,S,13712.8472,W,1,06,1.2,092.4,M,047.3,M,,*67
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPGGA	
3	UTC time at position	hhmmss.sss
4	Latitude	ddmm.mmm
5	North (N) or South (S)	
6	Longitude	ddmm.mmm
7	East (E) or West (W)	
8	GPS quality (1=GPS 2=DGPS 3=P-CODE)	
9	Number of GPS satellites used	
10	HDOP	
11	Antenna Height	meters
12	M for Meters	
13	Geoidal height	meters
14	M for meters	
15	age of diff. GPS data	
16	differential reference station ID	
17	checksum	

GLL: GPS Latitude/Longitude

```
00+019:23:59:59.381 $GPGLL,6849.6944,S,13712.8472,W,235958.409,A*35
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPGLL	
3	Latitude	degrees
4	North or South	
5	Longitude	degrees
6	East or West	
7	UTC of position	hhmmss.sss
8	staus of data (A = valid)	
9	checksum	

VTG: GPS Track and Ground Speed

```
00+019:23:59:59.382 $GPVTG,238.7,T,182.3,M,001.8,N,003.3,K*41
```

Field	Data	Units
1	RVDAS Time Tag	
2	$GPVTG	
3	heading	degrees
4	degrees True (T)	
5	heading	degrees
6	degrees magnetic (M)	
7	Ship speed	knots
8	N = knots	
9	speed	km/hr
10	K = km per hour	
11	checksum	

adcp

```
00+019:23:59:59.099 $PUHAW,UVH,-1.48,-0.51,250.6
```

Field	Data	Units
1	RVDAS Time Tag	
2	$PUHAW	
3	UVH (E-W, N-S, Heading)	
4	Ship Speed relative to reference layer, East vector	kn
5	Ship Speed relative to reference layer, North vector	kn
6	Ship heading	degrres

Ocean Data Files

ocean/9909pcoM.tar
ocean/9909xbt.tar

pCO2_m

The pCO_2 data has been merged with data from other sources for ease of data analysis.

