

# CTD Data RV Heincke HE461

## Data Processing Report

### Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Workflow</b>	<b>1</b>
<b>3</b>	<b>Cruise details</b>	<b>3</b>
<b>4</b>	<b>Sensor Layout</b>	<b>3</b>
<b>5</b>	<b>Processing</b>	<b>3</b>
<b>6</b>	<b>Results</b>	<b>5</b>

Contact:  
Gerd Rohardt  
Alfred-Wegener-Institute  
Am Handelshafen 12, D-27570 Bremerhaven, GERMANY  
Mail: [info@awi.de](mailto:info@awi.de)

Processing Agency:  
FIELAX  
Schleusenstr. 14, D-27568 Bremerhaven, GERMANY  
Mail: [info@fielax.de](mailto:info@fielax.de)

Ref.: CTD-HE461-report.pdf	Vers.: 1	Date: 2016/07/27	Status: final
----------------------------	----------	------------------	---------------

## 1 Introduction

This report describes the processing of CTD raw data acquired by Seabird SBE 911plus CTD on board RV Heincke during expedition HE461.

## 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.

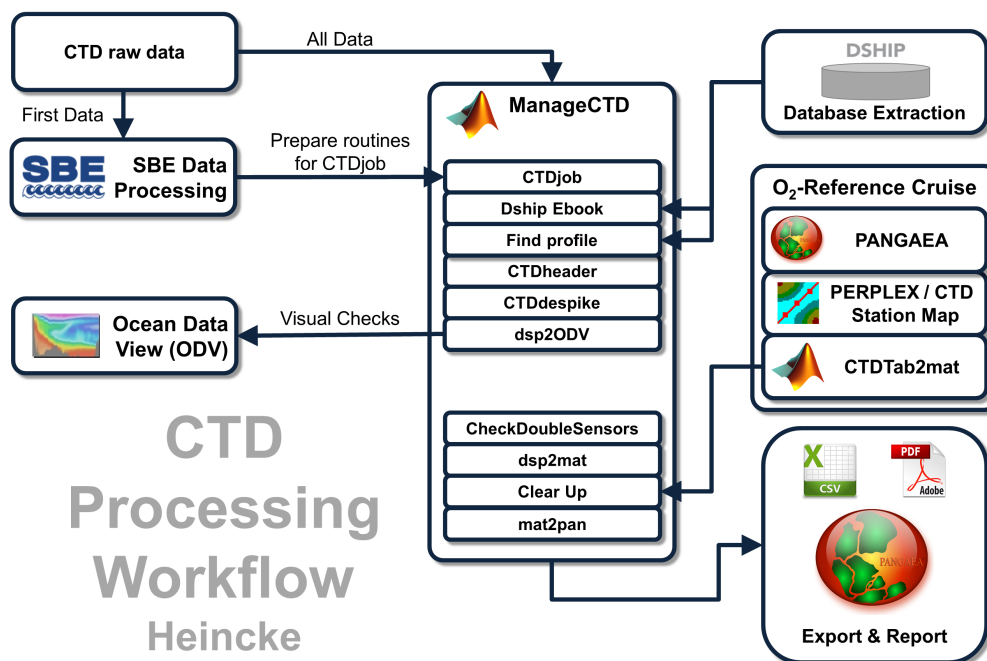


Figure 1: CTD data Processing Workflow

### 3 Cruise details

Vessel name       RV Heincke  
 Cruise name       HE461  
 Cruise start       15.04.2016 Bremerhaven  
 Cruise end         26.04.2016 Bremerhaven  
 Cruise duration   12 days  
 No. of CTD casts  58

### 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	19-Jan-16
3	ConductivitySensor	3810	08-Dec-15
45	PressureSensor	1015	05-Oct-10
55	TemperatureSensor	5375	19-Jan-16
3	ConductivitySensor	2470	08-Dec-15
0	AltimeterSensor	46466	23-Mar-09
71	WET_LabsCStar	1348DR	28-Jan-2016
20	FluoroWetlabECO_AFL_FL_Sensor	1365	15-Jan-2016
38	OxygenSensor	1597	22-Dec-15

### 5 Processing

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

#### Density Inversions and Manual Validation

Obvious outliers were removed manually. For the visual check density inversions  $> 0.005 \text{ kg/m}^3$  and  $> 0.01 \text{ kg/m}^3$  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](https://hdl.handle.net/10013/epic.47427)).

