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WHOI PROCESSED CTD DATA ORGANIZATION



by

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ABSTRACT

A data storage format has been developed to be used for processed C.T.D. data on the Woods Hole Oceanographic Institution's Digital Equipment Corporation VAX 11 780 computer. CTDVAX as defined in this report is designed as a flexible internal data format. Station data is organized by ship-cruise-project using a VAX-supplied subdirectory system on disk.

This report describes the data organization, file structures, and record formats. File naming conventions, data protection and documentation schemes are explained. Outlines are given of the data processing system in use and of the CTD data accessing utilities available on the VAX.

INTRODUCTION

The task of the CTD group is to collect, calibrate, and process vertical profiling data associated with a variety of projects. This report discusses the disk organization of CTD data implemented on the Woods Hole Oceanographic Institution's Digital Equipment Corporation VAX 11 780 computer. The format is flexible but is designed for storing calibrated CTD observations as a uniform pressure series. Each profile is stored as a single disk file. The profiles processed for each particular cruise project are stored together. To allow secondary users to locate CTD data of interest, a catalog of the various cruise-project data sets is maintained.

CTD Profile: Definition

A CTD profile (cast) is a set of observations collected during a single transit of the instrument through a pressure range. A CTD station consists of one or more casts collected at a geographic location during one time interval. Normally a single CTD station corresponds to a new data logging file on magnetic tape (see WHOI Reference 78-43). CTD stations are numbered sequentially beginning with one on a cruise. A station usually consists of just two profiles (lowering and raising) with only the lowering portion of the station (assigned a cast number of 0) carried beyond the data logging stage of processing. The terms cast and profile are used interchangeably in this report.

CTD DATA ORGANIZATION

System-supplied file organization techniques are used to store CTD data on the VAX (see VAX/VMS Command Language Users Guide). Data is stored in a single directory [CTD], which is organized into subdirectories. Each subdirectory contains an index file and the station observation files for a single cruise. Related calibration, water sample, and documentation files also reside in these subdirectories (see appendix D.2). Currently, directory [CTD] is stored on the BLUE NODE VAX, on disk DBA2.

CTDA:

Station Index File

The station index file contains a sequence of fixed length "index" records, one record for every profile in the cruise. Each record in the station index file describes the various attributes of a CTD profile; start and end positions and times, the minimum and maximum values of the variables, etc. Each record of a station index file uniquely describes a station observation file by station and cast number plus a data version character. This information forms the file specifier of the station observation file as described below.

Station Observation File

Every record in a station index file corresponds to a station observation file. The station observation files contain the CTD observations

(usually, temperature, salinity, and oxygen, when available) for each station in the data set. The CTD observations are stored sequentially as real numbers in 1024 byte fixed length unformatted (binary) records. Although the format permits unequally spaced vertical profiles to be stored, the standard WHOI data loading program creates a uniform pressure series in which pressure is implied from the observation position in the data record sequence. In order that the station observations file be self-documenting, the station index record is repeated from the index file immediately before the data records.

File Naming Convention and Directory Location

Within directory [CTD] are individual subdirectories, one subdirectory per cruise/project data set. The subdirectory name is formed from the ship, cruise, data code and project code. The project code is a three-digit numeral assigned by the CTD data base manager. The data code is a single letter, usually set to "D" to indicate data processed from CTD78 format by the pressure-averaging-salinity-oxygen-conversion program as a uniform 2 decibar pressure series. Other data codes are Z for data transcribed from Maltais format and W for data from other institutions. E indicates a second data set belonging to a given ship-cruise-project (i.e., data from a subsequent leg).

The ship code is a two-character letter mnemonic; for example, the R/V ATLANTIS II = AT. A list of ship mnemonics is included in Millard, et al. 1978 (WHOI TR 78-43). A cruise subdirectory specifier for the ATLANTIS Cruise 107 assigned a project code of 12 would be:

[CTD.AT107D012]

The station index file within the cruise subdirectory has a file name SUBINDEX.CTD;1. The complete file specifier is

DB2:[CTD.AT107D012]SUBINDEX.CTD;1

The station observation file name is formed from a four-digit station number and a three-digit cast number separated by a letter character code indicating the data version. The letter code "C" indicates a data file which corresponds directly to the source data without modifications to calibrations. Code "M" indicates that changes have been made to the source tape calibrations and "E" indicates tht edits have been performed on the data after loading.

All CTD files have a file extension of .CTD and a version number of 1. A typical observation file name is 0069C000.CTD;1. This file would contain the single-cast station 69. The complete file specifier is:

DB2:[CTD.AT107D102]0069C000.CTD;1

CTDA

An example of the CTD organization on the VAX is shown in Figure 1. System directory commands are used to display all of the cruise subdirectories in the [CTD] directory, and display all of the profiles available in a particular cruise subdirectory. Index Record information and station observations are obtained using the VAX CTD utility routines in program NODCEXCH.

VAX CTD FILE STRUCTURE AND RECORD FORMATS

File Structure

Each station index file contains one index record for each profile available in the data subdirectory. The station observation file consists of an index record repeated from the index file followed by a series of CTD observation records. Station index files have a control word in the first index record that gives the location of the last record in the file.

Record Formats and Information Content

All information is stored in unformatted form to minimize the overhead of storage and translation. Both index and data records have a full integer word keyword, and all records are 1024 bytes long. Fixed length records can be accessed directly on the VAX.

Station Index Record

The index record is identical in the index file and the station file. Words one to twelve are control words describing the record and the file. Beginning at word 13 are five categories of information.

Category one is a station header which contains position, date and time of station, instrument number, and other information relating to the station acquisition. Also included are the name and version date of the program which created the VAX data file. Category two contains information used to unpack the data. Included are the number of observations, the number of variables, the sampling interval, variable identifiers, and minimum and maximum values for all variables. All ASCII fields in Categories one and two can be printed in A2 format.

Category three contains the name of the source tape for the file. Category four contains documentation for the station observation file, including device, subdirectory, and data file name, and date and time of file creation. Category five documents edits performed on the VAX, tying edited data files to original pressure sorted files. ASCII fields in Categories 3, 4, and 5 are accessed in A4 format.

Station Observation Record

The CTD observations are stored sequentially by pressure in a series of fixed length records. Each data record contains an integral number of CTD observations. The remaining words at the end of each data record are filled with the value -999999.0. The first full VAX word of each data record is the relative record position of the data record within the sequence of data records of the profile.

\$ DIRE [CTD]*.DIR
Directory - DBA2:<CTD>

Figure 1

AT100D003.DIR;1	AT100D005.DIR;1	AT107D011.DIR;1	AT107D012.DIR;1
AT107D017.DIR;1	AT107E012.DIR;1	AT107E017.DIR;1	AT109D011.DIR;1
AT109D019.DIR;1	AT109E019.DIR;1	AT110D021.DIR;1	AT110E021.DIR;1
CH118A009.DIR;1	CH120A009.DIR;1	EN074D021.DIR;1	GY001W003.DIR;1
IS001W003.DIR;1	KN005D099.DIR;1	KN030W000.DIR;1	KN052Z005.DIR;1
KN060A002.DIR;1	KN060Z123.DIR;1	KN066D001.DIR;1	KN066D003.DIR;1
KN073D009.DIR;1	KN073D010.DIR;1	KN075D013.DIR;1	KN075D014.DIR;1
KN083D999.DIR;1	OC036D004.DIR;1	OC052D008.DIR;1	OC066D003.DIR;1
OC078D011.DIR;1	OC078D015.DIR;1	OC078D016.DIR;1	SC001D099.DIR;1
SC002E020.DIR;1	TT107Z008.DIR;1	TW001D018.DIR;1	TW002D020.DIR;1
WL907D002.DIR;1			

Total of 41 files.