```
00+019:23:58:15.502 2000019.9983 2445.2 965.0 32.90 52.8 372.3 352.5 -1.27 -68.8285 -137.2080
Equil -68.8280 -137.2079 -1.58 33.60 0.97 9.06 307.23 50.0
```

Field	Data	Units
1	RVDAS Time Tag	
2	pCO_2 Time Tag (decimal is time of day)	yyyjdd.fod
3	raw voltage	mV
4	barometer	mB
5	cell temperature	C
6	flow rate	cm^3/min
7	concentration	ppm
8	pCO_2 pressure	microAtm

Field	Data	Units
9	Equilibrated temperature	C
10	Latititude	degrees
11	Longitude	degrees
12	Flow Source (Equil = pCO_2 measurement)	
13	RVDAS latitude	degrees
14	RVDAS longitude	degrees
15	TSG external temperature	C
16	TSG salinity	PSU
17	TSG fluorometry	V
18	RVDAS true wind speed	m/s
19	RVDAS true wind direction	degrees
20	uncontaminated seawater pump flow rate	l/min

xbt

The xbt tar file contains the sound velocity profiles (.svp), the depth vs. temperature profiles (.edf) and raw files (.RDF) for each xbt station. To reprocess the raw data files the MK12 software from Sippican will need to be obtained. The xbt's were used in between CTD stations to determine temperature profiles.

PROCESSING RAW TSG DATA

Raw TSG data is stored as a hex string 20 bytes long.

Bytes	Data
1-4	Sensor Temperature
5-8	Conductivity
9-14	Remote Temperature
15-17	Fluorometer voltage
18-20	unused voltage

In all of the formulas listed below, the variables can be found in the TSGcal file.

Calculating Temperature

T = decimal equivalent of bytes 1-4

Temperature Frequency: f = T/19 +2100

q = ln(fo/f)

Temperature = 1/{a + b * q + c * q2 + d * q3} -273.15 (degrees C)

Calculating Conductivity

C = decimal equivalent of bytes 5-8

Conductivity Frequency f = sqrt(C*2100+6250000)

Conductivity = (afm +bf2 +c +dt)/[10(1+ep)] (siemens/meter)

note e = epsilon in the TSGcal file

Claculating Fluorometry Voltage

f = decimal equivalent of bytes 15-17

Fluorometry Voltage = f/819

NBP9909 Sensors

Shipboard Sensors

Sensor	Description	Serial #	Cal. Date	Status
Port Anemometer	Belfort 5-122AHD	7957	4/1/99	collect
Port Anemometer	Belfort 5-122AHD	7956	10/15/99	collect
Stbd Anemometer	Belfort 5-122AHD	92-2133	6/23/98	collect
Barometer	Atmospheric Instr. AIR-DB-3A	7G3095	5/17/99	collect
Mast PRR	BSI PRR-610	9696	3/18/99	not collect
UW PRR	BSI PRR-600	9695	3/18/99	not collect
Rel. Hum./Air Temp	Rotronics MP-101A-C4	R45618	5/12/99	collect.
Mast PAR	BSI QSR-240	6357	7/29/99	collect
P-Code GPS	Trimble 20636-00 (SM)			PCD/CIV
Attitude GPS	Ashtech 12	700273F2114 FW 7B13-D1-C21		collect
Pyranometer	Eppley PSP	28933F3	7/23/98	collect
Pyrgeometer	Eppley PIR	28903F3	7/23/98	collect
Dry Air Temp	R. M. Young 41342C	2267	10/1/99	collect
TSG	SeaBird SBE21	218091-1390	11/20/99	collect
TSG Remote Temp	SeaBird 3-01/S	031267	8/24/99	collect
Fluorometer	Turner 10-AU-005 Lamp: daylight 10-045, reference filter: 10-052, emission filter: 10-051, excitation filter: 10-050.	5651 FRTD		collect
Magnetometer	EG&G G-866			off ship
Gravimeter	Lacoste & Romberg Gravity Meter			not collect
Bathymetry	Simrad EK200	3001	11/1/95	collect
Bathymetry	Bathy 2000			collect

CTD Sensors

Sensor	Description	Serial Number	Cal.
CTD Fish	SeaBird SBE 9+	094857-0232	3/30/99
Pressure Sensor	Paroscientific 410K-105	43528	3/1/99
CTD Deck Unit	SeaBird SBE 11+	11P7536-0317	
Primary Temperature Sensor	SeaBird 3plus	03P2367	1/27/99
Secondary Temperature Sensor	SeaBird 3plus	03P2299	9/20/99
Primary Conductivity Sensor	SeaBird 4C	41852	3/2/99
Secondary Conductivity Sensor	SeaBird 4C	41850	11/24/99
Dissolved Oxygen Sensor	SeaBird 13-02-B	130327	3/24/99
Fluorometer	Chelsea Mk III Aquatracka	88080	9/28/99
Transmissometer	SeaTech 25cm	474	10/5/99
PAR (for casts >1000m)	BSI QCP-200L4S	7154	3/29/99

Acquisition Problems and Events

This section lists all known problems with acquisition during this cruise including instrument failures, data acquisition system failures and any other factor affecting this data set. The format is yy+jjj:hh:mm (yy is year, jjj is julian day, hh is hour, and mm is minute). All times are in GMT.

Start	End	Description
99+356		crossed 200 min limit leaving New Zealand
99+360:16:48	99+360:17:00	restarted TSG, pCO_2, Oxygen & Flurometer, pump had shut off, also pCO_2 had been unplugged, systems had been down for at least 2 hours
99+365:12:50	99+365:13:59	stopped RVDAS to fix resolve data archiving problem logger
00+002:00:41	00+002:01:40	TSG data has been flaky for past several days. system was shutdown and cleaned and run with a static water sample to test stability. Found unknown particulate surrounding sensors. System was fixed
00+008	unresolved	lost PCODE GPS accuracy, now under civilian accuracy
00+016:04:47	00+016:18:52	Ashtec data problems, data stream switched to other data info
00+034:08:57	00+034:11:30	Port Windbird failed, unit was replaced with Belfort serial # 7956
00+039:00:00		end of DAS collection

Sensor Calibration Sheets

Copies of the sensor calibration sheets are included with the hardcopy data report.