## Sensor Differences

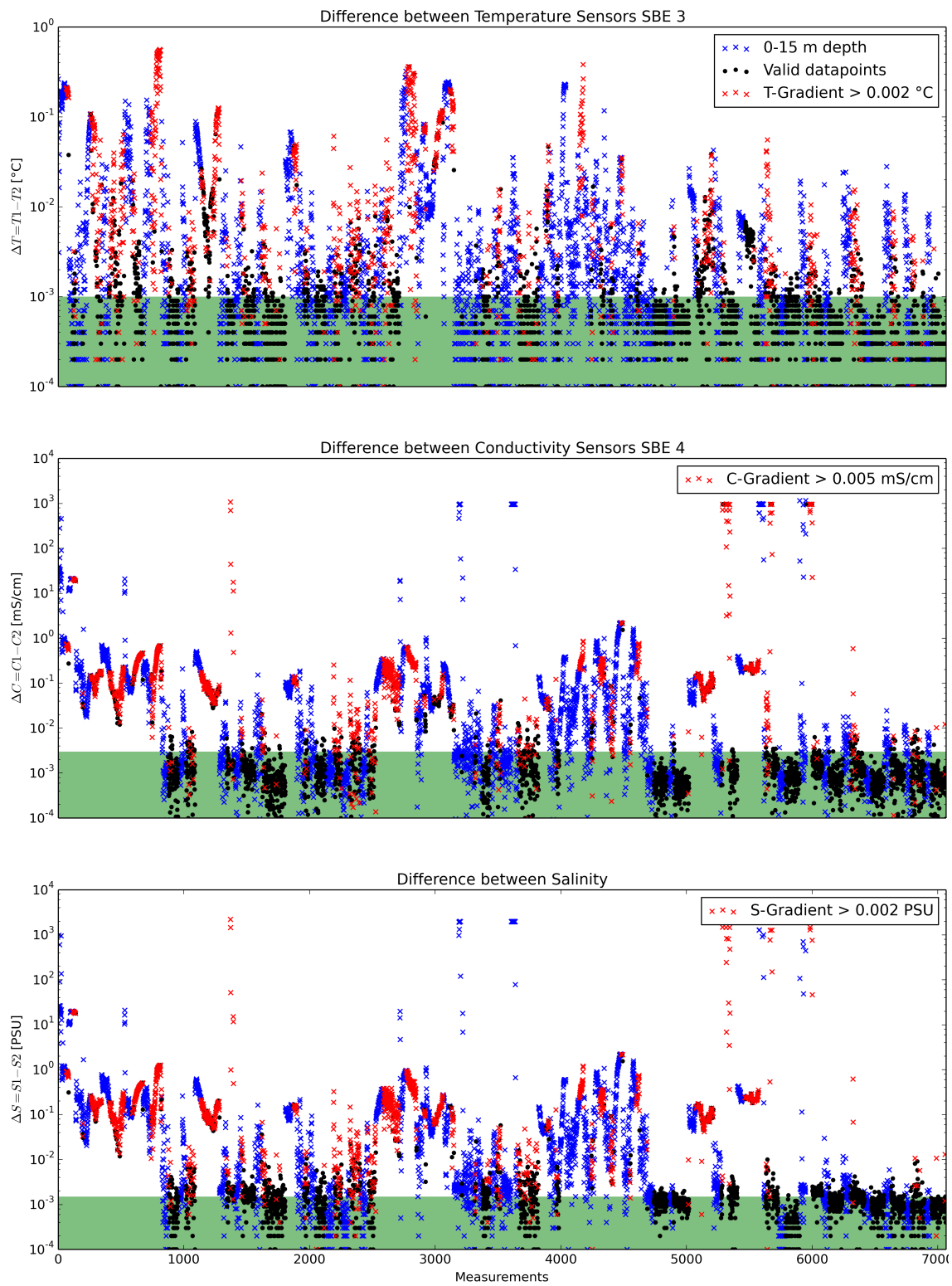


Figure 2: Data accuracy of sensor pairs HE461

## 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 re- moved Surface 0-15m + gradi- ent filter	Remaining measure- ments within accuracy specifi- cations
Temperature	$\pm 0.001^{\circ}C$	59.60%	71.56%
Conductivity	$\pm 0.003mS/cm$	59.75%	70.57%
Salinity	$\pm 0.0015PSU$	61.97%	50.43%

### Comments

- 58 CTD/RO "on ground" entries in DShip station book
- 58 CTD raw data sets delivered
- 1 CTD cast was invalid or test (999.hex)
- 0 CTD cast was made twice on a station
- 41 CTD casts had a wrong filename
- 57 CTD casts processed and uploaded (station HE461/0006-1 missing)
- of these 57 processed CTD casts:
  - 21 oxygen profiles deleted (spiky and not matching to reference casts)
  - 178 data points interpolated
  - 2009 data points erased

## Result files

Text File (HE461\_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-HE461-report.pdf):

This PDF document.