\$ DIRE [CTD.AT110D021]*.CTD
Directory - DBA2:<CTD.AT110D021>

0001M000.CTD;1	0002M000.CTD;1	0004M000.CTD;1	0005M000.CTD;1
0006M000.CTD;1	0008M000.CTD;1	0009M000.CTD;1	0010M000.CTD;1
0011M000.CTD;1	0012M000.CTD;1	0013M000.CTD;1	0014M000.CTD;1
0015M000.CTD;1	0016M000.CTD;1	0017M000.CTD;1	0018M000.CTD;1
0019M000.CTD;1	0020M000.CTD;1	0021M000.CTD;1	0022M000.CTD;1
0023M000.CTD;1	0024M000.CTD;1	0025M000.CTD;1	0026M000.CTD;1
0027M000.CTD;1	SUBINDEX.CTD;1		

Total of 26 files.

PROGRAM NODCEXCH:

SHIP AT CRUISE 110 STAT: 2				
DATE 81- 9-20 TIME: 1908 Z				
LAT 40 15.18 LG -63 30.69				
MAX. PRS = 93. Db DEPTH = 4650. M				
AVER 2.0 INST 77 RATE 31.00HZ				
OBS = 47 FMT(F7.1,2F8.4,F6.2,I6)				
<u>PRES</u>	<u>TEMP</u>	<u>SALT</u>	<u>OXYG</u>	<u>QUAL</u>
1.0	23.3706	30.5160	5.14	184
3.0	24.0713	35.9852	4.86	147
5.0	24.0756	35.9839	4.78	206
7.0	24.0774	35.9835	4.82	104
9.0	24.0785	35.9828	4.82	273
11.0	24.0801	35.9832	4.80	177
13.0	24.0801	35.9839	4.82	204
15.0	24.0802	35.9839	4.81	139
17.0	24.0811	35.9838	4.82	136
19.0	24.0813	35.9839	4.80	183
21.0	24.0783	35.9858	4.81	164
23.0	24.0744	35.9883	4.80	202

SHIP AT CRUISE 110 STAT: 5				
DATE 81- 9-23 TIME: 1205 Z				
LAT 40 16.60 LG -63 36.00				
MAX. PRS = 1015. Db DEPTH = 4630. M				
AVER 2.0 INST 77 RATE 31.00HZ				
OBS = 508 FMT(F7.1,2F8.4,F6.2,I6)				
<u>PRES</u>	<u>TEMP</u>	<u>SALT</u>	<u>OXYG</u>	<u>QUAL</u>
1.0	22.2142	27.2683	5.21	41
3.0	22.9319	36.0853	5.13	68
5.0	22.9255	36.1888	5.07	85
7.0	22.9233	36.1982	5.02	164
9.0	22.9233	36.1884	4.99	206
11.0	22.9254	36.1979	4.97	287
13.0	22.9238	36.1988	4.96	64
15.0	22.9294	36.2421	4.95	53

The variables within a single CTD observation (scan) are stored as real numbers in a calibrated form in physical units. The order of the variables within the scan are the same as the order of the variable descriptors in the station index record (category 2). The raw CTD variables have been converted to physical units and the conversions from conductivity to salinity (in practical salinity units) and oxygen current to oxygen (in milliliters per liter) have been made. Pressure, temperature and salinity are given special storage consideration because they are required for the computation of other oceanographic parameters. Temperature is always the first variable in a CTD observation and salinity is always the second. CTD data is normally converted to a uniform pressure series and pressure is not carried in the data file. The pressure value for an individual scan is inferred from the position of the observation in the data sequence, minimum pressure and pressure interval, which are available from the index record. When pressure is carried explicitly, its location is found in the index record (word 114).

The last variable in the scan is always a quality word. If positive, this field contains the number of observations averaged from the time series data. Negative quality words indicate accumulated data which has been modified, usually by interpolation. The value of the negative quality word indicates the position within the scan of the variable or variables that have that have been changed ($-1*n**2$ with $n =$ variable position). Interpolated temperature results in -1, and salinity -2. These values are summed if more than one variable has been modified (ie both temperature and salinity modified results in quality word = -3). Negative quality words are found only in files which have been edited after pressure averaging. These files are indentified by the data version code E (0069E000.CTD;1).

Positive quality words can be used to infer approximate time and lowering rate using the instrument sample rate, pressure average interval, and start time from the index record.

INDEX TO APPENDICES

Following are four appendices which describe aspects of the CTD VAX data storage system in detail.

Appendix A covers the information fields of index and data records. Schematic diagrams in A(1) are followed by descriptions in A(2).

Appendix B includes several user-oriented sections. B(1) explains the use of system supplied protections being applied to the data base. Each subdirectory evolves through phases during which different levels of protection are needed. B(2) describes the conventions in use for naming files in CTD subdirectories. The filename extension system on the VAX is used to identify the different types of files stored. Water sample data files, laboratory calibration files, documentation and program command files are identified by filenaming conventions. Appendix B(3) describes the documen-

tation file found in each CTD subdirectory. Although those files vary for each cruise, certain basic information is always included. This appendix details the essential documentation.

Appendix C outlines CTD data processing procedures, covering time series data collection and processing on the Hewlett Packard 2100 computers as well as VAX processing. In C(1) the steps of processing are outlined and in C(2) the programs are described briefly. Further documentation for VAX programs is available in directory [CTDSOFT] on VAX BLUE node disk DBA2. Documentation files are identified by the file extension 'DOC'. HP program documentation is available from the CTD group or from I.P.C.

Appendix D contains information for programmers who wish to access CTD data. Included is a sample program showing how the basic accessing utilities are used. This is followed by a summary list of those routines. Last is a listing of a file which describes index records fields, and which is used by CTD programs to set up common.

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APPENDICES

APPENDIX A.1 RECORD DIAGRAMS

INDEX RECORD

Word
Position

File/Record Control Words

INDEX

1	Key = -32768	Disk Format Version = 1	No. Categories Info. = 4 or 5	Start Word Cat. 1 = 13	Start Word Cat. 2 = 103	Start Word Cat. 3 = 179
7	Start Word Cat. 4 = 191	Start Word Cat. 5 = 210	Last Record Index File	Unused	Unused	Unused
Category 1 Station Header						
13	Keyword = -2 or -3	Project Code	Ship Code	Cruise No.	Station No.	Data Version Flag
19	Year of Station	Month of Station	Day of Station	Time (Start)	Latitude (Start) Degrees Mins * 100 23 24	
25	Longitude (Start) Degrees Mins * 100		Words per CTD Data Scan	100* Number Scan/sec	Time Pulse Frequency	Pressure Interval
31	Latitude (End) Degrees Mins * 100		Longitude (End) Degrees Mins * 100		Time End	Minimum Pressure
37	Maximum Pressure	Day Number (Julian)		Instrument Number	Quality Flag	Year of Edit
43	Month of Edit	Day of Edit	Number of Samples Taken	Position Method	Wind Speed	Water Depth
49	Station Type	Cast Number	WMO Geographic Area Code	Institution Code	Index File Record Number	
67	Name of Person Creating File and Comments.					
99	Loading Program Version Date.					

