



# **CTD Data RV Heincke HE601**

# **Data Processing Report**

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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 HE601.

### 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*  $\rightarrow$  *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*  $\rightarrow$  *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.



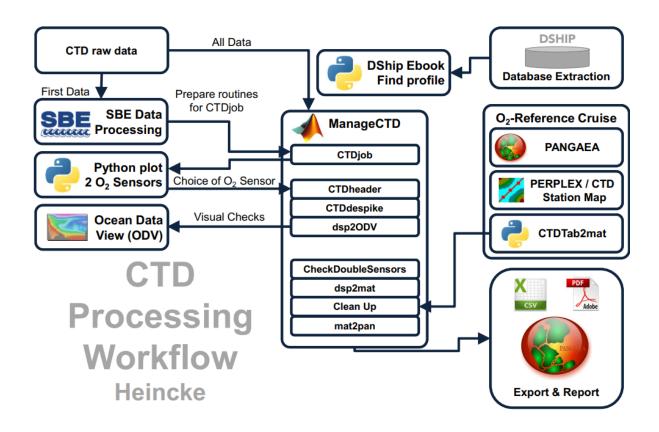


Figure 1: CTD data Processing Workflow



## 3 Expedition details

Vessel name RV Heincke

Expedition number HE601

Expedition leader Pineda-Metz, Santiago
Expedition start 14.06.2022 Bremerhaven
Expedition end 21.06.2022 Bremerhaven

Duration 7 days No. of CTD casts 26

BSH ID 20220161

Expedition report <a href="https://doi.pangaea.de/10.48433/cr\_he601">https://doi.pangaea.de/10.48433/cr\_he601</a>

Expedition map https://download.pangaea.de/reference/113265/attachments/HE601\_nav.jpg

Event list https://www.pangaea.de/expeditions/events/HE601

## 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	Valeport	None
71	WET_LabsCStar	435	None
20	FluoroWetlabECO_AFL_FL_Sensor	1365	7.1.2022

# 5 Processing

Details of processing procedures and processing parameters are described in *CTD Processing Log-book 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**

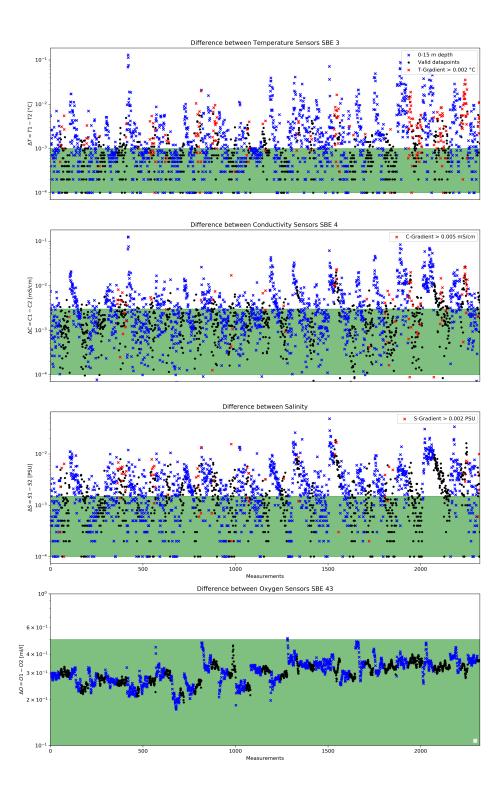


Figure 2: Data accuracy of sensor pairs HE601



### 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.

	Accuracy	Measurements re-	Remaining measure-				
		moved	ments				
Parameter	given by manufacturer	Surface 0-15m + gradi-	within accuracy specifi-				
		ent filter	cations				
Temperature	$\pm 0.001^{\circ}C$	68.75%	70.76%				
Conductivity	$\pm 0.003mS/cm$	63.53%	78.01%				
Salinity	$\pm 0.0015 PSU$	62.63%	56.63%				

#### **Comments**

- 26 CTD "max depth/on ground" entries in DShip station book
- 25 CTD raw data sets delivered
- 1 DShip station book entry was without corresponding CTD cast (HE601\_1-1)
- of these 25 processed CTD casts:
  - 0 oxygen profiles deleted (spiky and not matching to reference casts)
  - 64 data points interpolated
  - 19 data points erased



# **Result files**

Text File (HE601\_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-HE601-report.pdf):

This PDF document.



