SAMS CTD data processing protocol
Issue 1

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Table of Contents

Introduction

The procedures described in this report were devised to process Seabird CTDs from the 2007 cruise D321b. It is proposed that these procedures should form the basis of all future Seabird CTD processing until such time as a better procedure is found.

The aim of this process is to create:

a. A complete file of calibrated and despiked data at 24Hz sampling rate for archiving at BODC;
b. A file of calibrated/validated and despiked data at 2db intervals of a limited number of parameters, in ASCII format, for archiving at BODC and at the CLIVAR data centre (as part of the WHP- WOCE Hydrographic Programme).

During D321b, the data were collected using two different CTD systems: one housed in a stainless steel (SS) frame and the other in a titanium (Ti) frame (for more details, see cruise report: Sherwin, T., Baker, A., Brand, T., Fromlett, J., Gibson, R., Gieschen, L., Harden-Davies, H., Holland, R., Hinz, D., Inall, M., Kirkham, A., McKendrick, K., Nielsdottir, M., Painter, S., Porter, M., Reynolds, A., Sauer, S., Thomalla, S., Venables, E., Veszelovski, A. (2008) *Cruise D321b: Reykjavik to Clyde*, August and September 2007, SAMS Internal Report 255, Dunstaffnage Marine Laboratory, Oban, pp 160). The CTD in the SS frame was equipped with dual temperature and conductivity sensors, the one in the Ti frame had only single temperature and conductivity sensors. The data process and parameters applied to both systems is presented thereafter.

A step-by-step guide for users can be found in appendix A.

I. Data processing overview

The basic concept of the CTD data processing is:

During the cruise:

- process the 24Hz raw data using the standard Seabird Seasoft routines
- despike the data in Matlab
- average the data in 2 db-bins in Seasoft
- produce plots of the data (for the undespiked 24Hz, the despiked 24hz and the 2db-bin averaged datasets)

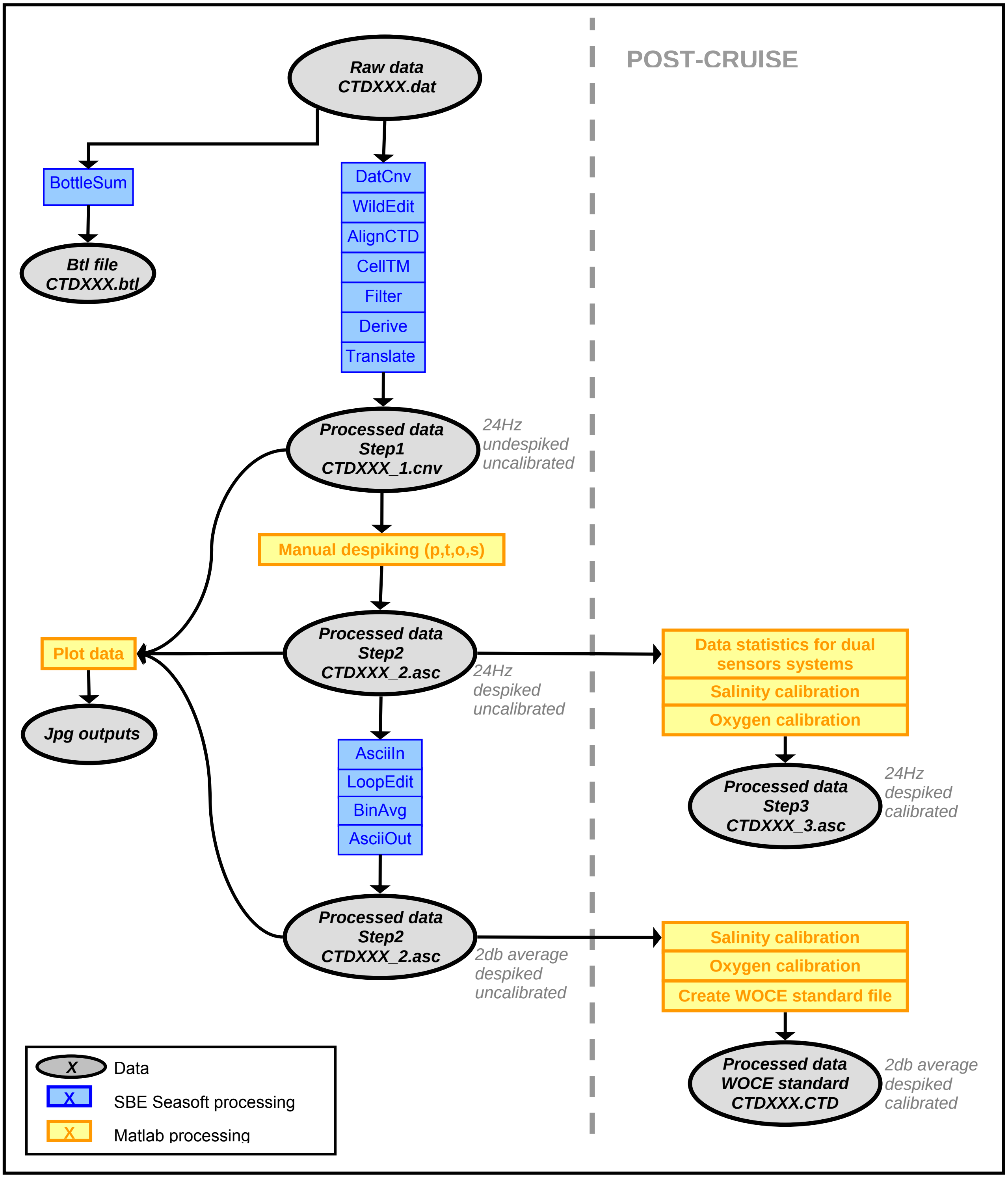
Post-cruise:

- calibrate the 24Hz and the 2db-bin averaged data
- create the WHP standard file (see details in the Annex IV-G)

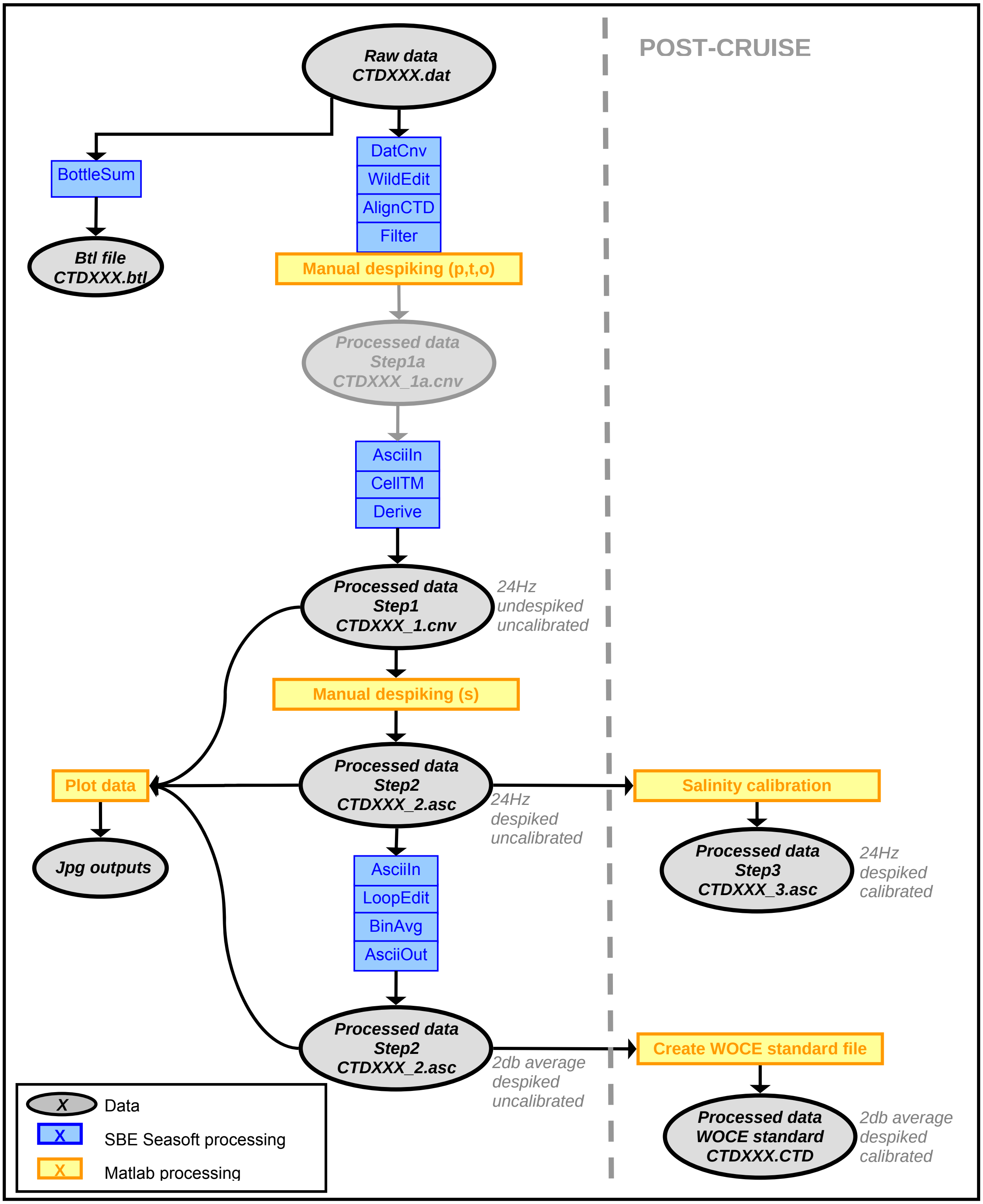
The processing for the SS and the Ti casts is schematised in I.A below. Details of each step are described in section II and III.

It has been described in the cruise report that there was a severe contamination of the CTD data due to a surging problem, making the temperature, salinity and oxygen data (and maybe other variables as well) very "noisy" in parts of the cast and some "blips" appearing in the profile. The temperature and conductivity sensors on the Titanium frame were even more affected by this problem and after a first process many spikes were found in the salinity data. The problem had been encountered and documented before (cruise P314 in 2004). The spikes are generated by the Seabird Seasoft module Cell Thermal Mass, which uses the temperature difference between 24 Hz data pairs to estimate the effect of the cell's thermal inertia. Consequently any spike creates a large jump in conductivity that returns exponentially. Therefore, for the D321b Ti casts only, it has been decided to despike the temperature and conductivity data in Matlab before deriving the salinity data in Seabird Seasoft. The step1 routine had to be divided into two sub-routines: step1a and step1b as shown in I.B. This data processing is much more time-consuming and should be seen as a rather exceptional case. The usual process is the one applied to the SS casts (I.A- 'Normal' Procedure), on which this report will focus.

A. Normal Procedure



B. Special Procedure (D321b Ti casts)



II. Seabird Seasoft processing routines

The data are processed according the common standards, using Seabird Data Processing version 7.15 (part of the Seasoft-Win32 suite). The modules run are described below. A complete list of all the variables and constants used can be found in the annex (IV.D)

A. Seasoft modules

1. Data Conversion

Converts raw data to engineering units from .dat file (…). Stores the converted data in a .cnv file and (optional) .ros file.

Parameters:

- scans to skip over = 0
- binary output
- upcast and downcast data
- create both data and bottle file
- source of scan range data = scans marked with bottle confirm bit
- scan range offset = 0
- scan range duration = 2

Output variables:

- scan number
- pump status
- Julian day
- latitude
- longitude
- pressure (db)
- temperature (primary, ITS90 °C)
- conductivity (primary, mS/cm)
- temperature (secondary, ITS90 °C)*
- conductivity (secondary, mS/cm)*
- oxygen (mg/l for SS casts, µmol/kg for Ti special casts)
- beam attenuation (1/m)
- altimeter (m)
- fluorescence (µg/l)
- beam transmission (%)

2. Wild Edit

Wild Edit marks wild points in the data by replacing the data value with badflag. The badflag value is documented in the input .cnv header. Wild Edit's algorithm requires two passes through the data: the first pass obtains an accurate estimate of the data's true standard deviation, while the second pass replaces the appropriate data with badflag.

Parameters:

- Standard deviations for pass one = 2
- Standard deviations for pass two = 20
- Scans per block = 100
- Exclude scans marked bad

Variables processed:

- pressure
- temperature (primary)
- conductivity (primary)
- temperature (secondary)*
- conductivity (secondary)*
- oxygen
- beam attenuation
- altimeter
- fluorescence
- beam transmission

* Only applicable for the dual-sensors system casts

3. Align CTD

Align CTD aligns parameter data in time, relative to pressure. This ensures that calculations of salinity, dissolved oxygen concentration, and other parameters are made using measurements from the same parcel of water.