Category 2
Abbreviated Variable Descriptors

Word
Position

103	Keyword of Source Scale Factor or Rec.	Total Number Descriptors	Descriptor Length = 4 (KSCAN)	Number of Variables /Scan (MSCAN)	Number Full Words Per Disk Data Record (RECLNG)	Number OBS (NTOT)
109	Implicit Variable Mnemonic I.D. (IMPVAR)	Implicit Variable Start Value (PMIN)	Implicit Variable Sample (PRSINT)	No. of Observations per Data Record (NSCAN)	Unused	Pressure Variable (IPLOC)

Variable Descriptors - (sample)

	Variable I.D.	Variable Word Type	Minimum Value	Maximum Value
115	TE	R	2.115	25.437
	SA	R	34.861	36.314
	OX	R	3.81	7.08
	QU	R	12.	192.
	PR	N	3.0	4735.0

Can Be Extended to 16 Descriptors

Category 3
Source Tape Information

179	Source Tape of Disk File	
-----	--------------------------	--

Category 4
Disk Data File Documentation

Word
 Position

191	Volume I.D.	Device Name	Date File Created
197	Continued	Time File Created	Sub-directory Name
203	Continued	Data File Name	Location of Index Record in Data File
209	Number of Observation Records in Station File		

Category 5
EDIT DOC

(Used Only for Vax-Edited Files)

Word
 Position

210	No. Data Edits on VAX	PRSORT PROG VER	PRSORT Date Year
216	PRSORT Date Month	Day	PRSORT Time Hour Minute PRSORT FILE SPEC
222	FILSPEC (Cont)	Number of Indexed Runs	PROG VER
228	PROG VER Continued for Most Recent Indexed Run	Indexed Date For Last Run Year	Month Day
234	Hour	Minute	

DATA RECORD: Length Found in Index Record Word 107

Record No.	SCAN 1 Temp	Salt	Other Variables		
SCAN 2			SCAN 3		
~ ~					
SCAN N			-999999.0	-999999.0	-999999.0

APPENDIX A.2

DEFINITIONS OF STATION INDEX RECORD FIELDS

CONTROL WORDS - Words 1-12

<u>Word No.</u>	<u>Type</u>	
1	I*4	The keyword of the station index record equals -32768.
2	I*4	Number of categories of information contained in this record = 4 or 5.
3	I*4	Starting word number for category 1. Station header information = 13.
4	I*4	Starting word number for category 2. Variable descriptor information = 103.
5	I*4	Starting word number for category 3. Source data tape information = 179.
6	I*4	Starting word number for category 4. Observation file documentation = 191.
7	I*4	First unused word in station index record = 210 for pressure-averaged data. (= 236 for VAX-edited data files).
8	I*4	The location of the last record in the station index file.
9-12		Unused

CATEGORY 1 - HEADER (ASCII files are defined in 2h format.)

<u>Word No.</u>	<u>Type</u>	
13-50	I*4	Station acquisition information, as defined in CTD 78 FORMAT, WHOI Ref. 78-43, Page 9 (add 12 to number location) except word 39.
39	I*4	Full Julian Day number including bias of 2440000. See WHOI Reference 78-43.
51	ASCII	See World Meteorological Organization Geographic Code.
52	ASCII	Two-character code of institutions responsible for collecting the data. Currently WH for WHOI.
53	I*4	The index file reference number is the record number within the index file.

<u>Word No.</u>	<u>Type</u>	
67-98	ASCII	Comment as defined in CTD 78 format, WHOI Ref. 78-43.
99-102	ASCII	Program name and version date creating the record.
CATEGORY 2 - DESCRIPTORS (ASCII fields are defined in 2h format)		
103	I*4	Keyword of scale factor record of the source data file.
104	I*4	The total number of variables described in this index record.
105	I*4	Number of full word items in each descriptors = 4.
106	I*4	The number of variables per observation in the data record described by this index record.
107	I*4	The number of full VAX words per disk observation data record.
108	I*4	Number of observations (scans) in this profile.
109	ASCII	The implicit variable descriptor - 2 character mnemonic. Normally equals PR (pressure).
110	R*4	The starting value of the implicit scan-related variable.
111	R*4	The increment between observations in physical units of the scan-related variable.
112	I*4	The number of observations per data record
114	I*4	The location of the pressure variable when explicitly written in each observation. Default = 0 means not carried. Variable descriptors are four-word sequences describing each variable of an observation followed by the scan-related variable.
115	ASCII	A two-character mnemonic identifier of the variable PR = pressure, TE = temperature, SA = salinity, OX = oxygen, QU = quality, NE = nephilometer.
116	I*4	Variable type: R = real, N = not carried (implicit) defined in 2H format.
117	R*4	The minimum value of the variable over the profile.
118	R*4	The maximum value of the variable over the profile.

Repeat four-word sequence one for each variable through word 178.

Word No. Type

CATEGORY 3

Tape Names: Unused fields are padded with blanks. Four-character tape name stored in second word only.

179 ASCII Source magnetic tape for this data file.

CATEGORY 4 Location of profile on disk and date and time created on disk.

191 ASCII The volume identifier of the dump tape name.

193 ASCII The device name on which observation file is located. Currently DB2: for disk data. Set to MTO: for data offlined on magnetic tape.

195 ASCII Date the observation disk file was created. The form is DD-MM-YY. See VAX Fortran Language Reference Manual subroutine DATE (IDATE). Appendix C.

198 ASCII The time observation disk data file was created. The form is HH:MM:SS. See VAX Fortran Language Ref. Manual subroutine TIME (ITIME). Appendix C.

200 ASCII The subdirectory name part of the observation file specifier. The subdirectory name is formed from the directory name plus ship, cruise, and project code, i.e., [CTD.KN073D010].

204 ASCII The data file name part of the observation file specifier. The data file name is formed from the station number and cast number with a file extension of CTD and a version number of 1.

208 I*4 The location of the index record in the observation file. Set to equal to 1 for current data organization.

209 I*4 Number of observation records in station file.

CATEGORY 5 Is used for VAX-edited stations only.

210 I*4 Number of data edits performed on VAX.

211-14 I*4 Program and version of pressure sort program.

215-19 I*4 Date and time of PRSORT run.

<u>Word No.</u>	<u>Type</u>	
220-25	ASCII	PRSORT filespec for edit input.
226	I*4	Number of index record edits.
227-30	I*4	Program version of most recent index edit run.
231-35	I*4	Date and time of most recent index edit run.