Commonte	Sollineits	no cast for this station book entry																										
	Offset		0.82	0.56	0.58	98.0	0.46	0.32	0.79	0.40	0.62	76.0	98.0	0.95	1.10	1.15	0.14	1.54	1.24	1.31	0.91	1.11	0.89	0.87	0.65	0.45	0.84	
Oxygen reference	dist. (km)		7.8	4.5	3.9	16.4	11.9	6.1	9.1	0.3	4.0	8.2	6.6	2.2	14.8	10.9	21.5	6.5	12.1	1.0	9.3	7.4	5.5	24.9	16.3	20.2	6.4	
Oxyger	cruise/sss-cc		HE329/870-2	HE329/870-2	HE329/870-2	HE329/868-1	HE329/868-1	HE329/868-1	HE329/870-2	HE329/868-1	HE329/870-2	HE329/870-1	HE329/870-1	HE329/870-1	HE329/870-1	HE329/870-1	HE329/932-1	HE329/856-1	HE329/856-1	HE329/924-1	HE329/922-1	HE329/847-1	HE329/846-1	HE329/862-1	HE329/864-1	HE329/848-1	HE329/862-1	
ensors	Offset c		0.27	0.32	0.26	0.28	0.25	0.35	0.29	0.30	0.27	0.31	0.26	0.23	0.24	0.22	0.29	98.0	0.33	0.36	0.33	0.37	0.35	0.34	0.34	0.37	0.34	
2 Oxy Sensors	Sensor		1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	1597	
olete	erased				9			2				4				2											2	19
Complete	interp		3				10		-				-			10		2			7		2	8	10		2	64
Oxy	erased																										1	1
ő	interp						2									2					1		1	1	2		1	10
Fluor	erased																										1	τ
FIL	interp		3				2									2					1		1	1	2		1	13
rans	erased											4															1	5
Tr	interp						2									2					-		1	-	2		1	10
Sal	erased				က			-								1											1	9
•	interp						2		-				-			2		-			2		2	4	2		1	6 18
dwa	erased				е			-								1											1	
Temp	interp						2									2		1			2		2	1	2		1	13
Sensor	pair		1	1	-	-	1	-	-	1	1	-	-	-	1	1	-	1	1	1	1	1	1	1	1	1 1	1	
File Name	riie ivallie		he601_stationB04	he601_stationB14	he601_stationB02	he601_stationB16	he601_stationB10	he601_stationB11	he601_stationB01	he601_stationB12	he601_stationB03	he601_stationB08	he601_stationB07	he601_stationB06	he601_stationB13	he601_stationB09	he601_stationT1	he601_stationT2	he601_stationT3	he601_stationT4	he601_stationT5	he601_stationT7	he601_stationT6	he601_stationSAR02	he601_stationSAR04	he601_stationSAR01	he601_stationSAR03	
Depth	Œ	33	28	25	26	26				27	56	23	26				24		31	34	35	19		22	24	20	16	
Position	Longitude	007° 36,336' E	006° 14,105' E	006° 16,563' E	006° 17,048' E	006° 05,531' E	006° 08,937' E	006° 14,209' E	006° 11,763' E	006° 19,678' E	006° 22,006' E	CTD 16.06.2022 13:46 53° 51,942' N 006° 22,319' E	006° 16,763' E	006° 25,331' E	CTD 17.06.2022 04:27 53° 53,931' N 006° 33,169' E	006° 28,625' E	006° 40,183' E	006° 54,486' E	CTD 18.06.2022 11:15 54° 03,674' N 007° 09,127' E	007° 20,762' E	007° 36,396' E	CTD 19.06.2022 08:52 54° 28,408' N 007° 33,692' E	CTD 19.06.2022 10:00 54° 19,422' N 007° 34,910' E	007° 24,129' E	007° 00,017' E	007° 18,945' E	007° 35,000' E	
Position		54° 09,623' N	53° 53,919' N	53° 54,962' N	CTD 15.06.2022 08:59 53° 57,370' N	15.06.2022 14:25 54° 02,768' N	53° 59,762' N	CTD 15.06.2022 15:42 54° 00,075' N	CTD 16.06.2022 07:37 53° 56,749' N	54° 00,127' N	53° 58,074' N	53° 51,942' N	16.06.2022 14:22 53° 51,264' N	53° 55,681' N	53° 53,931' N	CTD 17.06.2022 10:22 53° 53,053' N	53° 58,825' N	54° 01,495' N	54° 03,674' N	18.06.2022 12:09 54° 05,332' N	54° 09,638' N	54° 28,408' N	54° 19,422' N	54° 49,931' N	54° 51,072' N	CTD 20.06.2022 07:52 54° 40,975' N	54° 41,969' N	
Time		14.06.2022 18:32	15.06.2022 04:02	122 04:54	122 08:59	122 14:25	15.06.2022 15:07	15:42	122 07:37	16.06.2022 08:22	122 08:55	13:46	122 14:22	16.06.2022 15:42	122 04:27	10:22	17.06.2022 15:24	122 16:34	11:15	12:09	18.06.2022 13:20	122 08:52	10:00	19.06.2022 13:27	20.06.2022 06:02	122 07:52	20.06.2022 09:00	
Date		14.06.20		CTD 15.06.2022 04:54	15.06.20	15.06.20	15.06.20	15.06.20	16.06.20	16.06.20	CTD 16.06.2022 08:55	16.06.20	16.06.20	16.06.20	17.06.20	17.06.20	17.06.20	CTD 17.06.2022 16:34	18.06.20	18.06.20	18.06.20	19.06.20	19.06.20	19.06.20	20.06.20	20.06.20	20.06.20	
	Abbr.	СТБ	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD		CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	CTD	
Station	HE601	7	2-1	3-1	2-1	7-1	8-1	9-1	12-1	13-1	14-1	16-1	18-1	19-1	21-1	24-1	79-1	27-1	29-1	30-1	31-1	32-1	33-1	35-1	36-1	37-1	38-1	