Parameters: oxygen +4s

NB: Seabird recommends advancing the oxygen data by +2 to +5 seconds relative to pressure.

4. Cell Thermal Mass

Cell Thermal Mass uses a recursive filter to remove conductivity cell thermal mass effects from the measured conductivity.

Parameters:

- thermal anomaly amplitude: $\alpha = 0.03$
- thermal anomaly time constant: $1/\beta = 7$

NB: constants given by Seabird

5. Filter

Filter runs a low-pass filter on one or more columns of data. A low-pass filter smoothes high frequency (rapidly changing) data. To produce zero phase (no time shift), the filter is first run forward through the data and then run backward through the data. This removes any delays caused by the filter.

Parameters: low-pass filter = 0.2 for pressure

NB: Seabird recommends using a value ~4 times the data frequency, which would correspond here to 0.167. After a few tests it was decided that the value of 0.200 gave the best results for the D321b data.

6. Derive

Derive uses pressure, temperature, and conductivity from the input .cnv file to compute (…) oceanographic parameters.

Variables derived:

- density sigma-theta (kg/m^3)
- salinity (primary, psu)
- salinity (secondary, psu)*

NB: Derive needs to use the ctd CON file. For the batch processing to work, the CON file should be in the same directory as the data file. The easiest way is therefore to copy and paste all the CON files from the raw_data directory to the 1_cnv directory (or for the Titanium special cases in the 1b_cnv directory).

7. Translate

Translate changes the converted data file format from binary to ASCII and writes the data to an output .cnv file.

NB: the data has been kept in binary format up to this stage to avoid any loss in precision that could occur when converting to Ascii, possibly resulting in slightly different salinity calculations at the Derive stage.

8. BottleSum

Bottle Summary reads a .ros file created by Data Conversion and writes a bottle data summary to a .btl file. […]The output .btl file includes:

- ✧ *Bottle position, optional bottle serial number, and date/time*
- ✧ *User-selected derived variables computed for each bottle from mean values of input variables (temperature, pressure, conductivity, etc.)*
- ✧ *User-selected averaged variables computed for each bottle from input variables*

The maximum number of scans processed per bottle is 1440.

In addition to the .ros input file, if a .bl file created by SEASAVE (same name as input data file, with .bl extension) is found in the input file directory, Bottle Summary uses bottle position data *from the .bl file. The bottle position data defines the bottle firing sequence the .bl file contains the bottle firing sequence number, bottle position, date and time, and beginning and ending scan number for each bottle.*

Parameters: Averaged variables = select all

Derived variables = density sigma-theta (kg/m^3), salinity (primary, psu), salinity (secondary, psu)*

9. Ascii In

NB: After going through Matlab, the data files need to be re-formatted to be recognised by SBE Data Processing.

ASCII In adds a header to a .asc file that contains rows of ASCII data. The data can be separated by spaces, commas, or tabs (or any combination of spaces, commas, and tabs). The output file, which contains both the header and the data, is a .cnv file. ASCII In can be used to add a header to data that was generated by a non-SEASOFT program.

Parameters: scan interval = 0.041667s (≈ 24Hz)

Input variables:

- scan number
- pump status
- Julian day
- latitude
- longitude
- pressure (db)
- temperature (primary, ITS90 °C)
- conductivity (primary, mS/cm)
- temperature (secondary, ITS90 °C)*
- conductivity (secondary, mS/cm)*
- oxygen (mg/l or µmol/kg for the special Ti case).
- beam attenuation (1/m)
- altimeter (m)
- fluorescence (µg/l)
- beam transmission (%)
- density sigma-theta (kg/m^3)
- salinity (primary, psu)
- salinity (secondary, psu)*
- flag

NB: during the despiking process in Matlab, flagged erroneous oxygen values have been set to NaN. The AsciiIn module replaces the NaN values with the last value found for that variable (i.e. here the last oxygen value not flagged). Replacing the NaN by a "badflag" value in the Matlab routine (e.g. 0 or 9999) is not an option, as this value would be treated as a real measurement in the following SBE processing modules and included in the calculations of the bin-averaged data. There is no option in the AsciiIn module to replace a NaN by a badflag.

In theory the NaNs should be single isolated points, and replacing them with the value from the previous scan should not make a massive difference. However, if blocks of oxygen data are set to NaN during the Matlab despiking, this step of the process should be re-considered carefully and the Matlab routines would probably need to be modified. A solution could be to treat oxygen data as temperature and salinity during the despiking process, i.e. to erase the whole scan if a value is bad instead of setting it to NaN; or to find a way for NaNs to be recognised by the SBE software.

10. Loop Edit

Loop Edit marks scans bad by setting the flag value associated with the scan to badflag in input .cnv files that have pressure slowdowns or reversals (typically caused by ship heave). Optionally, Loop Edit can also mark scans associated with an initial surface soak with badflag. The badflag value is documented in the input .cnv header.

Parameters:

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* Only applicable for the dual-sensors system casts

- Fixed minimum velocity = 0.25m/s
- Remove surface soak: depth = 10m, min soak depth = 5m, max soak depth = 20m (NB: this function does not appear to work).
- Exclude scans marked as bad

11. Bin Average

Bin Average averages data, using averaging intervals based on pressure range, depth range, scan number range or time range.

Parameters:

- bin size = 2db
- include number of scans per bin
- downcast only
- exclude scans marked bad
- no scan to skip over
- do not include surface bin

12. Ascii Out

ASCII Out outputs the header portion and/or the data portion of a converted data file (.cnv). The data portion is written in ASCII engineering units to a .asc file, and may be useful if you are planning to export converted data for processing by other (non-Sea-Bird) software. The header portion is written to a .hdr file.

Parameters:

- output header and data files
- exclude scans marked as bad
- bad flag value = 999.999

Output variables:

- pressure (db)
- temperature (primary, ITS90 °C)
- conductivity (primary, mS/cm)
- temperature (secondary, ITS90 °C)*
- conductivity (secondary, mS/cm)*
- oxygen (μmol/kg)
- beam attenuation (1/m)
- altimeter (m)
- fluorescence (μg/l)
- beam transmission (%)
- density sigma-theta (kg/m^3)
- salinity (primary, psu)
- salinity (secondary, psu)*
- number of scans per bin
- flag

B. Batch processing

The modules described above can be run in batch files.

For the normal casts, step1 includes Data Conversion, Wild Edit, Align CTD, Cell Thermal Mass, Filter, Derive, Translate and BottleSum. The batch file step2 calls the modules Ascii In, Loop Edit, Bin Average and Ascii Out.

For the special (Ti) casts, step1a consists of the modules Data Conversion, Wild Edit, Align CTD and Filter; step1b Ascii In, Cell Thermal Mass and Derive; and step2 Ascii In, Loop Edit, Bin Average and Ascii Out.

* Only applicable for the dual-sensors system casts

III. Matlab processing routines

All the Matlab routines were created and run in Matlab version 7.4.0.287 (R2007a).

A. Step1: despiking

1. Normal casts

The Matlab step1 routine is run after the Seabird data processing modules Data Conversion, Wild Edit, Align CTD, Cell Thermal Mass, Filter, Derive, Translate and BottleSum. In this routine, the pressure, oxygen, temperature (primary and secondary) and salinity (primary and secondary) data are manually despiked using the function Scrollingplot. This tool provides a graphic interface where the data can be plotted, scrolled through, and bad data can be flagged manually (for further details on Scrollingplot see: http://www.mathworks.com/matlabcentral/fileexchange/loadFile.do?objectId=14255). Any data recorded while the pumps were not on are deleted by the user at this stage.

Notes on the despiking:

- When a spike occurs in the pressure, temperature or salinity data, making that/those point(s) flagged as bad, the whole corresponding scan is deleted.
- When a spike occurs in the oxygen data, making that point flagged as bad, the erroneous value is set to NaN, and other variables of the scan (i.e. temperature, salinity, etc) are kept in the dataset (if not flagged as bad themselves).
- During D321b (as described in the cruise report), there was a severe contamination of the CTD data due to a surging problem, making the temperature, salinity and oxygen data (and maybe other variables as well) to be very "noisy" in parts of the cast and some "blips" appearing in the profile. These parts of the dataset have not been removed during the despiking process, or anywhere in the whole data process as it was very difficult to establish which part of the dataset was erroneous and which part was right. The only spikes removed were the ones corresponding to obvious erroneous readings from the sensors. Usually these were single points and/or standing out clearly from the rest of the data.

2. Special (Ti) casts

The Matlab step1a routine was run after the Seabird data processing modules Data Conversion, Wild Edit, Align CTD and Filter. In the routine step1a the pressure, oxygen and temperature data were manually despiked using the function Scrollingplot (same process as described for the normal casts).

The step1b routine was run after the Seabird data processing modules Cell Thermal Mass and Derive. In this routine, the salinity data were manually despiked using the function Scrollingplot.

B. Step1.5: Data plot

Graphs of the data at different processing stages are produced by the routine CTD_plot.m. The datasets used are from the files:

- \1_cnv\CTDXXX_1.cnv (24Hz, not despiked, not calibrated)
- \2_cnv\CTDXXX_2.cnv (24Hz, despiked, not calibrated)
- \BinAverage\CTDXXX_2.cnv (2db-bin, despiked, not calibrated)

For each of the dataset, the plots produced are:

- primary & secondary* temperatures vs. pressure
- primary & secondary temperatures difference vs. scan number*
- primary & secondary* conductivities vs. pressure
- primary & secondary conductivities difference vs. scan number*
- primary & secondary* salinities vs. pressure

* Only applicable for the dual-sensors system casts

- primary & secondary salinities difference vs. scan number*
- density (sigma-theta) vs. pressure
- oxygen vs. pressure
- fluorescence vs. pressure
- transmittance vs. pressure

C. Step2: Post-cruise calibration and formatting

This routine:

- Compiles the final SBE header. Because of the Matlab routine in the middle of the process, the header has been split in two different files. The complete version is saved as CTDXXX.hdr in the Final_WHP directory.
- Calculates simple statistics on the SS data (on the difference between primary and secondary sensor measurements), before and after despiking the data.
- Calibrates the data

  Note on the D321b data calibration:

  For the SS casts:

  - The salinity and oxygen data were calibrated, using the following equations:
    - $Sal1_{calibrated}$ = 0.9969 $Sal1_{uncalibrated}$ + 0.0908 (units: psu)
    - $Sal2_{calibrated}$ = $Sal2_{uncalibrated}$ - 0.0111 (units: psu)
    - $Ox_{calibrated}$ = 0.9142 $Ox_{uncalibrated}$ + 6.6769 (units: µmol/l)

      ⇔ $Ox_{calibrated}$ = 0.9142 $Ox_{uncalibrated}$ + 0.2137 (units: mg/l)
  - The oxygen data were converted from mg/l to µmol/kg using the equation:
    - Ox[µmol/kg] = Ox[ml/l]*44660/(sigma-theta+1000)

  (NB: equation from Seabird application note 64)

  For the Ti casts:

  The salinity data was calibrated, using the following equation:

  - $Sal_{calibrated}$ = 1.0033 $Sal_{uncalibrated}$ -0.1235 (units: psu)

  NB: there has been no calibration of the oxygen data as no calibration data were available.
- Outputs the data in the WHP (WOCE Hydrographic Programme) standard format, gathering the metadata information required from the cnv file. An example of this format is shown in the Annex (IV-G). This is the format required for data submission to the WHPO (WHP Office).

  Mandatory variables are pressure, temperature, salinity and oxygen. Associated with them are the number of scans averaged per bin and a quality flag tag. Each digit corresponds to a quality flag for each variable (in the order p, t, s, o). NB: the variables bearing a quality flag are the ones underlined by 7 stars in the header. Due to the surging problems encountered in all of the CTD casts of D321b it has been decided to attribute the following flags for the variables:

  - Pressure: 2 = acceptable measurement
  - Temperature: 3 = questionable measurement
  - Salinity: 3 = questionable measurement
  - Oxygen: 3 = questionable measurement for the SS casts and 1= Not calibrated for the Ti casts.

  Additional variables have been included in the WHP file: transmittance (%) and fluorescence (mg/m^3). These variables have not been despiked, and no quality flag has been assigned to them.