APPENDIX B.1

CTD SUBDIRECTORY FILE PROTECTION

The VAX-supplied system of file protection is used. This system service is documented in VAX/VMS Command Language Users Guide. Protection of the data subdirectories in directory [CTD] serves two purposes. First, it prevents accidental or unauthorized deletion or purging of data files or of files which document the processing of CTD data. File protection also prevents subdirectories from being used to store miscellaneous data files, minimizing the bookkeeping and the storage space required for the CTD data base. Subdirectory protection occurs in two phases. The first phase begins with creating the subdirectory with the principal investigator's CTD account as the owner. Protection is set on the file [CTD] .DIR to allow only the owner to write. Since this file contains the list of all files in the subdirectory, this protection essentially prevents anyone other than the owner from creating any files within the subdirectory. Using the option to set protection by file extension, some file types are protected from deletion by anyone. CTD, CAL, and MLT file types are set for read/execute only, so that the owner must reset the protection before he can delete these files. This prevents accidental deletion by the group member loading the data. During this phase, it is possible for anyone to read from the subdirectory, so various users will have access to calibration information or data files. This also permits the principal investigator to use his data as soon as it is loaded. Reserving write privileges for the owner also provides some automatic bookkeeping of VAX costs which can be used for future budgets. This will work only if the UIC of the owner is used only by the CTD group member involved in loading the data. Other work should be done under another account.

The second phase of data protection occurs when the data has been loaded, plotted, and listed and is considered to be in its final form. At this point the subdirectory is copied to tape and deleted. A new subdirectory of the same name is opened, under the ownership of the CTD data base manager account. CTD data files, the subindex file, and the cruise documentation file are copied into the new subdirectory and protection is set to read/execute only for all users. At this point the subdirectory can be off-loaded by the DBM (after changing the protection) whenever it becomes inactive. The backup tape will always be current because no writing will have been done in the subdirectory. Normally the station data files in a CTD subdirectory will be kept on disk no longer than six months from the date of the final calibration decisions. The index file and documentation file will remain in the subdirectory as a permanent catalogue of the cruise.

APPENDIX B.2

FILE TYPES IN CTD SUBDIRECTORIES

CTD subdirectories normally contain pressure sorted data files, subindex files, cruise documentation files, calibration files, CTD water sample files, and copies of any special purpose programs used to generate the data set. To simplify access to the data in our subdirectories, the CTD group has adopted some filenaming conventions. Version numbers are not used (except temporarily) because the CTD directories are routinely purged. Files with the .DAT and .LIS extensions are also considered expendable.

SPECIAL FILE EXTENSIONS:

- .CTD;1 Pressure sorted data files or subindex files. Data files contain one station/cast per file. Name consists of station, data version code, cast number; i.e., 0003C000.CTD;1 for single cast Station No. 3, Code C. Note that only version;1 is used by the CTD utilities. Index records are fixed length 1024 byte binary records.

Subindex files contain index records for each station in the cruise subdirectory. Name is SUBINDEX.CTD;1.
- .CAL; Calibration data files containing comparisons between CTD and laboratory calibration units; serve as input for program LABFIT. Name consists of calibration date and CTD number; i.e.: 81JAN05C3.CAL is CTD No. 3 calibration from January 5, 1981. CAL files should be permanent files, providing documentation for the calibrations applied to the data. There should be a pre-cruise and a post-cruise CAL file for each instrument used in each subdirectory. These files are printable ASCII files.
- .DOC; Documentation file containing information relating to a specific data subdirectory. This file includes information on instruments used, calibrations, processing programs used, general information about the cruise, etc. See Appendix B.3 for further information. Note: there may also be software documentation files in a subdirectory, if a special version of a program was generated to process the data set. These are printable ASCII files.
- .RAW; Time series data loaded onto the VAX in CTD78 format via program CTDISK or CTLGAV. These are 2048 byte binary records.
- .MLT; CTD water sample data files in MLTRG format. Name consists of ship, cruise, instrument number, i.e., AT107C3.MLT;1. for CTD No. 3, data from AT 107. These are printable ASCII files.

.DYN; CTD water sample files translated from .MLT files into the format needed for VAX display by NODCX. Note: Hydrographic data files are not normally stored within CTD subdirectories, but also use the .DYN file type for NODCX input files. These are binary data files.

PRSORT FILES:

PSTAPE.COM files are command files which run the pressure sorting program. TAPE is the unique 4-character identifier of the input tape. Command files should be saved as documentation for the data load. They can be edited and used for reloading, if necessary, and are printable ASCII files.

PSTAPE.DLD files are created by the pressure sorting program (use external assign to direct output from FOR020.DAT to PSTAPE). These files document the actual PRSORT run and should be printed and saved. Printable ASCII files.

PSTAPE.SFR files are created by the pressure sorting program. They contain the station file documentation (filename, date created, program name, and scaling factors applied to the data) as a printable ASCII file.

APPENDIX B.3

CTD SUBDIRECTORY DOCUMENTATION

Each subdirectory in the CTD data base contains a documentation file. These files should provide all the information necessary to retrace the processing and calibration steps as well as providing a summary of general information about the cruise.

I. General Information

Name of principal investigator.

Name of CTD group member responsible for the data.

Approximate dates of cruise.

General location and port stops.

Number of stations, and station numbers.

Project name, if applicable (i.e. BETA-SPIRAL, ISOS).

Other related data - previous CTD cruises in this location or other types of data collected on this cruise (Hydro stations done, or nephelometer data, or sediment traps, for example).

Main focus of CTD work, if applicable (i.e., deep-water studies, or Gulf Stream tracking).

II. CTD Information

Instruments used (specify station numbers).

Unusual stations (i.e., aborted ones, sensor foulings).

Hardware problems affecting data collection.

Procedures used that would affect data, such as cell cleaning, or sensor replacements. If applicable, specify station numbers.

III. Lab Calibration Information

Laboratory calibrations used pre- or post-cruise.

Labfit file names.

Order of fit for pressure and temperature, and why chosen.

IV. Processing Information.

HP editor used (version date).

Pressure sort program used.

If multiple runs of PRSORT, give dates, reasons for reloads.

If VAX CTDED or INDEXED were run, give station numbers and reasons.

V. Data Calibration

Water sample quality (by specific station group).

Name of MLT files, version date of MLTRG.

Groupings of stations for salinity calibration.

Related data used for calibration - such as Worthington-Metcalf or previous data sets - or other special calibration methods.

Oxygen calibration method.

VI. Offlining the Data

Name of dump tape, date of offlining.

APPENDIX C.1

CTD DATA PROCESSING SUMMARY

Documentation for the programs described are available from IPC or from the CTD group.

I. PRECRUISE

The CTD acquisition program requires a description of the measurements telemetered from the instrument. Properties such as scan rate and scan length are needed to decode the instrument signal, and calibration corrections are needed for labelling and display. Precruise laboratory calibrations are used to calculate corrections which are communicated to the acquisition program by means of a common file created on magnetic tape by HP program INIT. INIT also sets up plot parameters and labelling information for AQUI. Commons can be tested using an audio tape recording from the instrument's 'big bath' calibration run.

II. AT SEA

A. Acquisition

The CTD acquisition program writes the raw data as digitized to a magnetic tape, labelled by program CTID, in CTD78 format (see W.H.O.I. 78-43). During a CTD station, the instrument signal is recorded directly on audio tape, while AQUI produces a data listing, a plot, and a 9 track magnetic tape. Station logs document time, position, depth, bottle firings, and other information about (or problems with) the station. As the CTD returns to the surface, water sample bottles are fired, and AQUI is used to tag related magnetic tape records for use in data calibration. The data from the tagged scans is also entered on the log form by the watchstanders.

