CTD Data RV Heincke HE594

Data Processing Report

Contents

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1 Introduction

This report describes the processing of CTD raw data acquired by Seabird SBE 911plus CTD on board RV Heincke during expedition HE594.

2 Workflow

The different steps of processing and validation are visualized in Figure 1. The CTD raw data are delivered from Dr. Sandra Tippenhauer (AWI). The station book of the RV Heincke cruise is extracted from the DAVIS SHIP data base (https://dship.awi.de). The first CTD station and cast is processed manually in SBE Data Processing to configure the *.psa Seabird routines *Data Conversion*, *Wild Edit*, *Bottle Summary*, *Split*, *Translate*, *Cell Thermal Mass*, *Loop Edit* and *Bin Average*. The Seabird routines are then run in a batch job *CTDjob* in ManageCTD to process the complete CTD data set. The downcast of each CTD station/cast is used for further processing. In *CTDjob* the start record and the lowest altimeter point of the downcast is selected. With the *Utilities* → *Dship Ebook* function of ManageCTD the DAVIS SHIP station book extraction is used for getting the header information of all CTD stations/casts of the cruise. ManageCTD *Utilities* → *Find Profile* function compares station times of the header with the entries in the station book to find out the correct naming of the stations and casts. In *CTDheader* in ManageCTD the header information of each CTD station/cast is displayed, controlled and corrected if necessary. *CTDdespike* in ManageCTD is used for a visual check of the data and to erase/interpolate spikes in the data if necessary. Additionally, a sensor pair (Temp1/Sal1 or Temp2/Sal2) is chosen for each station/cast of the RV Heincke cruise in *CTDdespike*.

ManageCTD *Utilities* → *CheckDoubleSensors* controls the quality of temperature and conductivity sensors. For this purpose outliers of too high sensor pair differences could be removed. The data is then converted to spreadsheet format with *dsp2odv* for visualization of the data in Ocean Data View (ODV). The second visual inspection of the CTD data allows a comparison with data from other CTD casts from close-by stations to verify the oxygen sensor data. Therefore, potential reference cruise data is downloaded from PANGAEA (http://www.PANGAEA.de). The reference data is converted to *.mat format. In the ManageCTD Final Processing the CTD data is displayed together with the reference data. Bad data points, sensors or casts are interpolated or erased from the data set and filters are applied if necessary. The processed CTD data are written to text files and imported to PANGAEA (http://www.PANGAEA.de) for publication.