Station HE461/ Abbr.	Gear	Date	Time	Position Latitude	Position Longitude	Depth [m]	File	Sensor pair	Temp		Sal		Trans		Chloro		Oxy		complete		Oxygen reference		Comments		
									interp	erased	interp	erased	interp	erased	interp	erased	interp	erased	interp	erased	interp	erased		interp	erased
0001-1	CTD/RO	15.04.2016	8:56	53° 46.7' N	008° 9.27' E	17	1-1.*	1												0	0	HE443/01-1	8.56	0.1	Conductivity 2 wrong
0003-1	CTD/RO	15.04.2016	14:02	54° 5.25' N	007° 58.12' E	30	3-1.*	1												0	0	HE443/10-1	0.24	0.4	
0004-2	CTD/RO	16.04.2016	7:05	54° 5.2' N	007° 57.99' E	31	4-2.*	1		1										1	0	HE443/10-2	0.22	0.4	File with this name belongs to 19-1 according to dateline
0006-1	CTD/RO	16.04.2016	8:49	54° 8.68' N	007° 51.73' E	52														0	0				
0007-1	CTD/RO	16.04.2016	11:04	54° 21.69' N	007° 44.28' E	21	7-1.*	1												0	0	HE443/71-1	15.73	0.8	
0009-1	CTD/RO	17.04.2016	6:23	54° 9.24' N	007° 54.58' E	39	9-1.*	1	2	2										10	0	HE443/04-1	1.38	0.4	Conductivity 2 very noisy
0012-1	CTD/RO	17.04.2016	10:52	54° 7.92' N	007° 52.94' E	51	12-1.*	2												0	2	HE399/02-1	9.41	1.0	no bt, Salinity 1 too low
0015-1	CTD/RO	18.04.2016	6:51	54° 13.52' N	008° 2.61' E	14	14-1.*	1												0	0	HE443/38-1	4.85	0.5	filename doesn't match station name
0016-1	CTD/RO	18.04.2016	7:46	54° 9.21' N	008° 0.03' E	30	16-1.*	1	1	2										8	0	HE443/06-1	2.56	0.3	
0018-1	CTD/RO	18.04.2016	10:56	54° 9.1' N	007° 57.8' E	38	18-1.*	1	2	2										10	0	HE443/82-1	1.59	0.3	
0019-1	CTD/RO	18.04.2016	13:47	54° 8.72' N	007° 55.33' E	47	16-1.*	1	1	1										25	12	HE443/82-1	1.39	0.4	
0020-1	CTD/RO	18.04.2016	14:56	54° 2.97' N	008° 4.98' E	18	Elbe3.*	1												0	0	HE443/54-1	0.27		O2 very noisy, oxygen deleted
0021-1	CTD/RO	18.04.2016	15:57	54° 1.1' N	008° 14.81' E	14	Elbe4.*	1	1	1										2	26	HE443/29-1	1.45	0.5	O2 very noisy > 10 m
0022-1	CTD/RO	18.04.2016	16:31	53° 59.47' N	008° 18.68' E	20	Elbe5.*	1	1	1										0	4	HE443/56-1	0.24		O2 very noisy, oxygen deleted
0023-1	CTD/RO	18.04.2016	17:06	53° 58.86' N	008° 24.48' E	21	Elbe6.*	1	1	1										6	70	HE443/31-1	0.28	0.2	O2 very noisy > 8 m
0024-1	CTD/RO	18.04.2016	17:54	53° 58.04' N	008° 31.47' E	16	Elbe7.*	1	1	1										5	51	HE443/58-1	0.15	0.3	O2 very noisy > 8 m
0025-1	CTD/RO	18.04.2016	18:39	53° 54.86' N	008° 40.65' E	17	Elbe8.*	1												33	0	HE443/33-1	2.19	0.2	O2 very noisy > 14 m
0026-1	CTD/RO	19.04.2016	6:01	54° 10.86' N	007° 47.16' E	39	P8-2.*	2												0	0	HE443/43-1	0.39		O2 very noisy, oxygen deleted