B. Post-AQUI Processing

Processing of the time series data takes place at sea on an HP-RTE system. The data and labelling records are edited, and downtrace data files are packed on magnetic tape. Water sample data files are built on disk using the AQUI-tagged CTD data, and bottle values are added for comparison. Quality control plots of the downtrace CTD data and the water sample data are created with program PLUCK or CTDPL. An ASCII tape file is created which contains the water sample data files for calibration on the VAX.

III. POST-CRUISE

A. Calibrations

As soon as the instrument has returned from sea, post-cruise laboratory calibrations are made. LABFIT is used to check for shifts in the sensors. A choice must be made between pre- and post-cruise (or combined) pressure and temperature calibrations (see Foffonoff, Hayes, and Millard, 1974). As soon as pressure and temperature calibrations have been chosen, VAX program MLTRG can be run, producing conductivity calibrations and plots of residual errors. Program MLTOXDWN creates a down trace oxygen file which can be used to calculate the oxygen calibrations. For further information, see 'CTD Calibration and Data Processing Techniques at WHOI' (Millard, 1982).

B. Pressure Sorting

When calibrations have been chosen for all variables, the data from the edited tapes are pressure averaged (normally to 2 decibar intervals) on the VAX using program PRSORT.

III. VAX DATA ACCESSING AND ARCHIVING

A. Display and Quality Control

Several CTD VAX display programs exist to perform different tasks. They can list CTD data and derived variables at specified pressure intervals, produce profile plots of multiple stations or multiple variables (including water sample comparisons), and can create geographic station plots (see Georgi, Piola, and Galbraith WHOI T.R. 81-71).

Editing programs are used to identify and interpolate spurious data values, and correct header information in the index records. An averaging program creates a station file with horizontally averaged data from all stations on a cruise, and a second program, CTDIF describes the variations of each station from the average profile.

B. Data Archiving

Finalized CTD data at WHOI is archived on VAX labelled tapes. VAX utility programs are used to create these tapes and to copy the data back to disk when needed.

Disk data files are offloaded whenever a cruise subdirectory becomes inactive, usually within six months of final calibration. The subdirectory is emptied of all files except the subindex file and the cruise documentation file. These two files are then protected and become the permanent online data catalog for the cruise.

APPENDIX C.2

CTD PROCESSING PROGRAMS

CTD data is processed through a sequence of programs on the H-P and VAX computers. Program categories are calibration, acquisition, processing, edit, and display. This list indicates the computer used and the principle I/O devices for each program currently in use for CTD processing. Documentation files for all VAX programs are found in [CTDSOFT] and have a file extension .DOC.

PRE-CRUISE

LABFIT

Computer: VAX Category: calibration I/O: disk/list Determines the least squares laboratory calibrations Use 2nd order temperature fit, cubic pressure fit. Conductivity is checked for the linearity of the sensor. Input data file has file extension of .CAL. LABFIT is run twice, once with precruise laboratory calibrations, once with post-cruise calibrations.

INIT

Computer: H-P Category: calibration I/O: keyboard/tape Describes the instrument variables and laboratory calibrations to the data logging (acquisition) program.

AT SEA

CTID

Computer: H-P Category: processing I/O: keyboard/tape Creates tape header file on tape in CTD-78 Format.

AQUI

Computer: H-P Category: acquisition I/O: CTD /tape Transcribes the serial CTD observations from the instrument to digital 9 track tape in CTD78 format (SEE WHOI Technical Report No. 78-43). Also plots and creates a list of data in real-time.

CTLOG

Computer: H-P Category: processing I/O: tape/tape and disk Truncates CTD station to a down profile and extracts CTD scans associated with rosette water samples.

CTROS

Computer: H-P Category: processing I/O: keyboard and disk/disk Merges water sample salinity and oxygens with coincident CTD observations previously stored on disk by CTLOG.

CTDED

Computer: H-P Category: edit I/O: tape/tape Edits CTD78 format station data and corrects station bookkeeping and calibration information; identifies errors in CTD observations.

PLUCK

Computer: H-P Category: display I/O: disk, tape/plot, list PLUCK plots and lists CTD data and associated water sample data and derived parameters. Used to quality control raw data.

MLOUT

Computer: H-P Category: calibration I/O: disk/tape Transcribes merged water sample/CTD observations to 9 track ASCII format file in multiple regression (MLTRG) format. VAX utility COPY is used to store tape file to VAX disk.

POST-CRUISE

MLTRG2D

Computer: VAX Category: calibration I/O: disk/list Applies standard least square regression methods to determine conductivity sensor calibrations from the water sample salinity observations. Also determines oxygen calibrations.

HYDROUT

Computer: VAX Category: processing I/O: disk/disk Creates file in NODC hydrographic format (file extension .DYN) from MLTRG2D "calibrated" water sample/CTD merged data. "Calibrated" WS/CTD data file is created by MLTRG2D.

CTLAGAV

Computer: VAX Category: processing I/O: tape/disk Loads CTD78 format from tape to disk (file extension .RAW) in CTD78 format. Recursive exponential filter applied to pressure and conductivity. Useful to test calibrations on select stations.

PRSORT

Computer: VAX Category: processing I/O: tape/disk Converts time series CTD78 format data to a pressure averaged set of observations at 2 decibar intervals. First data load may include oxygen current and oxygen temperature to refine oxygen calibrations.

CTD5

Computer: VAX Category: display I/O: disk/plotter Overplots water sample/CTD salinities versus potential temperature in station groups to check conductivity calibrations.

MLTOXDWN

Computer: VAX Category: calibration I/O: disk/disk Creates WS/CTD MLTRG format file of down profile CTD observations merged with up

profile water sample salinity and oxygen. This file is used to refine the oxygen calibrations (compensate for oxygen sensor down/up hysteresis) using MLTRG2D.

DATA VALIDATION AND EDITING

CTDED

Computer: VAX Category: edit I/O: disk/disk Edits PRSORTed data files. CTDED can interpolate data, rescale oxygen, truncate data files at either end. Some diagnostics are performed for the user, and some editing can be done automatically.

CRSUMARY

Computer: VAX Category: processing I/O: disk/disk Allows a SUBINDEX.CTD; file to be created from selected station/casts loaded into a data subdirectory. The VAX utility routine DIRE/DATE/OUTPUT=TEMP.DAT *.CTD;* Must be run prior to CRSUMARY to provide a list files to be included in the SUBINDEX.CTD;1 file. The text editor can be used to modify TEMP.DAT.

INDEXED

Computer: VAX Category: edit I/O: disk/disk and list Checks for unreasonable information and allows editing of index records in Subindex file. Also transfers edited index records to station files.

CTDAV

Computer: VAX Category: processing I/O: disk/disk Creates a mean pressure-sorted data file, including standard deviation of temperature and salt, from specified station files.

CTDIF

Computer: VAX Category: processing I/O: disk/disk Compares individual station profile with mean profile created by CTDAV, to identify anomalous data.

DISPLAY AND ANALYSIS

CTDLIST

Computer: VAX Category: display I/O: disk/list Lists CTD-VAX data files to printer or terminal, at standard depths which can be changed by user. Can access all the stations in a subdirectory, or single stations, or list just the SUBINDEX file.