* Only applicable for the dual-sensors system casts

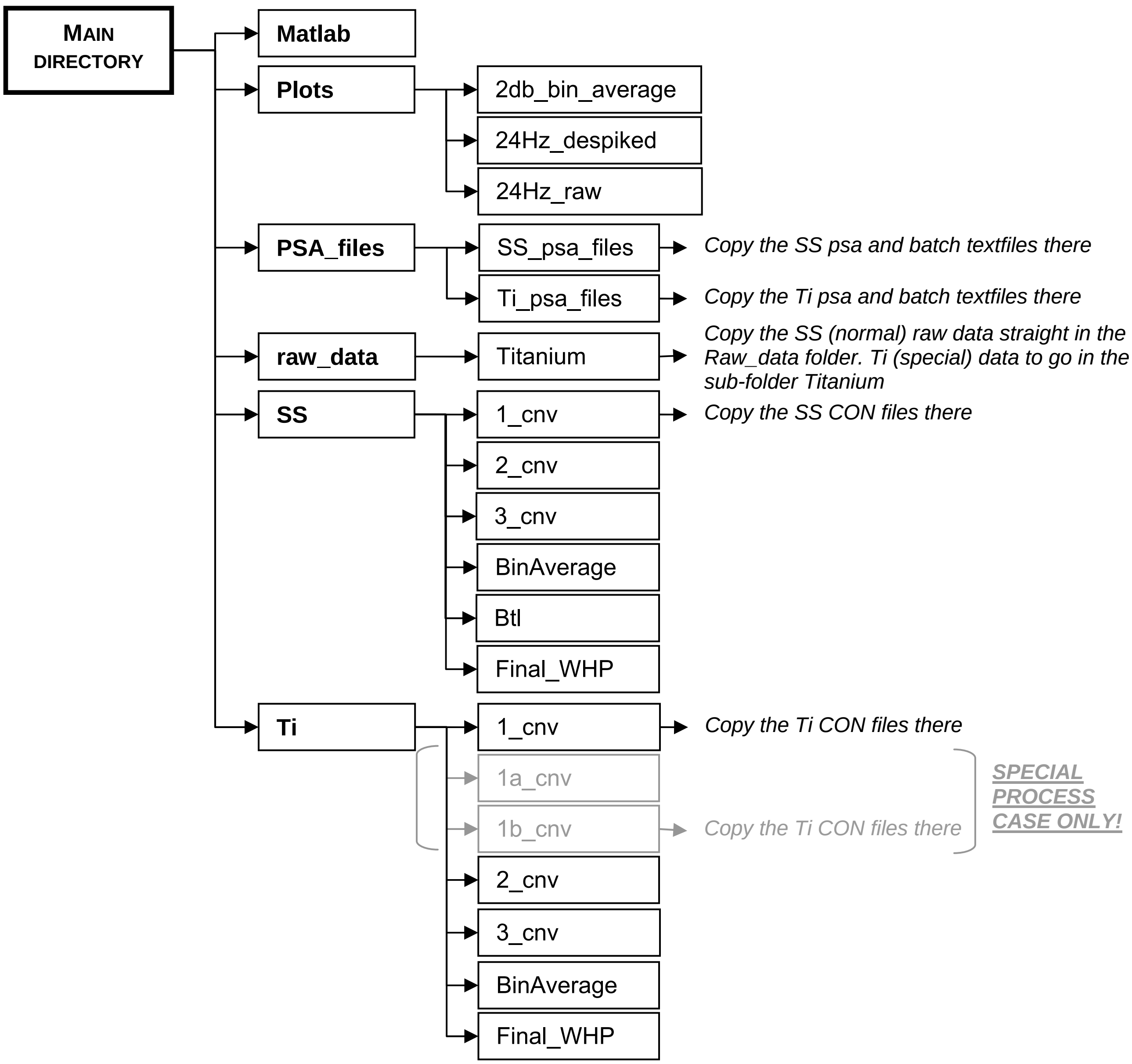
APPENDICES

IV. Appendices

A. Step-by-step guide

NB: all the SBE psa and batch files and the Matlab routines can be found under M:\Mar_Phys\ctd_data\CTD_processing

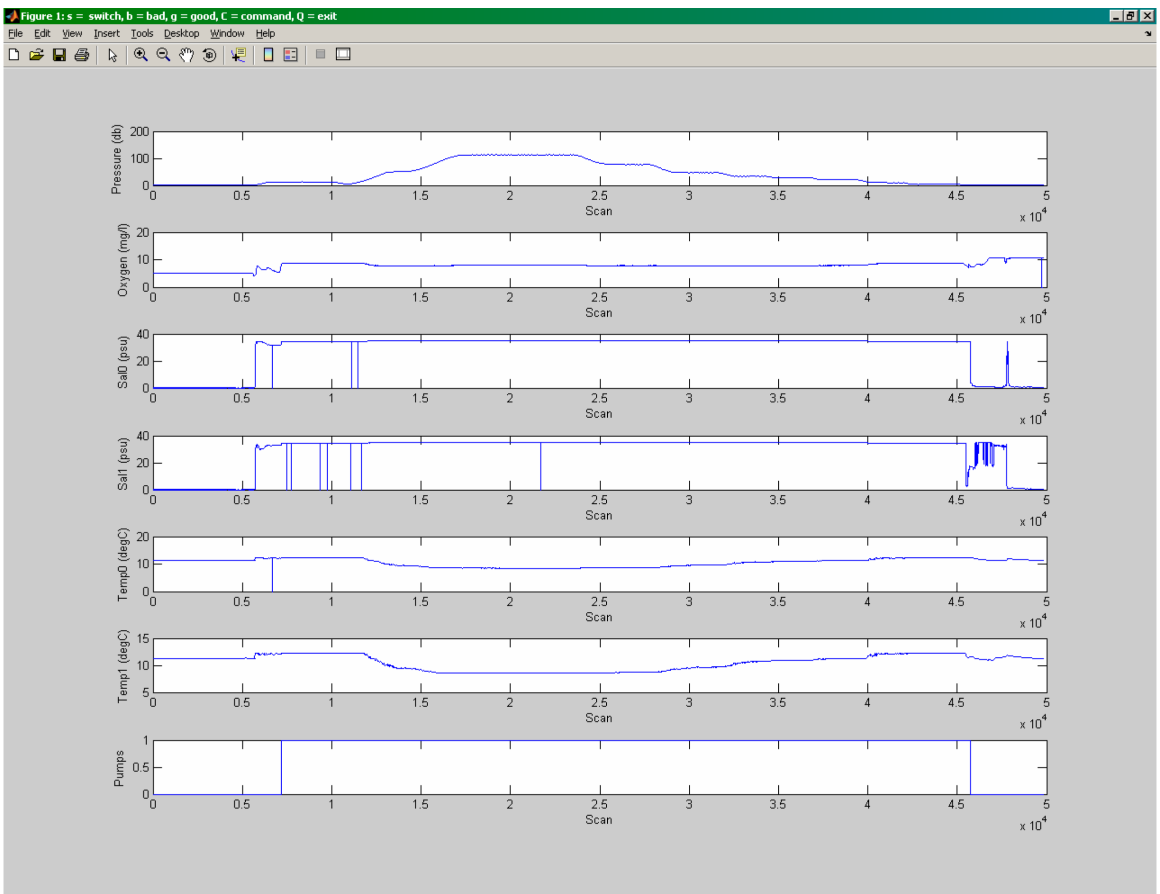
1- *Before starting:*
Set up your working directory and sub-directories as shown below (or copy the file structure from M:\Mar_Phys\ctd_data\CTD_processing\Folder_structure).



NB: this is an example of the processing of a Stainless Steel cast. To process a Titanium cast, replace ‘SS’ by ‘Ti’ in the commands / instructions.

2- *SBE step1: conversion of raw data and processing*
In Windows, click on **Start → Run** and type in the command:
`sbebatch` *`Main_Directory`*`/PSA_files/SS_psa_files/CTDProcess_step1_SS.txt` *`filename Main_Directory`*
NB: no extension after the filename (e.g. ctd001 and not ctd001.dat)
Output in folder SS\1_cnv: ctdXXX.cnv (intermediate step), ctdXXX_1.cnv, ctdXX.ros.
Output in folder SS\Btl: ctdXXX.btl

3- *Matlab step1: data despiking*
In Matlab, set the Current directory to your *Main_Directory*/Matlab
Type in **CTDProcess_step1** and Enter.
When asked, enter the Main_directory path (no backslash at the end!), cast number (=filename) and type of cast (SS, Ti or Ti special).
After a few seconds the despiking window will pop up (cf example below), followed by a second one. It is advisable to use the first despiking window to delete the biggest spikes, and use the second one for a close-up on the data and remove the smaller spikes.



How to despike the data:
- Use the zooms and pan tools to scroll through the plot.
- To flag some bad data: press 'b' on the keyboard and select the bad data on the screen using the Data Cursor tool . The points will turn red on the plot where you selected them, and will be circled in green on the other plots.
- If a mistake is made, the 'bad' data can be turned to 'good' by pressing 'g' and reselecting the data (Data Cursor Tool again). The red dots will remain but the green circles should disappear.

When finished, press 'Q' and close the window.

Tips:

- Start by flagging the data on the Pumps plot where the value is equal to zero (i.e. when the pumps are off, usually at the start and at the end).
- There seems to be some issues with the zooming tools. In theory when you zoom on one of the subplots, the other subplots should update to the same location, but it does not always work perfectly. If things get too confused, the easiest thing to get back to the proper scale and range on all subplots is probably to zoom back to the full extent. To do this, double-click with the Zoom Out tool on the subplot you zoomed in. If this does not do the trick you will probably need to try zooming out on all the subplots until the full extent and scale are restored.

Output in <u>folder SS\2_cnv</u>: ctdXXX_2a.asc (intermediate step), ctdXXX_2.asc

4- <u>*SBE step2: bin-averaging*</u>

In Windows, click on **Start → Run** and type in the command:

```
sbebatch   Main_Directory/PSA_files/SS_psa_files/CTDProcess_step2_SS.txt
filename Main_Directory
```

NB: no extension after the filename (e.g. ctd001 and not ctd001.dat)

Output in <u>folder SS\BinAverage</u>: ctdXXX_2.asc, ctdXXX_2.hdr

5- <u>*Matlab step 1.5: data plot*</u>

In Matlab, check that the Current directory is *Main_Directory*/Matlab.

Type in **CTD_plot** and Enter.

When asked, enter the Main_directory path (no backslash at the end!), cast number (=filename) the cast number (=filename).

Output in <u>folder \Plots\24Hz_raw</u>: CheckPlot_24hz_r_ctdXXX.jpg

Output in <u>folder \Plots\24Hz_despiked</u>: CheckPlot_24hz_d_ctdXXX.jpg

Output in <u>folder \Plots\2db_bin_average</u>: CheckPlot_2db_bin_ctdXXX.jpg

6- <u>POST-CRUISE:</u> <u>*Matlab step2: calibration and standard WHP file creation*</u>

The last Matlab routine is run when the calibration data has been made available. ***For each new calibration (i.e. each cruise) the equations need to be modified. All the calibration equations are located at the start of the routines*** *CTDProcess_step2.m and CTDProcess_step2_batch.m. When modifying the equations change the constants, but keep the variable names as they are (e.g. G2sal0, ox_calib_mgl, etc). Make sure the units of the equations terms are PSU for salinity and mg/l for oxygen.*

In Matlab, check that the Current directory is set to *Main_Directory*/Matlab.

<u>To process the casts one at a time</u>: type in **CTDProcess_step2** and Enter.

When asked, enter the Main_directory path (no backslash at the end!), the cast number (=filename), and the various quality flags (options for flag values will be shown on screen).

To process all of the casts at the same time, use the routine **CTDProcess_step2_batch**. The routine establishes a list of all the processed files by listing all the asc files existing in the Bin_Average directory. However, files from the 1_cnv and 2_cnv directories are also used by this routine, therefore you must make sure all of the files are still in the directory where they have been created! When asked, enter the Main_directory path (no backslash at the end) and the quality flags (options for flag values will be shown on screen).