0027-1	CTD/RO	19.04.2016	7:19	54° 9.03' N	007° 34.33' E	37	P8-4.*	1												0	0	HE443/44-1	0.19		O2 very noisy, oxygen deleted
0028-1	CTD/RO	19.04.2016	8:54	54° 10.8' N	007° 56.41' E	15	Elder-1.*	2												2	0	HE443/41-1	0.33		O2 very noisy, oxygen deleted
0029-1	CTD/RO	19.04.2016	9:34	54° 10.81' N	008° 2.48' E	28	Elder-2.*	1	1	1										1	100	HE399/02-1	11.37	0.8	O2 very noisy > 10 m
0030-1	CTD/RO	19.04.2016	10:15	54° 12.39' N	008° 8.81' E	22	Elder-3.*	1												35	0	HE399/20-1	12.60	1.1	O2 very noisy > 15 m
0031-1	CTD/RO	19.04.2016	11:11	54° 13.99' N	008° 18.23' E	13	Elder-4.*	1												25	0	HE443/36-1	0.06	0.4	O2 very noisy > 10 m
0032-1	CTD/RO	19.04.2016	11:49	54° 13.63' N	008° 23.56' E	1	Elder-5.*	1												0	0	HE443/35-1	0.28		O2 very noisy, oxygen deleted
0033-1	CTD/RO	20.04.2016	6:00	54° 31.13' N	006° 31.76' E	35	P-8-6.*	1	2	2										8	1	HE443/48-1	0.12		O2 very noisy, oxygen deleted
0034-1	CTD/RO	20.04.2016	7:33	54° 22.83' N	006° 53.94' E	34	P8-7.*	1												132	0	HE443/47-1	0.26	1.0	O2 very noisy
0035-1	CTD/RO	20.04.2016	9:04	54° 16.19' N	007° 11.59' E	36	P8-6.*	1	1	1										1	140	HE443/20-1	0.21	1.1	O2 very noisy > 10 m
0036-1	CTD/RO	20.04.2016	10:03	54° 15' N	007° 22.98' E	39	P8-5.*	1												140	0	HE443/45-1	0.31	0.7	O2 very noisy > 10 m
0037-1	CTD/RO	20.04.2016	13:14	54° 8.92' N	007° 55.55' E	47	Elbe1_2.*	1	1	3										1	202	HE443/82-1	1.19	0.5	O2 very noisy > 8 m
0038-1	CTD/RO	20.04.2016	14:25	54° 3.01' N	008° 4.68' E	19	Elbe3_2.*	1												0	0	HE443/28-1	0.48		O2 very noisy, oxygen deleted
0039-1	CTD/RO	20.04.2016	15:22	54° 1.28' N	008° 14.2' E	12	Elbe4_2.*	1												32	0	HE443/29-1	0.78	0.6	O2 very noisy
0040-1	CTD/RO	20.04.2016	16:02	53° 59.45' N	008° 18.43' E	19	Elbe5_2.*	2												53	0	HE443/56-1	0.50	0.5	O2 very noisy > 8 m
0041-1	CTD/RO	20.04.2016	16:50	53° 58.81' N	008° 24.22' E	19	Elbe6_2.*	1												0	0	HE443/31-1	0.11		O2 very noisy, oxygen deleted
0042-1	CTD/RO	20.04.2016	17:38	53° 58.04' N	008° 31.58' E	13	Elbe7_2.*	1	1	1										1	42	HE443/58-1	0.27	0.3	O2 very noisy > 8 m
0043-1	CTD/RO	20.04.2016	18:42	53° 54.53' N	008° 41.58' E	13	Elbe8_2.*	1												32	0	HE443/33-1	1.47	0.4	O2 very noisy > 10 m
0044-1	CTD/RO	21.04.2016	6:05	54° 46.74' N	005° 49.39' E	37	P8-10_2.*	1	2	2										8	0	HE443/25-1	0.18		O2 very noisy, oxygen deleted
0045-1	CTD/RO	21.04.2016	7:29	54° 39.59' N	006° 8.05' E	38	P8-9_2.*	1		1										1	0	HE443/50-1	0.08		O2 very noisy, oxygen deleted