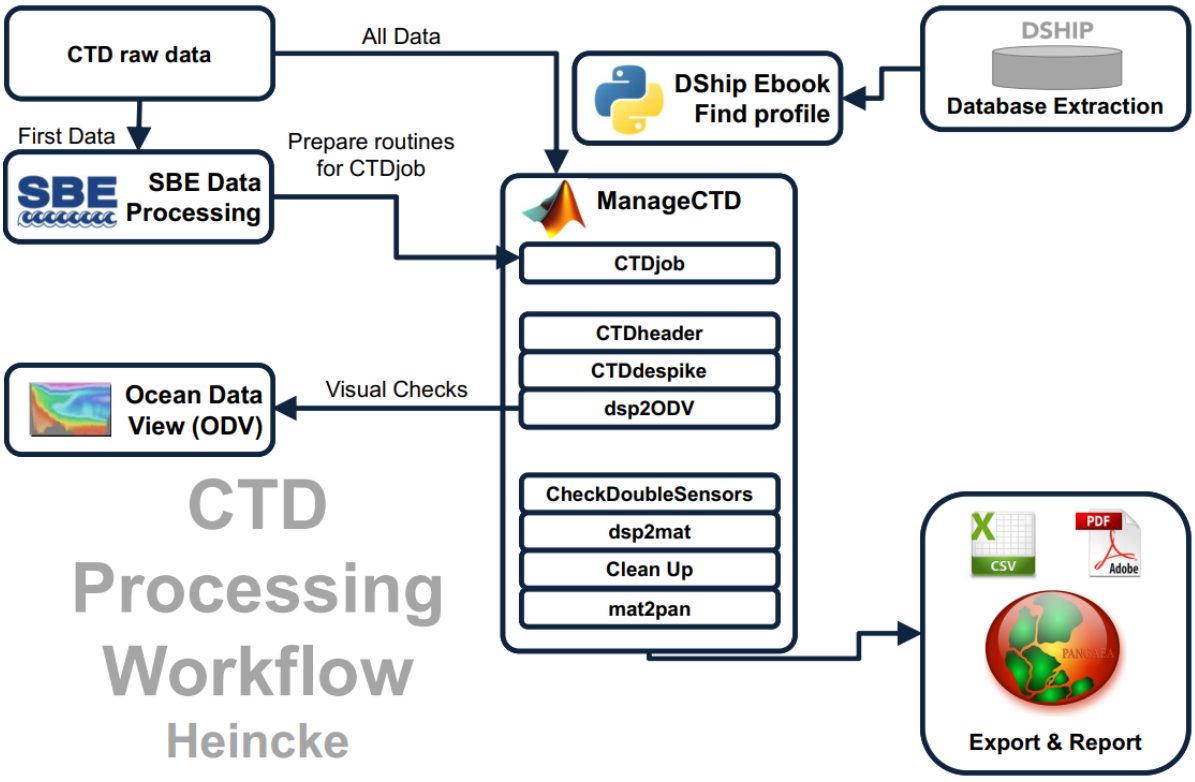

Figure 1: CTD data Processing Workflow

3 Expedition details

Vessel name	RV Heincke
Expedition number	HE594
Expedition leader	Giebel, Helge-Ansgar
Expedition start	10.03.2022 Bremerhaven
Expedition end	15.03.2022 Bremerhaven
Duration	6 days
No. of CTD casts	26
BSH ID	20220154
Expedition report	https://doi.pangaea.de/10.48433/cr_he594
Expedition map	https://epic.awi.de/id/eprint/55833/2/HE594_nav.jpg
Event list	https://www.pangaea.de/expeditions/events/HE594

4 Sensor Layout

This chapter describes the CTD sensors mounted during this cruise:
SBE 911plus CTD (SN: 1015), SBE Instrument Configuration Version 7.23.0.1.

ID	Sensor Name	Serial No.	Calibration Date
55	TemperatureSensor	4918	05-Mar-21
3	ConductivitySensor	3810	09-Feb-21
45	PressureSensor	1015	26-Jan-17
55	TemperatureSensor	5110	05-Mar-21
3	ConductivitySensor	3827	02-Feb-12
0	AltimeterSensor	not given	None
71	WET_LabsCStar	435	not given
20	FluoroWetlabECO_AFL_FL_Sensor	1365	07-Jan-2022

5 Processing

Details of processing procedures and processing parameters are described in *CTD Processing Logbook of RV Heincke* (hdl:10013/epic.47427).

Density Inversions and Manual Validation

Obvious outliers were removed manually. For the visual check density inversions > 0.005 kg/m^3 and > 0.01 kg/m^3 were flagged differently for display but not removed automatically. Decisions whether the flagged values were manually removed or not are based on the description in *CTD Processing Logbook of RV Heincke* (hdl:10013/epic.47427).