Output in the folder SS\3_cnv: ctdXXX_3.asc
Output or modified in the folder SS\3_cnv: CTD_statistics.txt
Output in the folder SS\Final_WHP: ctdXXX.CTD, ctdXXX.hdr

GENERAL COMMENTS:

- **Do not move, modify, rename or delete any files before the complete end of the processing (including the post-cruise processing), or else the SBE / Matlab routines may fail!**
- **Check carefully the WHP file (ctdXXX.CTD) header at the end of the processing, as some errors may occur, especially for the station and cast numbers. This information is inputted manually by the CTD operator, and variants in the input format could cause problems (e.g. if "station A" has been entered instead of "A").**

B. Output files summary

Folder	Filename	File type	Data frequency	Despiked	Calibrated	Description
1_cnv	ctdXXX **ctdXXX** ctdXXX_1	ros **cnv** cnv	24 Hz 24 Hz 24 Hz	NO	NO	Water bottle data **CTD data** CTD data – intermediate step
2_cnv	ctdXXX_2a **ctdXXX_2**	cnv **cnv**	24 Hz 24 Hz	YES	NO	CTD data – intermediate step **CTD data**
3_cnv	**ctdXXX_3**	**asc**	24 Hz	YES	YES	**CTD data**
BinAverage	**ctdXXX_2** ctdXXX_2 ctdXXX_2	**asc** cnv hdr	2 db 2 db 2 db	YES	NO	**CTD data** CTD data – intermediate step Header part 2
Btl	ctdXXX	btl	N/A	N/A	N/A	Water bottle data summary
Final_WHP	**ctdXXX** ctdXXX	**CTD** hdr	2 db 2 db	YES	YES	**CTD data** Complete header

C. Data submission to the WHPO

The .CTD files, along with the cruise report and the rest of the data (for more details see Joyce, T. and Corry, C., 1994, *WHP 90-1 : Requirements for WHP Data Reporting,* WOCE report 67/91, 144pp, available at http://cchdo.ucsd.edu/manuals.htm) can be sent to the WHPO via ftp.
Details of the ftp server:

Name	whpvax.whoi.edu (or 128.128.20.21)
Username	exchange
Password	woce
Commands	cd woce_write
	Put *file.dat*

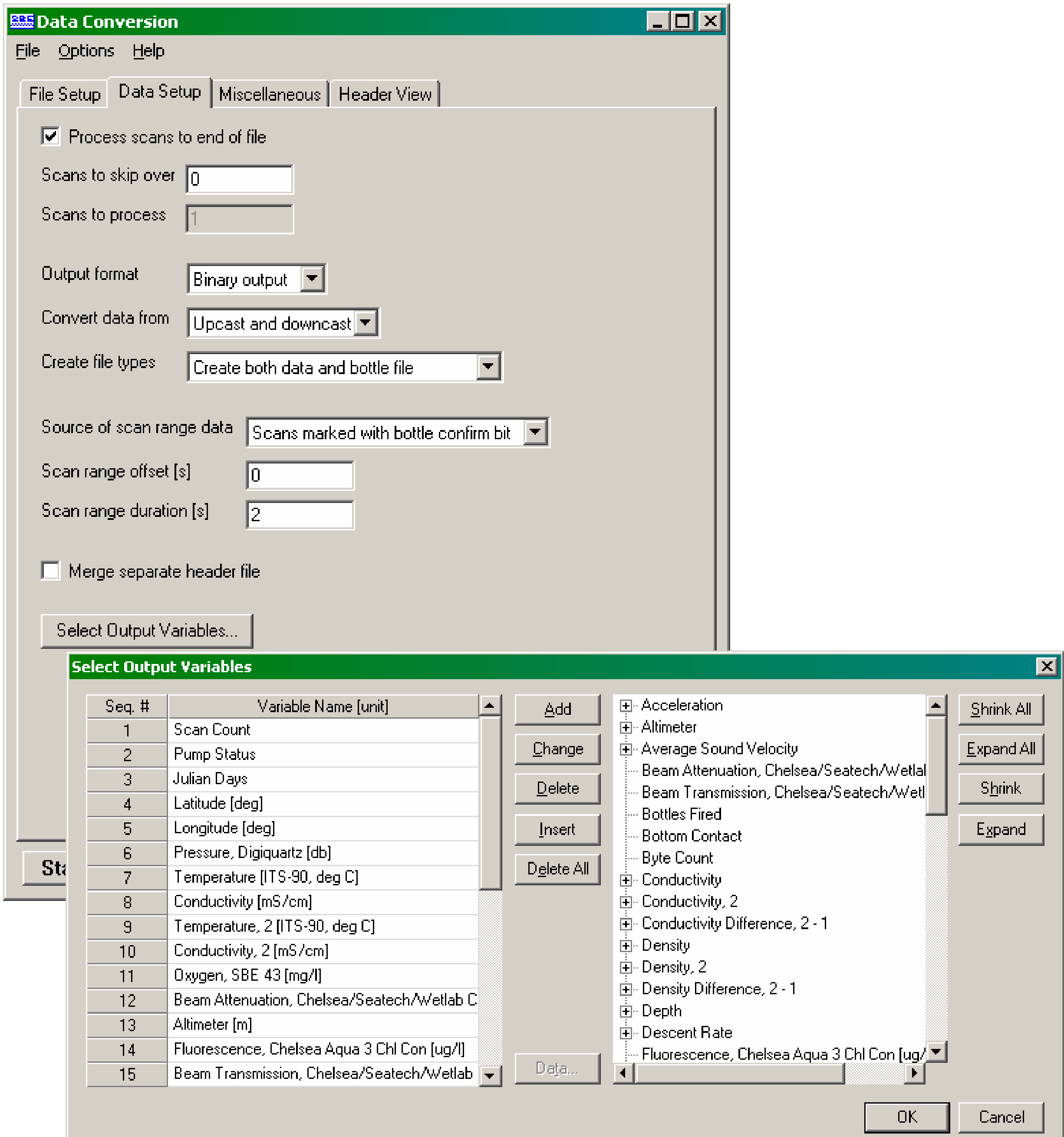
When files are submitted, please notify Jane Dunworth (jdunworth@whoi.edu) of the files sent (filenames and type of file/data).

D. Seasoft variables list

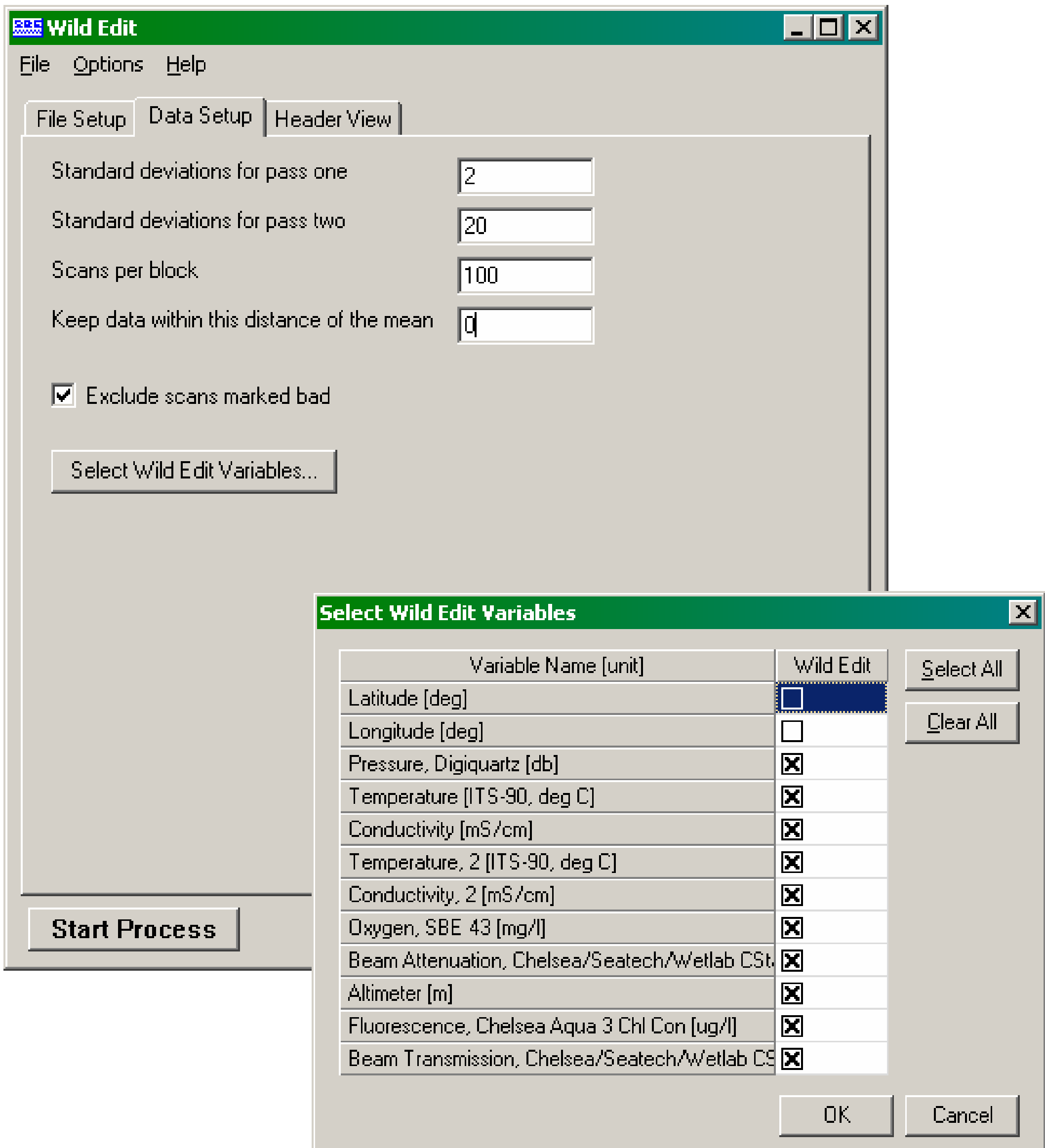
Module	***Variables processed***	***Parameter***	***Value***
Wild Edit	▪ pressure ▪ density ▪ oxygen ▪ altimeter ▪ temperature ▪ conductivity ▪ fluorescence ▪ beam transmission ▪ beam attenuation	Standard deviation for pass 1	2
		Standard deviation for pass 2	20
		Scans per block	100
Align CTD	oxygen	Advance (s)	4
Cell TM	conductivity	Thermal anomaly amplitude α	0.03
		Thermal anomaly time constant 1/β	7
Filter	pressure	Low-pass filter, time constant (s)	0.2
Loop Edit	all	Fixed minimum velocity (m/s)	0.25
Bin Avg	all	Bin size (db)	2

E. Seasoft set-up screens

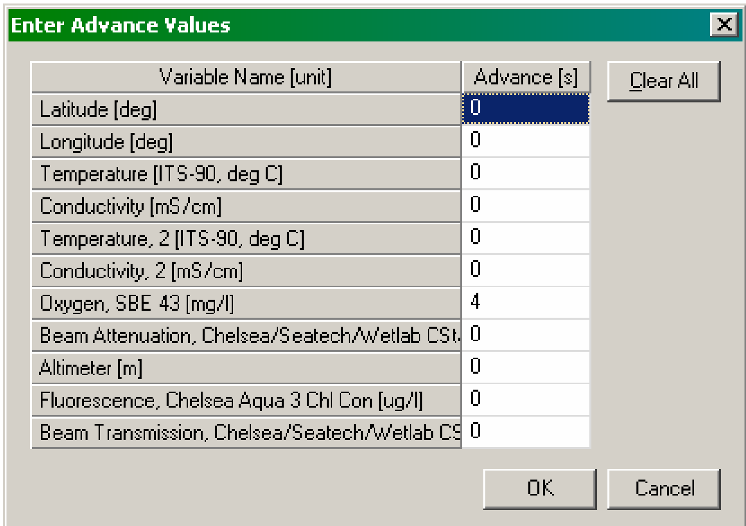
1. Data Conversion



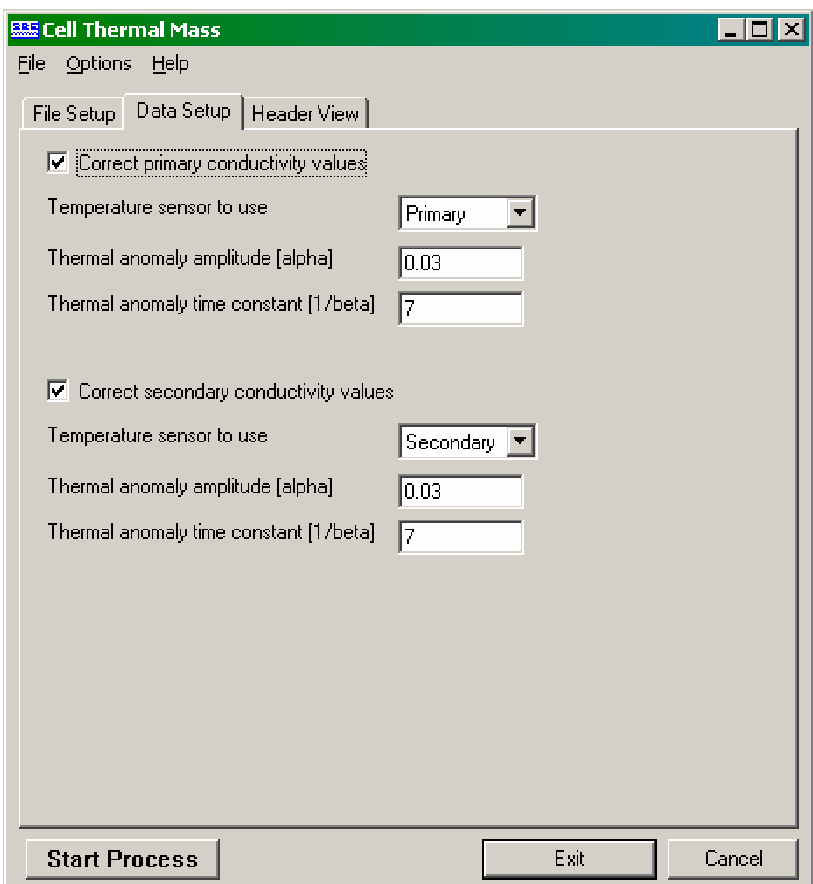
2. Wild Edit


Wild Edit
File Options Help
File Setup
Data Setup
Header View
Standard deviations for pass one
2
Standard deviations for pass two
20
Scans per block
100
Keep data within this distance of the mean
0
Exclude scans marked bad
Select Wild Edit Variables...
Start Process
Select Wild Edit Variables
Variable Name [unit]
Wild Edit
Latitude [deg]
Longitude [deg]
Pressure, Digiquartz [db]
Temperature [ITS-90, deg C]
Conductivity [mS/cm]
Temperature, 2 [ITS-90, deg C]
Conductivity, 2 [mS/cm]
Oxygen, SBE 43 [mg/l]
Beam Attenuation, Chelsea/Seatech/Wetlab CSt
Altimeter [m]
Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
Beam Transmission, Chelsea/Seatech/Wetlab CS
Select All
Clear All
OK
Cancel