Figure 3: CTD data Processing Summary HE461  
Page 7 of 9



Station HE461/ Abbr.	Gear	Date	Time	Position Latitude	Position Longitude	Depth [m]	File	Sensor pair	Temp		Sal		Trans		Chloro		Oxy		Oxygen reference		Comments						
									interp	erased	interp	erased	interp	erased	interp	erased	interp	erased	complete	erased		cruise/sss-cc	dist. (km)	Offset			
0046-1	CTD/RO	21.04.2016	9:05	54° 31.09' N	006° 31.46' E	35	P8-8_2_*	1													0	145	HE443/22-1	0.08	1.1	O2 very noisy	
0047-1	CTD/RO	21.04.2016	10:42	54° 22.71' N	006° 53.86' E	35	P8-7_2_*	1														0		HE443/47-1	0.19		O2 very noisy, oxygen deleted
0048-1	CTD/RO	21.04.2016	12:08	54° 16.12' N	007° 11.5' E	36	P8-6_2_*	1	1		1											7	154	HE443/20-1	0.20	1.1	O2 very noisy
0049-1	CTD/RO	21.04.2016	13:08	54° 15' N	007° 22.96' E	37	P8-5_2_*	1	3		5											8	0	HE443/45-1	0.32		Conductivity 2 wrong, O2 very noisy, oxygen deleted
0050-1	CTD/RO	21.04.2016	14:16	54° 9.07' N	007° 33.84' E	35	P8-4_2_*	1														0	0	HE443/18-1	0.40		Conductivity 2 wrong, O2 very noisy, oxygen deleted
0051-1	CTD/RO	21.04.2016	15:21	54° 11.04' N	007° 47.33' E	40	P8-2_2_*	1	2		2											12	0	HE443/43-1	0.29		Conductivity 2 wrong, O2 very noisy, oxygen deleted
0052-1	CTD/RO	21.04.2016	17:47	54° 13.6' N	008° 23.35' E	8	Eider5_2_*	1														20	0	HE443/35-1	0.25	0.2	O2 very noisy > 8 m
0053-1	CTD/RO	21.04.2016	18:16	54° 14' N	008° 18.2' E	10	Eider4_2_*	2														18	0	HE443/36-1	0.03	0.3	O2 very noisy > 9 m
0054-1	CTD/RO	22.04.2016	6:00	54° 12.35' N	008° 8.57' E	17	Eider3_2_*	2	2		2											4	0	HE443/37-1	0.17		O2 very noisy, oxygen deleted
0055-1	CTD/RO	22.04.2016	6:37	54° 10.88' N	008° 2.48' E	28	Eider2_2_*	2			1											1	0	HE443/64-1	0.06		O2 very noisy, oxygen deleted
0056-1	CTD/RO	22.04.2016	7:15	54° 10.97' N	007° 56.57' E	14	Eider1_2_*	2														48	0	HE399/02-1	11.85	0.9	O2 very noisy > 8 m
0057-1	CTD/RO	22.04.2016	13:15	54° 6.21' N	007° 57.8' E	31	57-1_*	2														75	0	HE399/02-1	3.35	0.6	O2 very noisy > 16 m
0059-1	CTD/RO	23.04.2016	6:42	54° 6.21' N	007° 57.8' E	30	59-1_*	2														0	0	HE443/76-1	0.45		O2 very noisy, oxygen deleted
0061-1	CTD/RO	23.04.2016	11:06	54° 17.01' N	007° 41.61' E	25	61-1_*	1	1		2											5	0	HE443/14-1	11.53		O2 very noisy, oxygen deleted
0062-1	CTD/RO	23.04.2016	13:20	54° 10.97' N	007° 35.52' E	36	62-2_*	1	1		2											5	0	HE443/18-1	3.98		O2 very noisy, oxygen deleted
0063-1	CTD/RO	24.04.2016	6:29	54° 8.08' N	007° 53.49' E	53	63-1_*	1	1		1											4	0	HE443/03-1	0.32		O2 very noisy, oxygen deleted
0074-1	CTD/RO	25.04.2016	8:03	54° 10.42' N	008° 4.17' E	21	74-1_*	2	1		1											75	5	HE399/02-1	11.30	0.6	O2 very noisy
0076-1	CTD/RO	25.04.2016	9:00	54° 10.57' N	008° 1.51' E	28	76-1_*	1	3		3											9	111	HE443/38-1	1.06	0.3	O2 very noisy filename doesn't match
0076-2	CTD/RO	25.04.2016	9:15	54° 10.59' N	008° 1.48' E	27	77-1_*	1														71	0	HE443/38-1	1.06	0.4	station name, O2 very noisy > 14 m
0076-3	CTD/RO	25.04.2016	9:38	54° 10.57' N	008° 1.54' E	28	76-3_*	1														78	0	HE443/38-1	1.03	0.4	O2 very noisy > 12 m
0076-4	CTD/RO	25.04.2016	9:54	54° 10.59' N	008° 1.53' E	25	76-4_*	1	2		2											82	4	HE443/38-1	1.02	0.3	O2 very noisy > 16 m
									34		1											38	2004				
											1											178	2009				