RADOP

Computer: VAX Category: display I/O: disk/plot or list Display program with geographic sort capabilities. RADOP can plot vertical sections, and geographic station positions.

USERDAT

Computer: VAX Category: processing I/O: disk/core. Basic data accessing program for user-supplied data manipulation. Links CTD utilities to load CTD-VAX data into memory.

CTDPL

Computer: VAX Category: display I/O: disk/plotter. Displays CTD-VAX data and derived variables.

CTDEXCH

Computer: VAX Category: processing I/O: disk/tape. Data transfer program to create ASCII data files on tape for outside users. First records in each file document the data format. The user may supply output format at run-time.

APPENDIX D.1

CTD DATA ACCESSING ROUTINES

The CTD data accessing library contains routines to open index and data files, to read index records and data files into memory, to display information from index records and to facilitate data manipulation. The file specifier including the device and directory parts are defaulted to blanks so that station and subindex files will be accessed from the users default directory in the absence of calls to subroutines DEVCE and CRUISE below.

I. FILE ACCESSING ROUTINES FROM DB2:[CTDSOFT]CTDATA/LIB

CALL CRUISE (ISHIP, ICRUISE, IPROJECT)

CRUISE specifies the subdirectory within directory [CTD], given ship, cruise, and project code. (Ship is read in A2 format, and is full integer, as are cruise and project code). The subdirectory version character defaults to D. If this must be changed, proceed the call to CRUISE with a call to PVER(PROV) in which PROV is a byte variable containing subdirectory version. The default subdirectory version D is for data sets processed through the standard CTD processing sequence. The default device is DB2:

CALL DEVCE(DEVICE)

DEVCE changes DEVICE (character *4) for input data. If DEVICE is passed as 4 blanks, DEVCE allows user to access subdirectories within the current default directory or subdirectory. Call DEVCE before cruise.

CALL INDEX(KUNIT)

INDEX opens the subindex file (integer logical unit KUNIT, which defaults to 11), reads the first index record, and stores the number of the last record in the file.

CALL RECIDX(IFIL)

RECIDX reads record number IFIL from the subindex file opened in subroutine Index.

CALL DATIDX(IFIL)

DATIDX gets the filespec from record number IFIL in the subindex file, then opens the corresponding data file (default logical Unit 10) and reads the index record from that data file. To read from a data file on a different logical unit, proceed the call to DATIDX with a call to station using a negative station number.

CALL STATION(ISTATION, ICAST, IUNIT)

STATION opens a specified data file on logical unit IUNIT and reads the record. If unit is 0 or negative, it will be set to the default unit 10. The data version character defaults to C; proceed the call to STATION with a call to DVER(DATVER) to access files with other data versions. Datver C implies that PRSORT created the file with no modifications.

Datver is also a byte variable. If ISTATION or ICAST is negative, no file is opened. CALL STATION(-1, -1, IUNIT) to modify the logical unit number of the input data file.

CALL CTERR(IERR)

CTERR checks for successful opening of subindex or data files. I*4 IERR is zero for a successful open. Other values indicate errors as described in VAX-11 FORTRAN Users Guide, under FORTRAN Routine Error Processing. Call after CRUISE and after STATION.

CALL GETDAT(IUNIT, DATA, NOBS, NVAR)

GETDAT fills the array DATA with data from IUNIT. NOBS is the integer maximum number of observations to return, NVAR is the number of variables returned in each observation. DATA array is dimensioned DATA(NOBS, 0:NVAR), with pressure in column 0. GETDAT checks for the location of pressure in the input file (IPLOC). If pressure is implicit (IPLOC=0), element 0 is generated from the minimum pressure and the pressure interval. For uniform pressure series data, the array is sorted to increasing pressure. DATA (1,0) is always the first pressure value, DATA (1,1) is always the first temperature, and DATA (1,2) is the first salt value encountered. The last variable in each scan, DATA (n, NVAR), is the quality value for that scan. A call to GETDAT will retrieve the first NOBS values of the first NVAR variables into array DATA.

CALL VARSL (MNEM, ICOL)

VARSL selects a variable from the input data file to be read into data array. Uses character *4 MNEM as mnemonic of variable to be selected. I*4 ICOL is position in array. ICOL 0, 1, and 2 are reserved for P, T, and S, and cannot be accessed by VARSL. Call after STATION, before GETDAT.

II. INDEX RECORD PRINT ROUTINES

The index record is stored in labelled common IDXREC. It is divided into five categories of information. Category one is basically the station header record from CTD78 format, and is passed as the IFHED array to HEADR and PRFH. FILDOC and BOUNDS use the labelled common and are passed only the logical unit of the print device, KOUT. See APPENDIX D.2 for a description of the IDXREC common array. All print routines are available in [CTDSOFT]UPACK/LIB.

CALL FILDOC(KOUT)

FILDOC prints the file specifier from the index record, including the date file was created.

CALL BOUNDS(KOUT)

BOUNDS prints the portion of the index record containing the mnemonics of the variables stored in the file and the minimum and maximum value of each.

CALL HEADR (KOUT, IFHED)

HEADR prints the start date, time and position of the station from Category 1 of the index record, which is passed in array IFHED.

CALL PRCAT5(IDXREC, KOUT)

PRCAT5 prints category 5 information (relevant to VAX edit operations that have been performed on the data) from the IDXREC array.

CALL PRFH(KOUT, IFHED, IFLAG)

PRFH is stored in [CTDSOFT]UPACK/LIB. See CTD78 Utility Package Documentation for details. Note that the information displayed by PRFH is relevant to the station header from the time series source data tape. IFLAG is an integer with a value of 1-4 which controls the amount of information displayed. IFLAG = 4 displays the complete header.

III. OTHER BASIC ACCESSING ROUTINES IN [CTDEV.GETDAT]CTDATA/LIB

CALL LZERO(IA)

LZERO converts an integer number IA to an ASCII character string of four characters, with unused leading digits set to ASCII zero. Used to form fixed length CTD data file specs.

CALL SCANS(A, I, J, ISCAN, ENG)

SCANS unpacks a scan of data from a data record in array A. I is the scan length, J is the number of scans in the buffer. ISCAN is the scan number to be placed in array ENG.

FUNCTIONS

NELEM (PRESS) is a function which returns the array element (scan number) implied by a pressure value, based on the minimum pressure and the pressure interval. Value returned is bounded by the number of observations (maximum) and 1 (minimum). If data is not uniformly sampled, -1 is returned.

SLAT (IDEG,IMIN) is a function which converts position information into real numbers. Latitude and longitude are stored as integers in the index record, with minutes x 100.

