CTD Data RV Heincke HE441
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 HE441.

2 Workflow

The different steps of processing and validation are visualized in Figure 1. The CTD raw data are delivered from Gerd Rohardt (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.
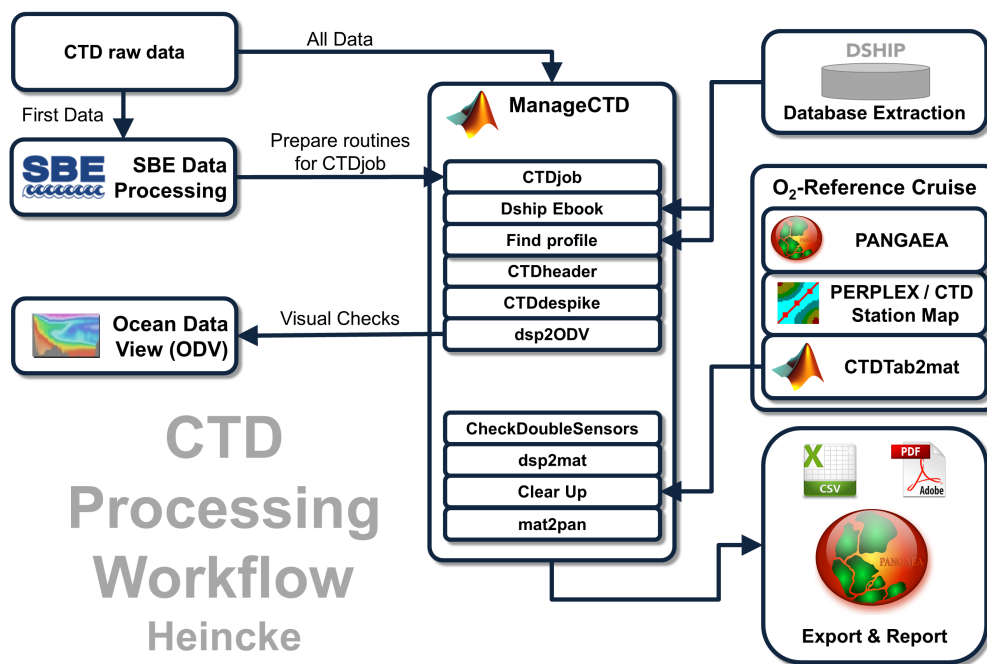
Figure 1: CTD data Processing Workflow

3 Cruise details

Vessel name	RV Heincke
Cruise name	HE441
Cruise start	20.03.2015 Bremerhaven
Cruise end	31.03.2015 Bremerhaven
Cruise duration	12 days
No. of CTD casts	9

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	5354	21-Jan-12
3	ConductivitySensor	2470	15-Nov-13
45	PressureSensor	1015	05-Oct-10
55	TemperatureSensor	5375	21-Jan-12
3	ConductivitySensor	3810	08-Feb-12
0	AltimeterSensor	46466	23-Mar-09
71	WET_LabsCStar	1348DR	13-Oct-2010
20	FluoroWetlabECO_AFL_FL_Sensor	1346	26-Feb-2009
38	OxygenSensor	1597	19-Jun-12