Figure 4: CTD data Processing Summary HE461 (continuation)  
Page 8 of 9

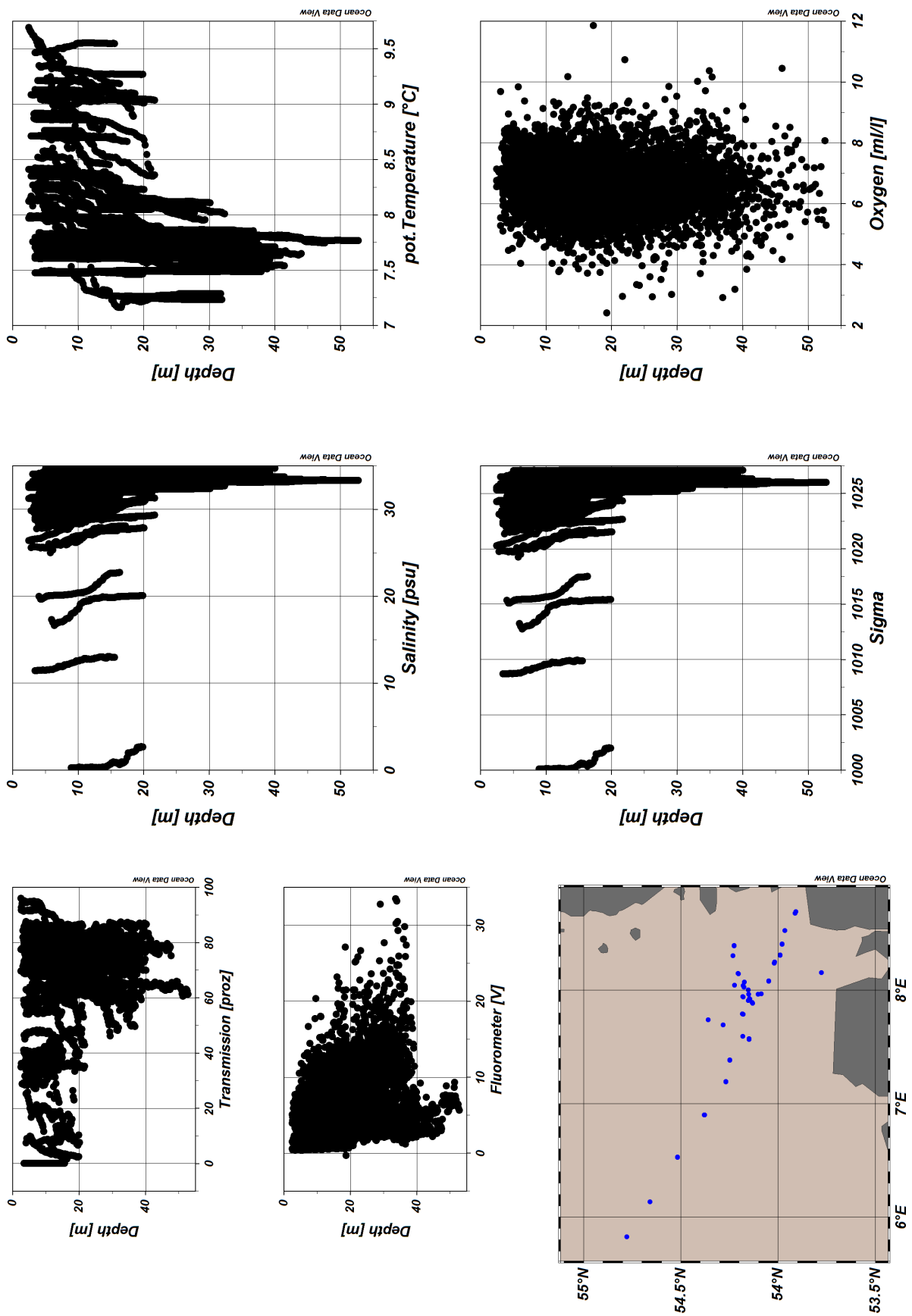


Figure 5: ODV Screenshot of HE461 CTD data  
Page 9 of 9