Figure 3: CTD data Processing Summary HE601 Page 7 of 8



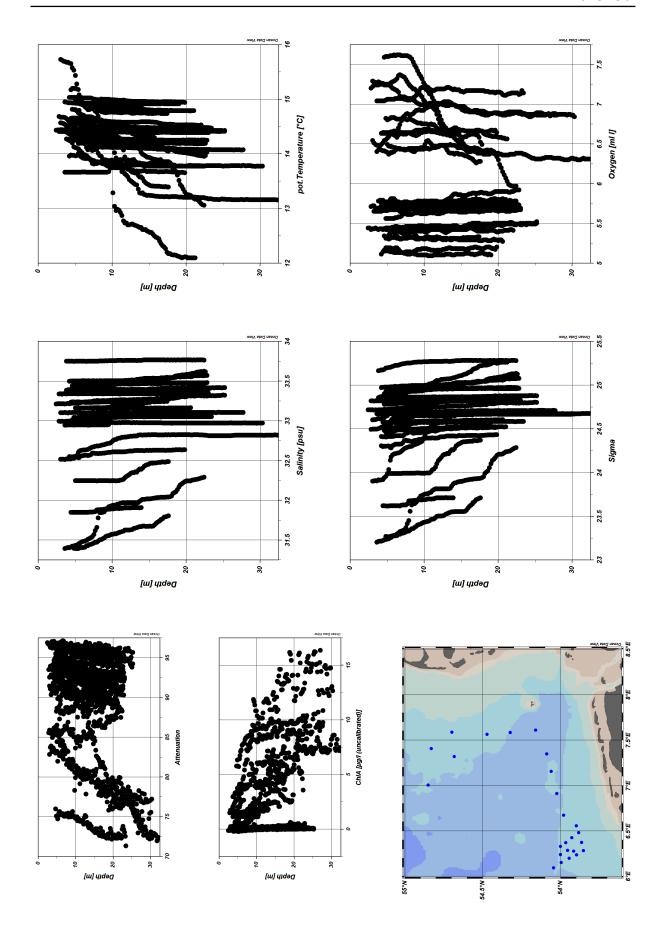


Figure 4: ODV Screenshot of HE601 CTD data Page 8 of 8