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

Obvius 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 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).
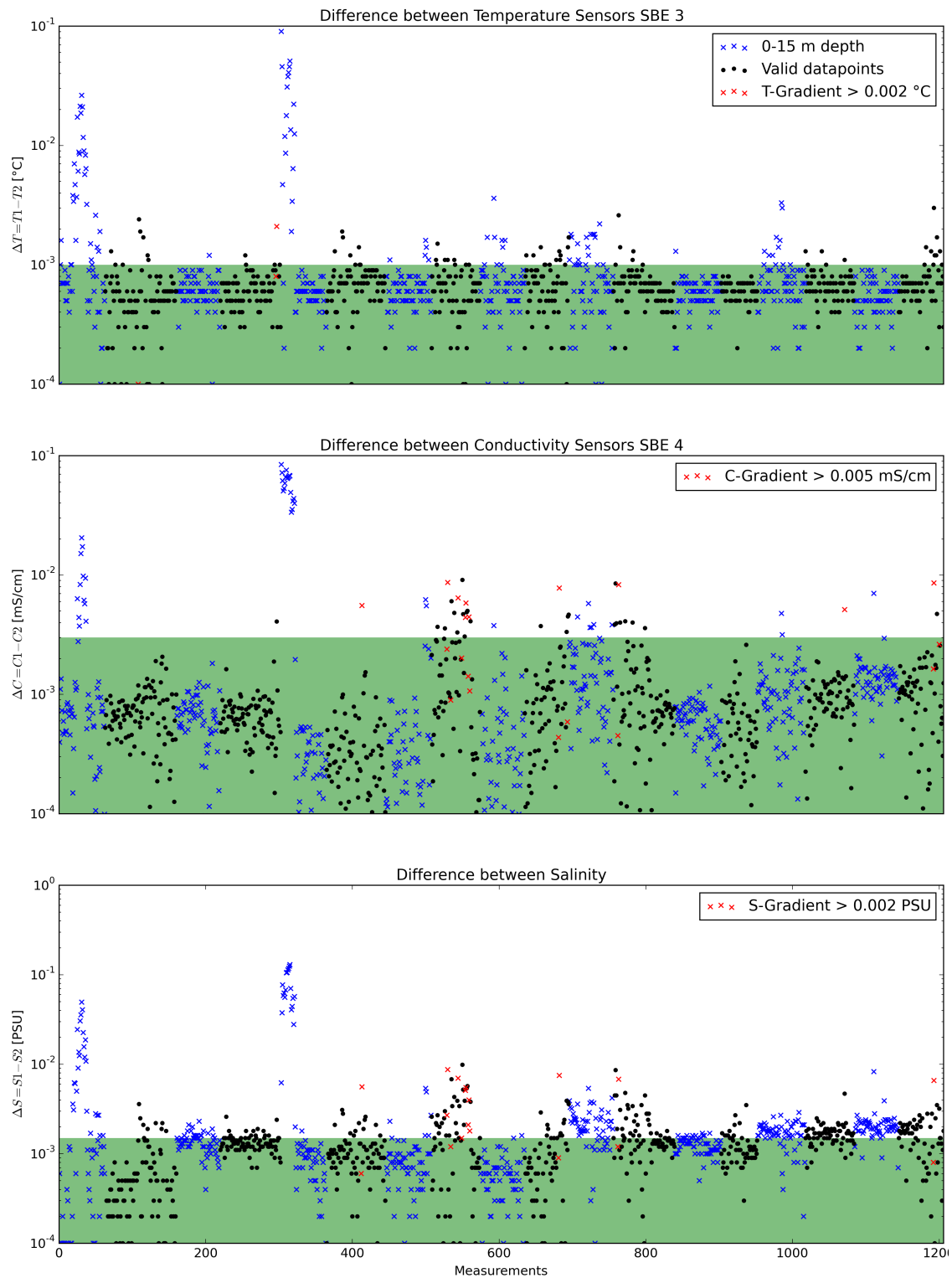
Sensor Differences

Figure 2: Data accuracy of sensor pairs HE441

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	$\pm 0.001^{\circ}C$	46.10%	91.85%
Conductivity	$\pm 0.003 mS/cm$	47.60%	96.20%
Salinity	$\pm 0.0015 PSU$	47.35%	65.51%

Comments

- 9 CTD/RO "on ground" entries in DShip station book

- 9 CTD raw data sets delivered

- 1 CTD cast data set with unequal sensor pair values and oxygen data differs from reference cast (data deleted)

- 8 CTD casts processed and uploaded

- of these 8 processed CTD casts:
    - 22 data points interpolated
    - 0 data points erased

Result files

Text File (HE441_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-HE441-report.pdf):

This PDF document.