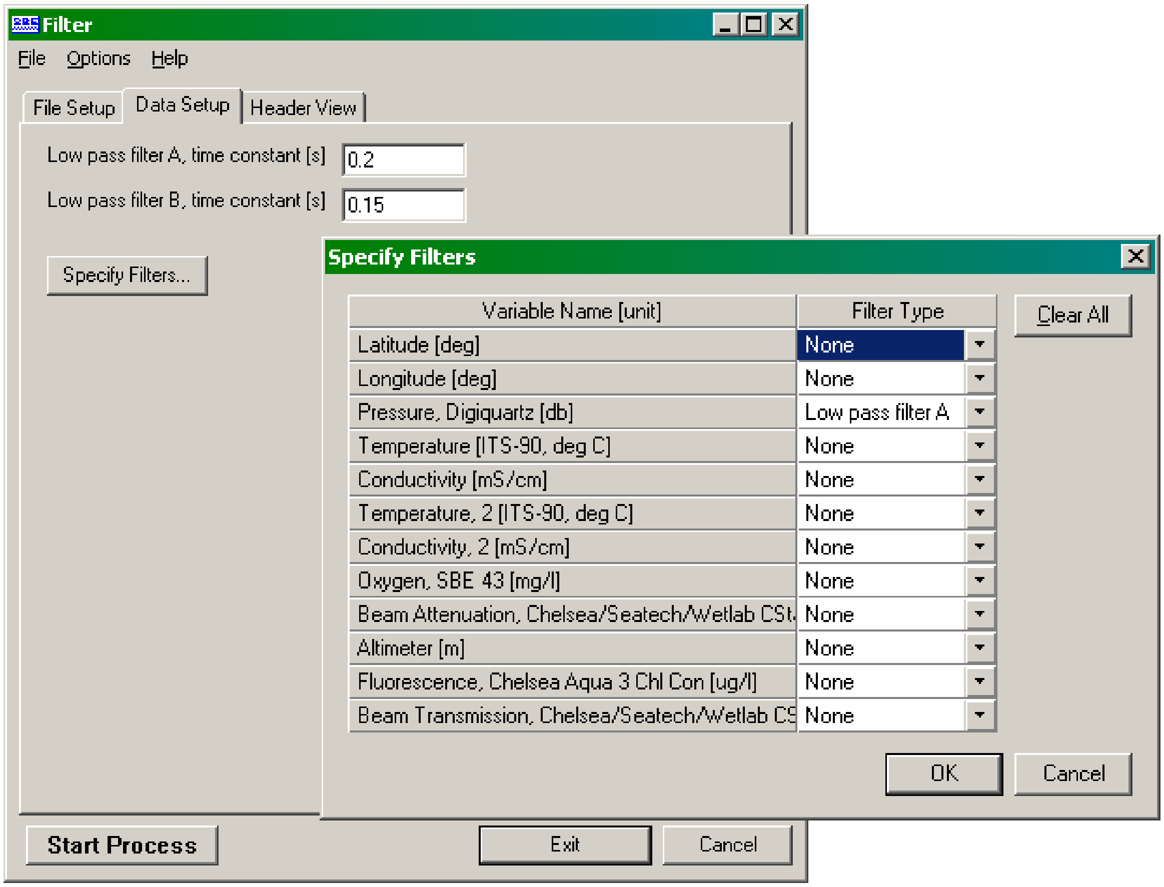
3. Align CTD



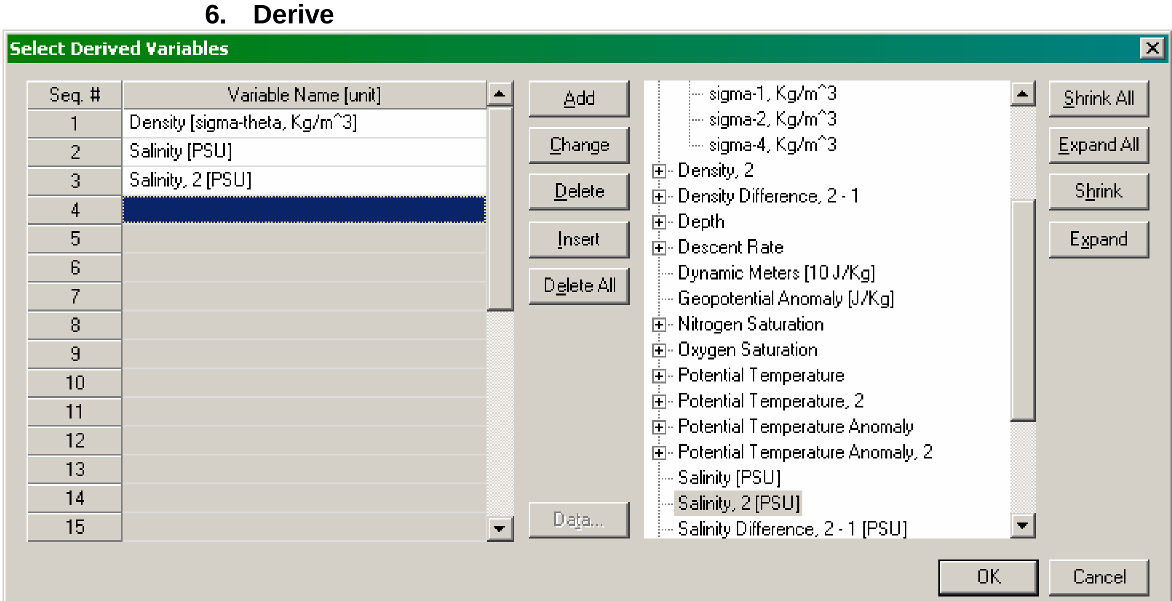
4. Cell TM



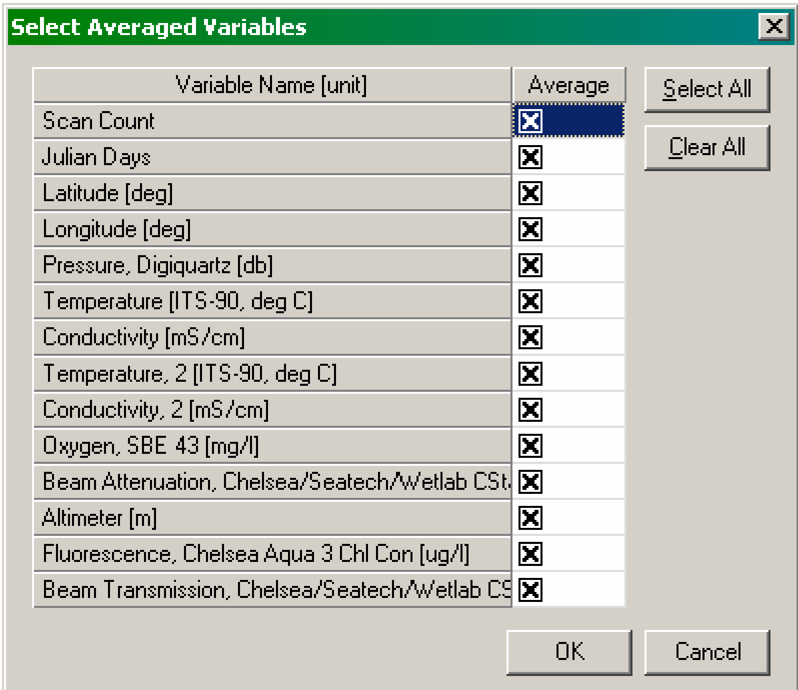
5. Filter

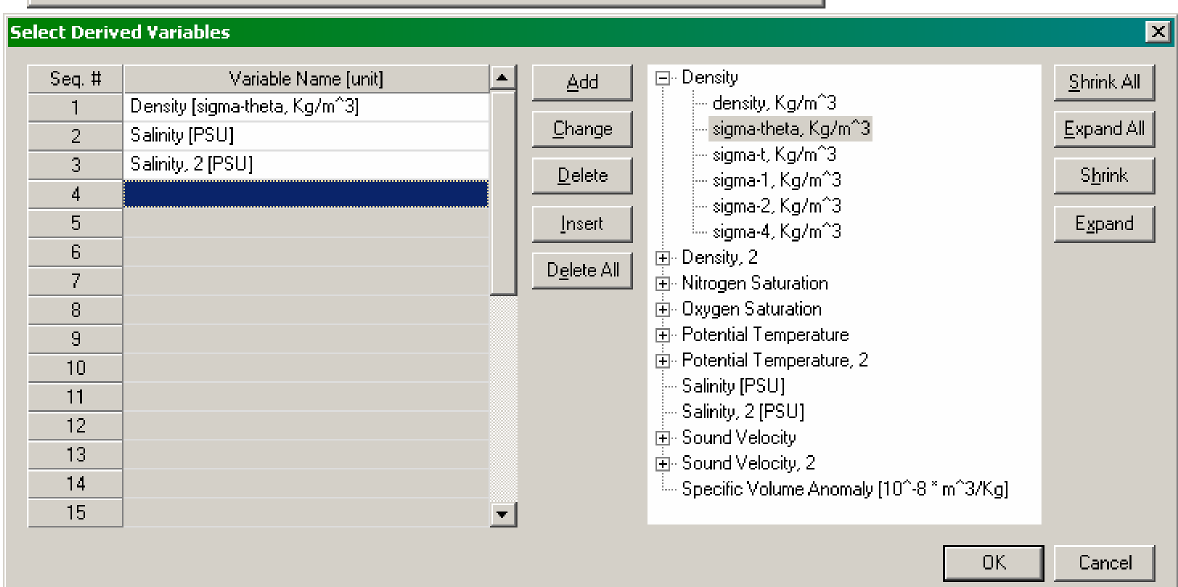


6. Derive

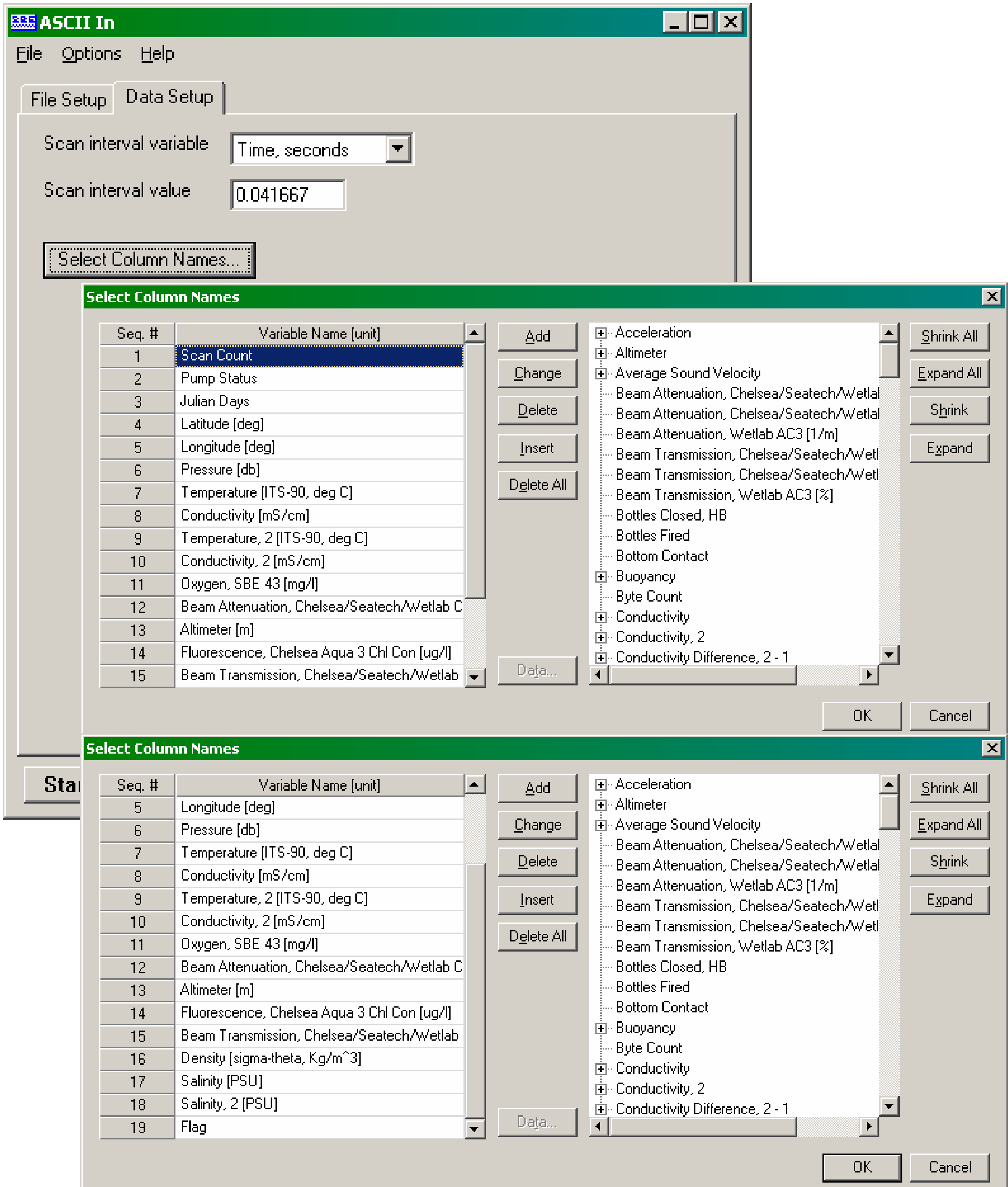


7. Bottle Summary

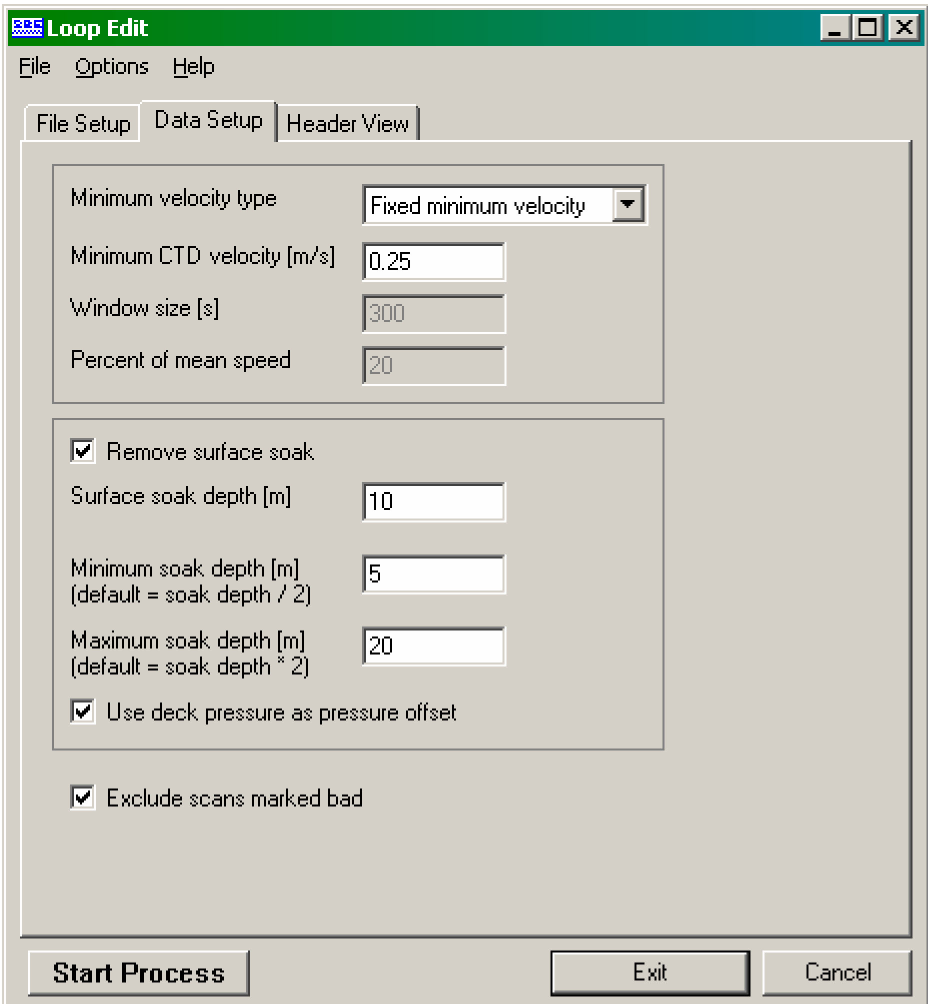




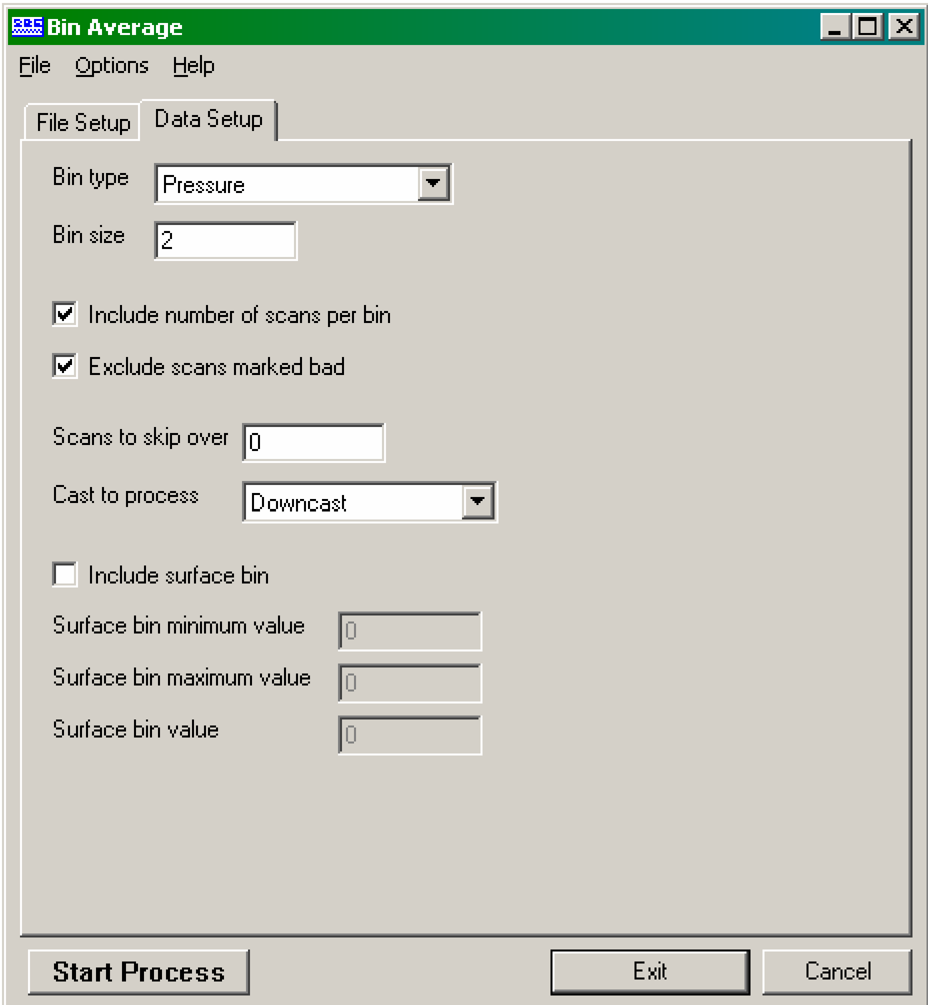
8. Ascii In


ASCII In
File
Options
Help
File Setup
Data Setup
Scan interval variable
Time, seconds
Scan interval value
0.041667
Select Column Names...
Select Column Names
Seq. #
Variable Name [unit]
1 Scan Count
2 Pump Status
3 Julian Days
4 Latitude [deg]
5 Longitude [deg]
6 Pressure [db]
7 Temperature [ITS-90, deg C]
8 Conductivity [mS/cm]
9 Temperature, 2 [ITS-90, deg C]
10 Conductivity, 2 [mS/cm]
11 Oxygen, SBE 43 [mg/l]
12 Beam Attenuation, Chelsea/Seatech/Wetlab C
13 Altimeter [m]
14 Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
15 Beam Transmission, Chelsea/Seatech/Wetlab
Add
Change
Delete
Insert
Delete All
Data...
Acceleration
Altimeter
Average Sound Velocity
Beam Attenuation, Chelsea/Seatech/Wetlal
Beam Attenuation, Chelsea/Seatech/Wetlal
Beam Attenuation, Wetlab AC3 [1/m]
Beam Transmission, Chelsea/Seatech/Wetl
Beam Transmission, Chelsea/Seatech/Wetl
Beam Transmission, Wetlab AC3 [%]
Bottles Closed, HB
Bottles Fired
Bottom Contact
Buoyancy
Byte Count
Conductivity
Conductivity, 2
Conductivity Difference, 2 - 1
Shrink All
Expand All
Shrink
Expand
OK