Sensor Differences

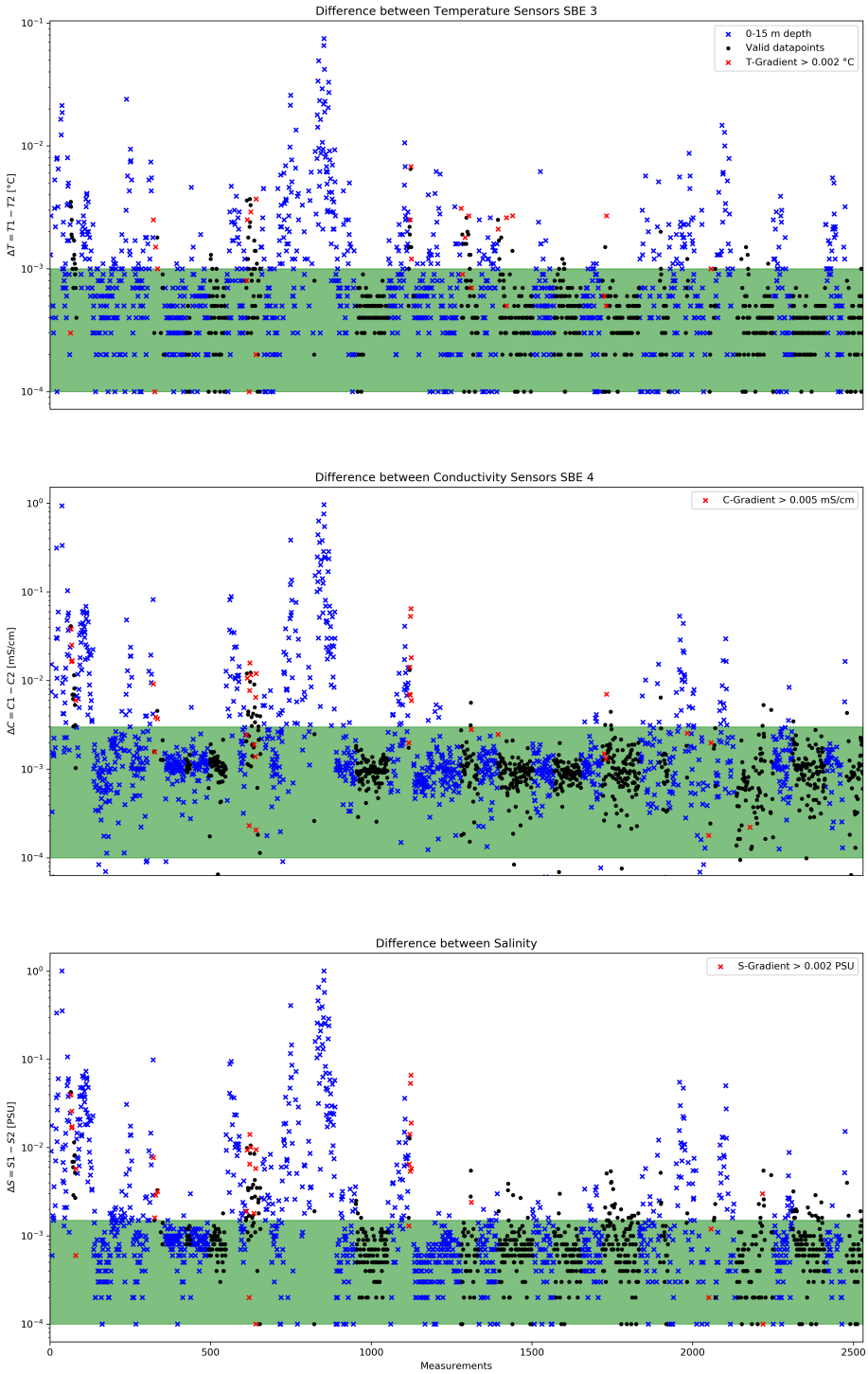

Figure 2: Data accuracy of sensor pairs HE594

6 Results

A complete processing overview for each sensor at each station is summarized in the table in the Appendix (Figure 3).

Double Sensor Check

In Figure 2, the absolute residuals between the two sensorpairs are shown for the measured parameters *Temperature* and *Conductivity* and the derived parameter *Salinity*. Measurements in shallow water depths < 15 m (blue crosses) and gradients between two datapoints exceeding a defined threshold (red crosses) were omitted for accuracy calculation.

Parameter	**Accuracy** given by manufacturer	**Measurements removed** Surface 0-15m + gradient filter	**Remaining measurements** within accuracy specifications
Temperature	$\pm 0.001°C$	63.48%	90.04%
Conductivity	$\pm 0.003 mS/cm$	63.87%	93.44%
Salinity	$\pm 0.0015 PSU$	63.56%	82.10%

Comments

- 26 CTD "max depth/on ground" entries in DShip station book
- 26 CTD raw data sets delivered
- 26 CTD casts processed and uploaded
- of these 26 processed CTD casts:
  - 23 data points interpolated
- HE594_32_Dship_4-1 was delivered without .hex and .hdr file just with .bl and .xmlcon file

Result files

Text File (HE594_phys_oce.tab):

The format is a plain text (tab-delimited values) file.

Column separator	Tabulator "\t"
Column 1	Event label
Column 2	Date/Time of event
Column 3	Latitude of event
Column 4	Longitude of event
Column 5	Elevation of event
Column 6	DEPTH, water
Column 7	Pressure, water
Column 8	Temperature, water
Column 9	Conductivity
Column 10	Salinity
Column 11	Temperature, water, potential
Column 12	Density, sigma-theta (0)
Column 13	Oxygen
Column 14	Oxygen, saturation
Column 15	Attenuation, optical beam transmission
Column 16	Fluorometer
Column 17	Number of observations

Processing Report (CTD-HE594-report.pdf):
This PDF document.