Figure 3: CTD data Processing Summary HE441

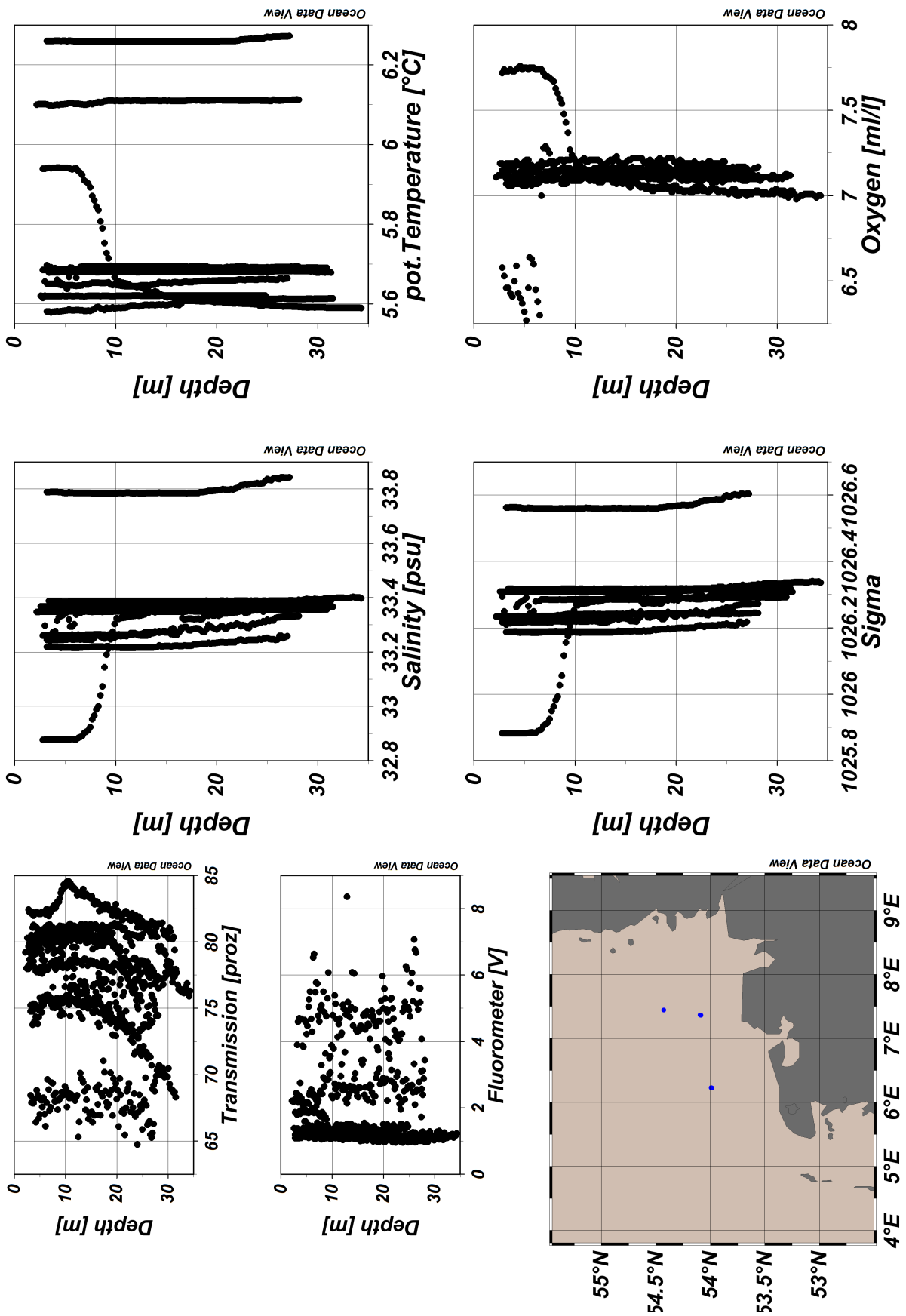| Station HE441/	Gear Abbr.	Date	Time	Position Latitude	Position Longitude	Depth [m]	File name	Sensor pair	Temp interp	Temp erased	Sal interp	Sal erased	Trans interp	Trans erased	Fluor interp	Fluor erased	Oxy interp	Oxy erased	complete interp	complete erased	Oxygen reference cruise/sss-cc	dist. (km)	Offset	Comments
0001-1	CTD/RO	20.03.2015	13:51	54° 5.51' N	7° 21.48' E	33.0	0001-01.*	1											0	0	HE370/34-1	9.18	~ 1.5	no btl file
0012-1	CTD/RO	21.03.2015	14:13	54° 5.75' N	7° 21.91' E	33.5	0012-01.*	1	1		1		1		1		1		5	0	HE370/34-1	9.4	~ 1.6	no btl file
0013-1	CTD/RO	21.03.2015	15:12	54° 5.66' N	7° 21.78' E	32.2	0013-01.*	1											1		HE370/34-1	9.3		no btl file; sensor pairs unequal; oxygen reference cast different; cast deleted
0014-1	CTD/RO	21.03.2015	16:05	54° 5.72' N	7° 21.76' E	32.6	0014-01.*	1	1		1		1		1		1		5	0	HE370/34-1	9.41	~ 1.5	no btl file
0015-1	CTD/RO	21.03.2015	17:09	54° 5.73' N	7° 21.74' E	31.4	0015-01.*	2											0	0	HE370/34-1	9.44	~ 1.5	no btl file
0017-1	CTD/RO	22.03.2015	7:11	54° 5.33' N	7° 21.65' E	31.9	0017-01.*	2	1		1		1		1		1		5	0	HE370/34-1	8.8	~ 1.5	no btl file
0018-1	CTD/RO	23.03.2015	21:10	54° 25.78' N	7° 26.50' E	24.7	0018-01.*	1			1								1	0	HE404/29-1	9.43	~ 2.1	no btl file
0031-1	CTD/RO	25.03.2015	20:05	53° 59.68' N	6° 13.60' E	26.6	0031-01.*	1	1		1		1		1		1		5	0	HE370/08-1	16.34	~ 1.5	no btl file
0047-1	CTD/RO	27.03.2015	7:29	53° 59.15' N	6° 13.36' E	26.6	0047-01.*	1			1								1	0	HE370/08-1	15.46	~ 1.5	no btl file
									4	0	6	0	4	0	4	0	4	0	22	0				

Figure 4: ODV Screenshot of HE441 CTD data