APPENDIX D.2

```
C      IDXREC.DIM
C INDEX RECORD FIELDS DESCRIBED
C USES LABELLED COMMON : USE INCLUDE STATEMENT TO MERGE INTO PROGS.
C RCM MAR 27 1980
C EDITS APR 24, JAN 25 81 NRG
C ARRAY IDXREC CONTAINS THE INDEX RECORD
C   ALWAYS THE FIRST RECORD OF A DATA FILE
C   AND HAS THE SAME STRUCTURE IN THE SUBINDEX FILE
C
C INDEX RECORD IS COMPOSED OF CONTROL WORDS(1-13)
C FOLLOWED BY THESE CATEGORIES:
C   1=CTD78 HEADER 2=ABREVIATED DATA DESCRIPTORS 3=TAPE
C   4= DISK FILE SPEC, 5= DISK FILE HISTORIC INFO
C
C   COMMON/INDX/ IDXREC(256)
C *****
C *****
C
C SET UP CONTROL WORDS (1ST SECTION OF INDEX RECORD)
C *****
C
C EQUIVALENCE (KEYWD,IDXREC(1))
C INTEGER CNTRL(6)!   LOCATIONS OF ALL CATEGORIES IN INDEX REC
C EQUIVALENCE (CNTRL(1),IDXREC(2))
C EQUIVALENCE (LSTREC,IDXREC(9))!NEXT AVAIL INDEX REC (IN FIRST
C                               RECORD OF SUBINDEX FILE ONLY)
C
C
C   CATEGORY 1: STATION HEADER INFO (WORDS 13-102)
C *****
C
C   INTEGER IFHED(90)!   FOR CATEGORY 1 INFO, IN CTD78 FORMAT
C
C ISHIP   IFHED 3--SHIP CODE - 2 CHARACTERS   A2
C ICRUZ   4--CRUISE NUMBER- INTEGER
C ISTAS   5--STATION NUMBER - INTEGER
C IYR     7-- LAST 2 DIGITS OF YEAR DATA ACQUIRED - INTEGER
C IMO     8--MONTH NUMBER WHEN DATA ACQUIRED - INTEGER
C IDA     9--DAY OF MONTH DATA ACQUIRED - INTEGER
C ISTME   10-- GMT OF LOWERING - 24 HOUR CLOCK - INTEGER
C ILTSD   11-- START LAT.OF LOWERING, DEGREES - INTEGER
C ILTSM   12-- START LAT. (MINUTES*100) - INTEGER
C ILNSD   13-- START LONG. OF LOWERING, DEGREES - INTEGER
C ILNSM   14-- START LONG. (MINUTES*100) - INTEGER
C INWPS   15-- No. OF 16-BIT WORDS PER DATA SCAN - INTEGER
C IHRZ    16-- NUMBER OF SCANS PER SECOND * 100
C IHRTZ   17-- FREQUENCY OF TIMING PULSE * 100 - INTEGER
C ILTED   19-- END LAT.OF LOWERING, DEGREES - INTEGER
```

C ILTEM 20-- END LAT. OF CAST (MINUTES*100) - INTEGER
C ILNED 21-- END LONG. OF CAST, DEGREES - INTEGER
C ILNEM 22-- END LONG. OF CAST (MINUTES*100) - INTEGER
C IETME 23-- GMT AT END OF FILE, 24 HOUR CL - INTEGER
C JDAY 27-- UNIQUE (JULIAN DAY)
C INST 28-- INSTRUMENT NUMBER - INTEGER
C INWS 33-- No. OF WATER SAMPLES FOR STATION - INTEGER
C IMPOS 34-- POSITION METHOD - 2 CHAR ALPHA
C IWS 35-- WIND SPEED (METERS PER SECOND) - INTEGER
C IDEP 36-- WATER DEPTH IN METERS - INTEGER
C ISTYP 37-- STATION TYPE - 2 CHARACTERS ALPHA
C ICAST 38-- CAST NUMBER - INTEGER
C

INTEGER LPGVER(4)
INTEGER ICMNT(35)! COMMENT FIELD
EQUIVALENCE (IFHED(1),IDXREC(13))

C

EQUIVALENCE

1 (IFHED(3),ISHIP),(IFHED(4),ICRUZ),(IFHED(5),ISTAS)
2,(IFHED(7),IYR),(IFHED(8),IMO),(IFHED(9),IDA)
2,(IFHED(10),ISTME)
3,(IFHED(11),ILTSD),(IFHED(12),ILTSM)
4,(IFHED(13),ILNSD),(IFHED(14),ILNSM)
5,(IFHED(15),INWPS),(IFHED(16),IHRZ),(IFHED(17),IHRTZ)
6,(IFHED(19),ILTED),(IFHED(20),ILTEM)
7,(IFHED(21),ILNED),(IFHED(22),ILNEM)
8,(IFHED(23),IETME)
*,(IFHED(33),INWS),(IFHED(34),IMPOS),(IFHED(35),IWS)
*,(IFHED(36),IDEP),(IFHED(37),ISTYP)
9,(IFHED(38),ICAST),(IFHED(27),JDAY),(IFHED(28),INST)
X,(IFHED(55),ICMNT)
3,(LPGVER(1),IDXREC(99))!ASCII DESCRIPTOR OF LOADING PROG VERSION

C

C CATEGORY 2 FOR DATA DESCRIPTION (WORDS 103-178)

C

C

DIMENSION VARDES(4,16)! VAR DESCRIPTORS AND MIN/MAX VALUES
DIMENSION IVARDES(4,16)! MNEMONIC IDENTIFIERS
EQUIVALENCE (KSCAN,IDXREC(105))! NUMBER OF DESCRIPTORS
EQUIVALENCE (MSCAN,IDXREC(106))! NUMBER OF VARIABLES/SCAN
EQUIVALENCE (RECLNG,IDXREC(107))! No. WORDS/RECORD
EQUIVALENCE (NTOT,IDXREC(108))! No. SCANS TOTAL
EQUIVALENCE (IMPVAR,IDXREC(109))! MNEMONIC OF IMPLICIT VAR
EQUIVALENCE (PMIN,IDXREC(110))! MIN PRESSURE IN FILE
EQUIVALENCE (PRSINT,IDXREC(111))! PRESSURE INTERVAL (REAL)
EQUIVALENCE (NSCANS,IDXREC(112))! No. SCANS PER RECORD
EQUIVALENCE (IPLOC,IDXREC(114))! LOC OF PRESS, = 0 IF IMPLICIT
EQUIVALENCE (VARDES(1,1),IDXREC(115)),(IVARDES(1,1),IDXREC(115))
C VARDES AND IVARDES OVERLAY. USE IVARDES TO ACCESS THE ASCII FIELDS
C AND VARDES TO ACCESS THE NUMERIC ((3,N) AND (4,N))
C VARDES(1,1) IS MNEMONIC OF 1ST VARIABLE

C VARDES(2,1) IS VARIABLE TYPE - R FOR REAL, N FOR NOT CARRIED
C VARDES(3,1) IS MINIMUM VALUE OF 1ST VARIABLE
C VARDES(4,1) IS MAXIMUM VALUE OF 1ST VARIABLE
C

C CATEGORY 4: DISK FILE DOCUMENTATION (WORDS 191-209)

C *****

C FORM CHARACTER VARIABLE FILE SPEC

BYTE BTSPEC(40)

CHARACTER*40 STSPEC

EQUIVALENCE (BTSPEC(1),STSPEC(1:1))

INTEGER FILSPEC(8),DEVICE! THESE FORM COMPLETE SPECIFIER

C

INTEGER LDATE(3),LTIME(2)! ASCII DATA FILE CREATED

INTEGER RMAX! No. OF LAST DATA RECORD IN FILE

EQUIVALENCE

1 (DEVICE,IDXREC(193)),(FILSPEC(1),IDXREC(200))

a ,(BTSPEC(1),IDXREC(200))