Station HE594_	Gear Abbr.	Date	Time	Position Latitude	Position Longitude	Depth [m]	File Name HE594_	Sensor pair	Temp		Sal		Trans		Fluor		Complete		Comments
									interp	erased	interp	erased	interp	erased	interp	erased	interp	erased	
1-1	CTD	10.03.2022	11:14	53° 46,673' N	008° 09,104' E	17.5	01_Dship_1-1	2											no Fluorescence sensor
2-1	CTD	10.03.2022	12:37	53° 50,031' N	008° 06,277' E	11.9	02_Dship_2-1	2											no Fluorescence sensor
3-1	CTD	11.03.2022	07:07	53° 47,483' N	006° 59,425' E	13.8	31_Dship_3-1	2											no Fluorescence sensor
4-1	CTD	11.03.2022	08:44	53° 50,461' N	007° 15,352' E	2.8	32-1_Dship_4-1	1											no Fluorescence sensor
5-1	CTD	11.03.2022	10:18	53° 52,901' N	007° 31,636' E	17.4	33-1_Dship_5-1	2											no Fluorescence sensor
6-1	CTD	11.03.2022	11:52	53° 56,417' N	007° 48,445' E	2.3	34-1_Dship_6-1	1	1		1		1				3		no Fluorescence sensor
7-1	CTD	11.03.2022	14:10	54° 02,816' N	008° 13,681' E	12.6	36_Dship_7-1	2	1		1		1				3		no Fluorescence sensor
8-1	CTD	11.03.2022	15:16	54° 08,328' N	008° 19,997' E	10.7	37_Dship_8-1	2	1		1						2		no Fluorescence sensor
9-1	CTD	11.03.2022	16:33	54° 13,742' N	008° 20,892' E	11.5	25_Dship_9-1	1											no Fluorescence sensor
10-1	CTD	12.03.2022	07:02	53° 57,362' N	008° 37,752' E	13.5	39_Dship_10-1	2											no Fluorescence sensor
11-1	CTD	12.03.2022	08:06	53° 59,112' N	008° 24,681' E	14.5	38_Dship_11-1	2											no Fluorescence sensor
12-1	CTD	12.03.2022	09:50	53° 57,859' N	008° 03,743' E	23.3	35_Dship_12-1	1	1		1		1				3		no Fluorescence sensor
13-1	CTD	13.03.2022	06:33	54° 22,034' N	008° 09,817' E	15.8	23_Dship_13-1	2											with Fluorescence sensor
14-1	CTD	13.03.2022	07:49	54° 32,320' N	008° 10,940' E	9.9	12_Dship_14-1	1											with Fluorescence sensor
15-1	CTD	13.03.2022	09:00	54° 42,551' N	008° 09,842' E	10.5	11_Dship_15-1	2											with Fluorescence sensor
16-1	CTD	13.03.2022	10:57	54° 36,787' N	007° 42,158' E	18.3	09_Dship_16-1	1											with Fluorescence sensor
17-1	CTD	13.03.2022	13:10	54° 30,034' N	007° 10,201' E	34.5	07_Dship_17-1	2											with Fluorescence sensor
18-1	CTD	13.03.2022	14:54	54° 18,922' N	007° 07,174' E	36.2	16_Dship_18-1	2											with Fluorescence sensor
19-1	CTD	13.03.2022	16:57	54° 22,196' N	007° 34,239' E	24.7	14_Dship_19-1	2											with Fluorescence sensor
20-1	CTD	14.03.2022	06:32	54° 18,191' N	007° 48,702' E	19.7	22_Dship_20-1	2	1		1		1		1		4		with Fluorescence sensor
21-1	CTD	14.03.2022	08:10	54° 13,990' N	007° 29,407' E	37.6	21_Dship_21-1	1	1		1		1		1		4		with Fluorescence sensor
22-1	CTD	14.03.2022	09:59	54° 10,424' N	007° 05,553' E	31.3	19_Dship_22-1	2											with Fluorescence sensor
23-1	CTD	14.03.2022	11:37	53° 58,830' N	007° 04,481' E	24.7	30_Dship_23-1	2	1		1		1		1		4		with Fluorescence sensor
24-1	CTD	14.03.2022	14:00	54° 04,563' N	007° 37,087' E	34.9	28_Dship_24-1	1											with Fluorescence sensor
25-1	CTD	14.03.2022	15:26	54° 06,184' N	007° 53,283' E	37.6	27_Dship_25-1	2											with Fluorescence sensor
26-1	CTD	14.03.2022	16:45	54° 10,682' N	008° 06,618' E	18.8	26_Dship_26-1	2											with Fluorescence sensor
									7	0	7	0	6	0	3	0	23	0	