Cancel
Sta
Select Column Names
Seq. #
Variable Name [unit]
5 Longitude [deg]
6 Pressure [db]
7 Temperature [ITS-90, deg C]
8 Conductivity [mS/cm]
9 Temperature, 2 [ITS-90, deg C]
10 Conductivity, 2 [mS/cm]
11 Oxygen, SBE 43 [mg/l]
12 Beam Attenuation, Chelsea/Seatech/Wetlab C
13 Altimeter [m]
14 Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
15 Beam Transmission, Chelsea/Seatech/Wetlab
16 Density [sigma-theta, Kg/m^3]
17 Salinity [PSU]
18 Salinity, 2 [PSU]
19 Flag
Add
Change
Delete
Insert
Delete All
Data...
Acceleration
Altimeter
Average Sound Velocity
Beam Attenuation, Chelsea/Seatech/Wetlal
Beam Attenuation, Chelsea/Seatech/Wetlal
Beam Attenuation, Wetlab AC3 [1/m]
Beam Transmission, Chelsea/Seatech/Wetl
Beam Transmission, Chelsea/Seatech/Wetl
Beam Transmission, Wetlab AC3 [%]
Bottles Closed, HB
Bottles Fired
Bottom Contact
Buoyancy
Byte Count
Conductivity
Conductivity, 2
Conductivity Difference, 2 - 1
Shrink All
Expand All
Shrink
Expand
OK
Cancel

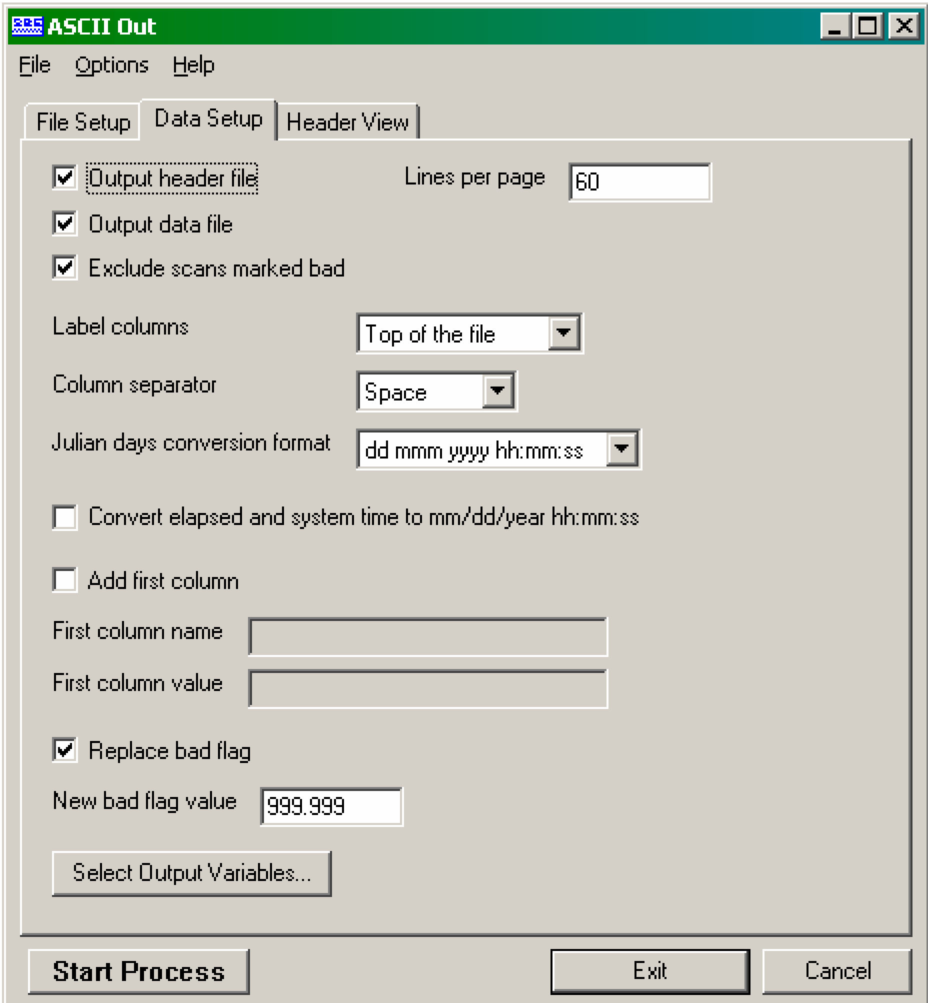
9. Loop Edit


Loop Edit
File
Options
Help
File Setup
Data Setup
Header View
Minimum velocity type
Fixed minimum velocity
Minimum CTD velocity [m/s]
0.25
Window size [s]
300
Percent of mean speed
20
Remove surface soak
Surface soak depth [m]
10
Minimum soak depth [m]
(default = soak depth / 2)
5
Maximum soak depth [m]
(default = soak depth * 2)
20
Use deck pressure as pressure offset
Exclude scans marked bad
Start Process
Exit
Cancel