2 ,(LDATE(1),IDXREC(195)),(LTIME(1),IDXREC(198))

3,(RMAX,IDXREC(209))! LAST RECORD OF DATA FILE

4,(IDXLOC,IDXREC(208))!REC No. WITHIN INDEX FILE

C

C

C END LABELLED COMMON FOR INDEX RECORD

C

APPENDIX D.3

SUBIL DATAACCESS

SAMPLE PROGRAM

```
C PROGRAM DATAACCESS
C SAMPLE PROGRAM TO SHOW USAGE OF CTD-VAX ACCESSING UTILITIES
C 82-02-23
C LINK:DATAACCESS,[CTDEV.GETDAT]CTDATA/LIB,[CTDSOFT]UPACK/LIB
C
C PARAMETER NOBS=3000, NVAR=4
C
C     IDXREC.DIM SETS UP COMMON, WITH MNEMONICS FOR INDEX FIELDS
C     CTDA
C     INCLUDE 'DBA2:[CTDEV.GETDAT]IDXREC.DIM' INDEX
C
C     PRESSURE STORED AS OTH ELEMENT OF DATA ARRAY
C     NOBS IS MAX NUMBER OBSERVATIONS, NVAR IS MAX VARIABLES
C
C     DIMENSION DATA(NOBS,0:NVAR)
C     DIMENSION TEMP(NOBS),SALT(NOBS),QUAL(NOBS)
C     DIMENSION PRESS(NOBS)
C     EQUIVALENCE (TEMP(1),DATA(1,1)),(SALT(1),DATA(1,2))
C     EQUIVALENCE (QUAL(1),DATA(1,NVAR))
C     EQUIVALENCE(PRESS(1),DATA(1,0))
C     BYTE PROVER,DATVER
C     DATA IUNIT/10/      !INPUT DATA FILE UNIT ← common TEMP, SALT, PRESS
C
C     GET INFORMATION TO FIND SUBDIRECTORY
C
C     PRINT *, ' ENTER SHIP, SUBDIRECTORY VERSION CHARACTER '
C     READ(5,1000) ISHIP,PROVER
1000 FORMAT(A2,X,A1)
C     PRINT *, ' ENTER CRUISE No., PROJECT No. '
C     READ(5,*) ICRUIS,IPROJ
C
C     FOR DIRECTORY VERSION CHARACTER OTHER THAN D, USE ENTRY PVER
C     IF(PROVER.NE.'D') CALL PVER(PROVER)
C
C     CRUISE FINDS SUBDIRECTORY WITHIN [CTD], OPENS SUBINDEX FILE
C     CALL CRUISE(ISHIP,ICRUIS,IPROJ)
C
C     GET INFORMATION FOR STATION FILE
C
C     PRINT *, ' ENTER STATION No., CAST No. '
C     READ (5,*) ISTAT,ICAST
C     PRINT *, ' ENTER DATA VERSION CHARACTER '
C     READ (5,1050) DATVER
1050 FORMAT(A1)
C     FOR DATA VERSIONS OTHER THAN C, USE ENTRY DVER
C     IF(DATVER.NE.C) CALL DVER(DATVER)
```

```
C      STATION CALL LIST IS STATION,CAST,AND INPUT UNIT
CALL STATION(ISTAT,ICAST,IUNIT)
C
C      DISPLAY STATION HEADER INFORMATION
C      PRFH LIST IS OUTPUT UNIT,ARRAY,AND OPTION(3 = SHORT LIST)
CALL PRFH(6,IFHED,3)
C
C      GET STATION DATA
C      GETDAT FILLS ARRAY DATA FROM INPUT UNIT
CALL GETDAT(IUNIT,DATA,NOBS,NVAR)
C
C      LIST DATA ARRAY
PRINT *,' INPUT START PRESSURE,END PRESSURE FOR LIST'
READ (5,*) PRES1, PRES2
C      FUNCTION NELEM RETURNS ARRAY ELEMENT NUMBER CORRESPONDING TO PRESSURE
C      VALUE(BOUNDED). FOR NON-UNIFORM PRESSURE SERIES, -1 IS RETURNED.
NP1 = NELEM(PRES1)
NP2 = NELEM(PRES2)
C
DO 60 J = NP1, NP2
WRITE (6,600) (PRESS(J),TEMP(J),SALT(J),QUAL(J))
600  FORMAT(2X,F8.1,3F9.3)
60  CONTINUE
STOP
END
```

SAMPLE RUN

```
§ RUN DATACESS
ENTER SHIP,SUBDIRECTORY VERSION CHARACTER
AT,D
ENTER CRUISE No., PROJECT No.
109,11
ENTER STATION No., CAST No.
106,0
ENTER DATA VERSION CHARACTER
M
SHIP AT CRUISE 109 STATION 106 DATA VERSION 4010
START 35 38.30 N 27 23.26 W AT 429 81/ 7/20
END 35 38.30 N 27 23.26 W AT 506
WIND = 6 DEPTH = 3058 POS. = SA STA. TYPE = CL
W/SCN = 7 SRATE = 3125 FREQ. =6000 INST. NO. = 8
EDIT DATE 81/ 7/25 QUAL. = 0 WAT. SAM. = 0
PMIN = 0 PMAX = 2803
INPUT START PRESSURE ,END PRESSURE FOR LIST
1,7
1.0 21.644 35.760 2.517
3.0 21.648 36.468 2.395
5.0 21.650 36.469 2.377
7.0 21.649 36.471 2.381
```

REFERENCES

- Fofonoff, N. P., S. P. Hayes and R. C. Millard, Jr. (1974) WHOI/Brown microprofiler: Methods of calibration and data handling. Woods Hole Oceanographic Institution Technical Report No. 74-89.
- Georgi, D. T., A. R. Piola, and N. Galbraith (1981) Pressure, Temperature, Salinity and Dissolved-Oxygen Profile Data from R/V Atlantis II, Cruise 107 - Leg X. Woods Hole Oceanographic Institution Technical Report No. 81-71.
- Millard, R. C., Jr. (1982) CTD Calibration and Data Processing Techniques at WHOI using the 1978 Practical Salinity Scale. Proceedings of the MTS Conference, San Diego, February, 1982.
- Millard, R. C., Jr., A. Blumer and N. Galbraith (1978) A digital format for Woods Hole Oceanographic Institution CTD data. WHOI Technical Report No. 78-43.
- VAX/VMS Command Language Users Guide, May, 1981. Digital Equipment Corp.
- VAX-11 Fortran Language Reference Manual, April, 1980. Digital Equipment Corp.
- VAX-11 Fortran Users Guide, April, 1980. Digital Equipment Corporation.

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20.

A data storage format has been developed to be used for processed C.T.D. data on the Woods Hole Oceanographic Institution's Digital Equipment Corporation VAX 11 780 computer. CTDVAX as defined in this report is designed as a flexible internal data format. Station data is organized by ship-cruise-project using a VAX-supplied subdirectory system on disk.

This report describes the data organization, file structures, and record formats. File naming conventions, data protection and documentation schemes are explained. Outlines are given of the data processing system in use and of the CTD data accessing utilities available on the VAX.