Figure 3: CTD data Processing Summary HE594

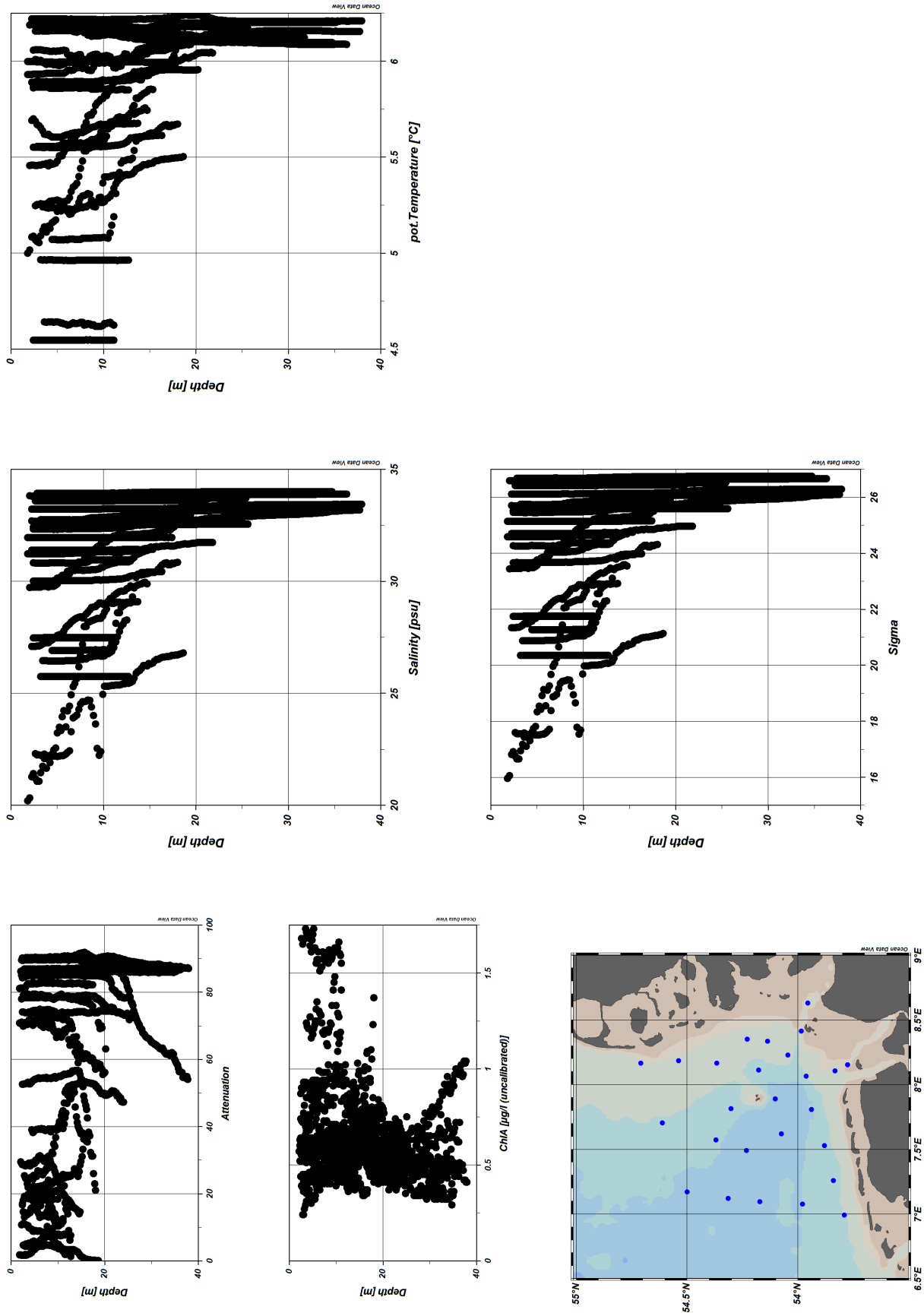

Figure 4: ODV Screenshot of HE594 CTD data