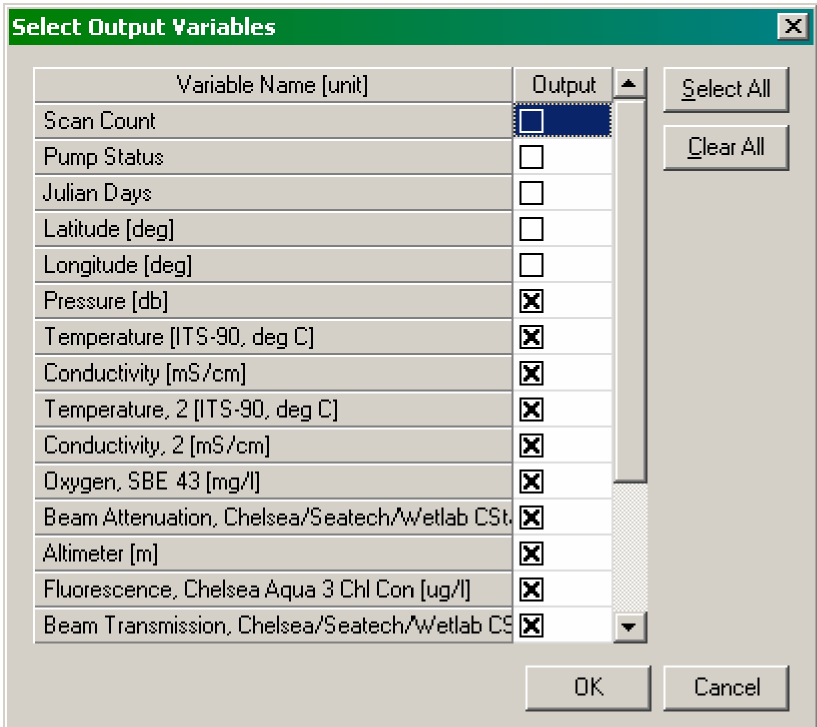
10. Bin Average

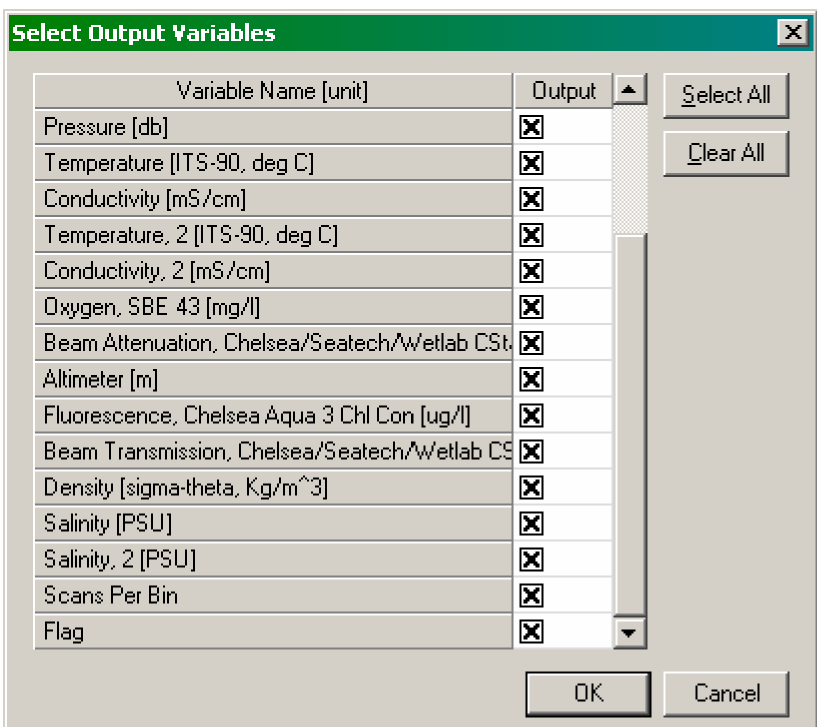


11. Ascii Out



ASCII Out
File Options Help
File Setup
Data Setup
Header View
Output header file
Lines per page
60
Output data file
Exclude scans marked bad
Label columns
Top of the file
Column separator
Space
Julian days conversion format
dd mmm yyyy hh:mm:ss
Convert elapsed and system time to mm/dd/year hh:mm:ss
Add first column
First column name
First column value
Replace bad flag
New bad flag value
999.999
Select Output Variables...
Start Process
Exit
Cancel


Select Output Variables
Variable Name [unit]
Output
Select All
Clear All
Scan Count
Pump Status
Julian Days
Latitude [deg]
Longitude [deg]
Pressure [db]
Temperature [ITS-90, deg C]
Conductivity [mS/cm]
Temperature, 2 [ITS-90, deg C]
Conductivity, 2 [mS/cm]
Oxygen, SBE 43 [mg/l]
Beam Attenuation, Chelsea/Seatech/Wetlab CSt
Altimeter [m]
Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
Beam Transmission, Chelsea/Seatech/Wetlab CS
OK
Cancel


Select Output Variables
Variable Name [unit]
Output
Select All
Clear All
Pressure [db]
Temperature [ITS-90, deg C]
Conductivity [mS/cm]
Temperature, 2 [ITS-90, deg C]
Conductivity, 2 [mS/cm]
Oxygen, SBE 43 [mg/l]
Beam Attenuation, Chelsea/Seatech/Wetlab CSt
Altimeter [m]
Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
Beam Transmission, Chelsea/Seatech/Wetlab CS
Density [sigma-theta, Kg/m^3]
Salinity [PSU]
Salinity, 2 [PSU]
Scans Per Bin
Flag
OK
Cancel

F. Data file headers

1. End of Step1

From file \1_cnv\ctdXXX_1.cnv

```
* Sea-Bird SBE 9 Data File:
* FileName = C:\Program Files\Sea-Bird\Seasave-Win32\D321b\D321bSts\CTD027.dat
* Software Version Seasave Win32 V 5.35
* Temperature SN = 4782
* Conductivity SN = 3258
* Number of Bytes Per Scan = 41
* Number of Voltage Words = 4
* Number of Scans Averaged by the Deck Unit = 1
* Append System Time to Every Scan
* System UpLoad Time = Aug 29 2007 22:23:30
* NMEA Latitude = 57 18.01 N
* NMEA Longitude = 010 22.86 W
* NMEA UTC (Time) = Aug 29 2007  22:23:30
* Store Lat/Lon Data = Append to Every Scan and Append to .NAV File When <Ctrl F7> is
Pressed
** Ship:      Discovery
** Cruise:     D321
** Cast Number: 027
** Station Number: M
** Latitude: 57 18.018 N
** Longitude: 010 22.849 W
** Date (Julian): 241/29 August 2007
** Time (GMT): 2220
** PES Depth (Uncorrected): 2208
** Principal Scientist:  T. Sherwin
** Operator: jrbn
# nquan = 19
# nvalues = 188597
# units = specified
# name 0 = scan: Scan Count
# name 1 = pumps: Pump Status
# name 2 = timeJ: Julian Days
# name 3 = latitude: Latitude [deg]
# name 4 = longitude: Longitude [deg]
# name 5 = prDM: Pressure, Digiquartz [db]
# name 6 = t090C: Temperature [ITS-90, deg C]
# name 7 = c0mS/cm: Conductivity [mS/cm]
# name 8 = t190C: Temperature, 2 [ITS-90, deg C]
# name 9 = c1mS/cm: Conductivity, 2 [mS/cm]
# name 10 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l]
# name 11 = bat: Beam Attenuation, Chelsea/Seatech/Wetlab CStar [1/m]
# name 12 = altM: Altimeter [m]
# name 13 = flC: Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
# name 14 = sigma-é00: Density [sigma-theta, Kg/m^3]
# name 15 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%]
# name 16 = sal00: Salinity [PSU]
# name 17 = sal11: Salinity, 2 [PSU]
# name 18 = flag: flag
# span 0 =          1,     188597
# span 1 =          0,          1
# span 2 = 241.932983, 242.023941
# span 3 =   57.29238,   57.30026
# span 4 =  -10.38128,  -10.37756
# span 5 =      0.774,   2231.808
# span 6 =     2.9496,    14.0905
# span 7 =   0.000130, 237.094086
# span 8 =     2.9506,    14.0905
# span 9 =   0.677127,  42.446980
# span 10 =    6.17255,   10.52336
# span 11 =     0.6296,    18.3097
# span 12 =       0.00,     100.00
```

```
# span 13 =    -0.0113,     2.0449
# span 14 =    -0.6699,    27.8425
# span 15 =     1.0281,    85.4359
# span 16 =     0.0069,    99.0000
# span 17 =     0.4310,    35.5153
# span 18 = 0.0000e+00, 0.0000e+00
# interval = seconds: 0.0416667
# start_time = Aug 29 2007 22:23:30
# bad_flag = -9.990e-29
# sensor 0 = Frequency  0  temperature, primary, 4782, 12 Apr 07
# sensor 1 = Frequency  1  conductivity, primary, 3258, 27 March 07, cpcor = -9.5700e-08
# sensor 2 = Frequency  2  pressure, 83008, 13 May 2005
# sensor 3 = Frequency  3  temperature, secondary, 4383, 1 May 2007
# sensor 4 = Frequency  4  conductivity, secondary, 2164, 1 May 2007, cpcor = -9.5700e-08
# sensor 5 = Extrnl Volt  0  Oxygen, SBE, primary, 0619, 5 October 2006
# sensor 6 = Extrnl Volt  2  altimeter
# sensor 7 = Extrnl Volt  3  fluorometer, chelsea, 088095, 4 January 2007
# sensor 8 = Extrnl Volt  4  irradiance (PAR), primary, 10, 23 mar 05
# sensor 9 = Extrnl Volt  5  irradiance (PAR), secondary, 10, 23 mar 05
# sensor 10 = Extrnl Volt  7  transmissometer, primary, 161/2642/002, 4 September 1996
# datcnv_date = Mar 25 2008 09:38:28, 7.16a
# datcnv_in = C:\CRUISES\D321b\PROCESS_FINAL\raw_data\test8.dat
C:\CRUISES\D321b\PROCESS_FINAL\raw_data\test8.CON
# datcnv_skipover = 0
# wildedit_date = Mar 25 2008 09:38:39, 7.16a
# wildedit_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# wildedit_pass1_nstd = 2.0
# wildedit_pass2_nstd = 20.0
# wildedit_pass2_mindelta = 0.000e+000
# wildedit_npoint = 100
# wildedit_vars = prDM t090C c0mS/cm t190C c1mS/cm sbeox0Mg/L bat altM flC sigma-é00 xmiss
# wildedit_excl_bad_scans = yes
# alignctd_date = Mar 25 2008 09:38:40, 7.16a
# alignctd_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# alignctd_adv = sbeox0Mg/L 4.000
# celltm_date = Mar 25 2008 09:38:41, 7.16a
# celltm_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# celltm_alpha = 0.0300, 0.0300
# celltm_tau = 7.0000, 7.0000
# celltm_temp_sensor_use_for_cond = primary, secondary
# filter_date = Mar 25 2008 09:38:42, 7.16a
# filter_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# filter_low_pass_tc_A = 0.200
# filter_low_pass_tc_B = 0.150
# filter_low_pass_A_vars = prDM
# filter_low_pass_B_vars =
# Derive_date = Mar 25 2008 09:38:44, 7.16a
# Derive_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.CON
# file_type = ascii
*END*
```

2. End of Step2

File \BinAverage\ctdXXX_2.hdr

```
# nquan = 15
# nvalues = 1113
# units = specified
# name 0 = prM: Pressure [db]
# name 1 = tnc90C: Temperature [ITS-90, deg C]
# name 2 = c0mS/cm: Conductivity [mS/cm]
# name 3 = tnc290C: Temperature, 2 [ITS-90, deg C]
# name 4 = c1mS/cm: Conductivity, 2 [mS/cm]
# name 5 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l]
# name 6 = bat: Beam Attenuation, Chelsea/Seatech/Wetlab CStar [1/m]
# name 7 = altM: Altimeter [m]
# name 8 = flC: Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
# name 9 = sigma-é00: Density [sigma-theta, Kg/m^3]
# name 10 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%]
# name 11 = sal00: Salinity [PSU]
# name 12 = sal11: Salinity, 2 [PSU]
# name 13 = nbin: number of scans per bin
# name 14 = flag: flag
# span 0 =      8.000,   2232.000
# span 1 =     2.9502,    14.0761
# span 2 =  32.506980,  42.421777
# span 3 =     2.9514,    14.0767
# span 4 =  32.512235,  42.430119
# span 5 =    6.83161,    8.64886
# span 6 =     0.6305,     0.8466
# span 7 =       8.47,     102.32
# span 8 =     0.0165,     1.2553
# span 9 =    26.4601,    27.8419
# span 10 =    80.9244,    85.4162
# span 11 =    34.9069,    35.4182
# span 12 =    34.9119,    35.4259
# span 13 =         23,        118
# span 14 = 0.0000e+00, 0.0000e+00
# interval = decibars: 2
# start_time = Mar 25 2008 09:54:57
# bad_flag = -9.990e-29
# asciiin_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\2_cnv\test8_2.asc
# loopedit_date = Mar 25 2008 09:55:13, 7.16a
# loopedit_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\BinAverage\test8_2.cnv
# loopedit minVelocity = 0.250
# loopedit surfaceSoak: minDepth = 5.0, maxDepth = 20, useDeckPress = 1
# loopedit_excl_bad_scans = yes
# binavg_date = Mar 25 2008 09:55:37, 7.16a
# binavg_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\BinAverage\test8_2.cnv
# binavg_bintype = decibars
# binavg_binsize = 2
# binavg_excl_bad_scans = yes
# binavg_skipover = 0
# binavg_surface_bin = no, min = 0.000, max = 0.000, value = 0.000
# file_type = ascii
*END*
```

3. Final header

File \Final_WHP\ctdXXX.hdr

```
* Sea-Bird SBE 9 Data File:
* FileName = C:\Program Files\Sea-Bird\Seasave-Win32\D321b\D321bSts\CTD027.dat
* Software Version Seasave Win32 V 5.35
* Temperature SN = 4782
* Conductivity SN = 3258
* Number of Bytes Per Scan = 41
* Number of Voltage Words = 4
* Number of Scans Averaged by the Deck Unit = 1
* Append System Time to Every Scan
* System UpLoad Time = Aug 29 2007 22:23:30
* NMEA Latitude = 57 18.01 N
* NMEA Longitude = 010 22.86 W
* NMEA UTC (Time) = Aug 29 2007  22:23:30
* Store Lat/Lon Data = Append to Every Scan and Append to .NAV File When <Ctrl F7> is
Pressed
** Ship:      Discovery
** Cruise:     D321
** Cast Number: 027
** Station Number: M
** Latitude: 57 18.018 N
** Longitude: 010 22.849 W
** Date (Julian): 241/29 August 2007
** Time (GMT): 2220
** PES Depth (Uncorrected): 2208
** Principal Scientist:  T. Sherwin
** Operator: jrbn
# nquan = 19
# nvalues = 188597
# units = specified
# name 0 = scan: Scan Count
# name 1 = pumps: Pump Status
# name 2 = timeJ: Julian Days
# name 3 = latitude: Latitude [deg]
# name 4 = longitude: Longitude [deg]
# name 5 = prDM: Pressure, Digiquartz [db]
# name 6 = t090C: Temperature [ITS-90, deg C]
# name 7 = c0mS/cm: Conductivity [mS/cm]
# name 8 = t190C: Temperature, 2 [ITS-90, deg C]
# name 9 = c1mS/cm: Conductivity, 2 [mS/cm]
# name 10 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l]
# name 11 = bat: Beam Attenuation, Chelsea/Seatech/Wetlab CStar [1/m]
# name 12 = altM: Altimeter [m]
# name 13 = flC: Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
# name 14 = sigma-é00: Density [sigma-theta, Kg/m^3]
# name 15 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%]
# name 16 = sal00: Salinity [PSU]
# name 17 = sal11: Salinity, 2 [PSU]
# name 18 = flag: flag
# span 0 =          1,     188597
# span 1 =          0,          1
# span 2 = 241.932983, 242.023941
# span 3 =   57.29238,   57.30026
# span 4 =  -10.38128,  -10.37756
# span 5 =      0.774,   2231.808
# span 6 =     2.9496,    14.0905
# span 7 =   0.000130, 237.094086
# span 8 =     2.9506,    14.0905
# span 9 =   0.677127,  42.446980
# span 10 =    6.17255,   10.52336
# span 11 =     0.6296,    18.3097
# span 12 =       0.00,     100.00
# span 13 =    -0.0113,     2.0449
# span 14 =    -0.6699,    27.8425
# span 15 =     1.0281,    85.4359
# span 16 =     0.0069,    99.0000
```

```
# span 17 =     0.4310,    35.5153
# span 18 = 0.0000e+00, 0.0000e+00
# interval = seconds: 0.0416667
# start_time = Aug 29 2007 22:23:30
# bad_flag = -9.990e-29
# sensor 0 = Frequency  0  temperature, primary, 4782, 12 Apr 07
# sensor 1 = Frequency  1  conductivity, primary, 3258, 27 March 07, cpcor = -9.5700e-08
# sensor 2 = Frequency  2  pressure, 83008, 13 May 2005
# sensor 3 = Frequency  3  temperature, secondary, 4383, 1 May 2007
# sensor 4 = Frequency  4  conductivity, secondary, 2164, 1 May 2007, cpcor = -9.5700e-08
# sensor 5 = Extrnl Volt  0  Oxygen, SBE, primary, 0619, 5 October 2006
# sensor 6 = Extrnl Volt  2  altimeter
# sensor 7 = Extrnl Volt  3  fluorometer, chelsea, 088095, 4 January 2007
# sensor 8 = Extrnl Volt  4  irradiance (PAR), primary, 10, 23 mar 05
# sensor 9 = Extrnl Volt  5  irradiance (PAR), secondary, 10, 23 mar 05
# sensor 10 = Extrnl Volt  7  transmissometer, primary, 161/2642/002, 4 September 1996
# datcnv_date = Mar 25 2008 09:38:28, 7.16a
# datcnv_in = C:\CRUISES\D321b\PROCESS_FINAL\raw_data\test8.dat
C:\CRUISES\D321b\PROCESS_FINAL\raw_data\test8.CON
# datcnv_skipover = 0
# wildedit_date = Mar 25 2008 09:38:39, 7.16a
# wildedit_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# wildedit_pass1_nstd = 2.0
# wildedit_pass2_nstd = 20.0
# wildedit_pass2_mindelta = 0.000e+000
# wildedit_npoint = 100
# wildedit_vars = prDM t090C c0mS/cm t190C c1mS/cm sbeox0Mg/L bat altM flC sigma-é00 xmiss
# wildedit_excl_bad_scans = yes
# alignctd_date = Mar 25 2008 09:38:40, 7.16a
# alignctd_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# alignctd_adv = sbeox0Mg/L 4.000
# celltm_date = Mar 25 2008 09:38:41, 7.16a
# celltm_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# celltm_alpha = 0.0300, 0.0300
# celltm_tau = 7.0000, 7.0000
# celltm_temp_sensor_use_for_cond = primary, secondary
# filter_date = Mar 25 2008 09:38:42, 7.16a
# filter_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
# filter_low_pass_tc_A = 0.200
# filter_low_pass_tc_B = 0.150
# filter_low_pass_A_vars = prDM
# filter_low_pass_B_vars =
# Derive_date = Mar 25 2008 09:38:44, 7.16a
# Derive_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.cnv
C:\CRUISES\D321b\PROCESS_FINAL\SS\1_cnv\test8.CON
# file_type = ascii
*END*
# nquan = 15
# nvalues = 1113
# units = specified
# name 0 = prM: Pressure [db]
# name 1 = tnc90C: Temperature [ITS-90, deg C]
# name 2 = c0mS/cm: Conductivity [mS/cm]
# name 3 = tnc290C: Temperature, 2 [ITS-90, deg C]
# name 4 = c1mS/cm: Conductivity, 2 [mS/cm]
# name 5 = sbeox0Mg/L: Oxygen, SBE 43 [mg/l]
# name 6 = bat: Beam Attenuation, Chelsea/Seatech/Wetlab CStar [1/m]
# name 7 = altM: Altimeter [m]
# name 8 = flC: Fluorescence, Chelsea Aqua 3 Chl Con [ug/l]
# name 9 = sigma-é00: Density [sigma-theta, Kg/m^3]
# name 10 = xmiss: Beam Transmission, Chelsea/Seatech/Wetlab CStar [%]
# name 11 = sal00: Salinity [PSU]
# name 12 = sal11: Salinity, 2 [PSU]
# name 13 = nbin: number of scans per bin
# name 14 = flag: flag
# span 0 =      8.000,   2232.000
# span 1 =     2.9502,    14.0761
# span 2 =  32.506980,  42.421777
# span 3 =     2.9514,    14.0767
# span 4 =  32.512235,  42.430119
```

```
# span 5 =    6.83161,    8.64886
# span 6 =     0.6305,     0.8466
# span 7 =       8.47,     102.32
# span 8 =     0.0165,     1.2553
# span 9 =    26.4601,    27.8419
# span 10 =    80.9244,    85.4162
# span 11 =    34.9069,    35.4182
# span 12 =    34.9119,    35.4259
# span 13 =         23,        118
# span 14 = 0.0000e+00, 0.0000e+00
# interval = decibars: 2
# start_time = Mar 25 2008 09:54:57
# bad_flag = -9.990e-29
# asciiin_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\2_cnv\test8_2.asc
# loopedit_date = Mar 25 2008 09:55:13, 7.16a
# loopedit_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\BinAverage\test8_2.cnv
# loopedit minVelocity = 0.250
# loopedit_surfaceSoak: minDepth = 5.0, maxDepth = 20, useDeckPress = 1
# loopedit_excl_bad_scans = yes
# binavg_date = Mar 25 2008 09:55:37, 7.16a
# binavg_in = C:\CRUISES\D321b\PROCESS_FINAL\SS\BinAverage\test8_2.cnv
# binavg_bintype = decibars
# binavg_binsize = 2
# binavg_excl_bad_scans = yes
# binavg_skipover = 0
# binavg_surface_bin = no, min = 0.000, max = 0.000, value = 0.000
# file_type = ascii
*END*
```

G. WHP standard file format

Example of the CLIVAR/WHP formatted file produced by the last Matlab routine (CTDProcess_step2_SS or CTDProcess_step2_Ti).

```
EXPOCODE      74E3D321b WHP-ID       DATE 082507
STNNBR   IB23S CASTNO 001 NO. RECORDS=   56
INSTRUMENT NO. SBSS1 SAMPLING RATE  24.00 HZ
  CTDPRS  CTDTMP  CTDSAL  CTDOXY   XMISS   FLUOR  NUMBER  QUALT1
    DBAR  ITS-90  PSS-78 UMOL/KG  %TRANS  MG/CUM    OBS.
 ******* ******* ******* *******
     4.0 12.2306 34.1890   248.3   67.28   1.644      10    2333
     6.0 12.2323 34.1875   248.5   67.22   1.647      79    2333
     8.0 12.2316 34.1892   248.6   67.17   1.656      91    2333
    10.0 12.2317 34.1906   248.8   67.18   1.667      81    2333
    12.0 12.2321 34.1903   248.5   67.16   1.685      81    2333
    14.0 12.2251 34.1966   248.8   67.05   1.706      91    2333
    16.0 12.1870 34.2258   249.4   67.16   1.796      90    2333
    18.0 11.9551 34.3765   245.2   70.20   1.783     101    2333
    20.0 11.7349 34.5042   241.1   74.61   1.358      76    2333
```