

CTD Data RV Heincke HE449

Data Processing Report

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

Processing Agency:
FIELAX
Schleusenstr. 14, D-27568 Bremerhaven, GERMANY
Mail: info@fielax.de

Ref.: CTD-HE449-report.pdf

Vers.: 1

Date: 2016/04/07

Status: final

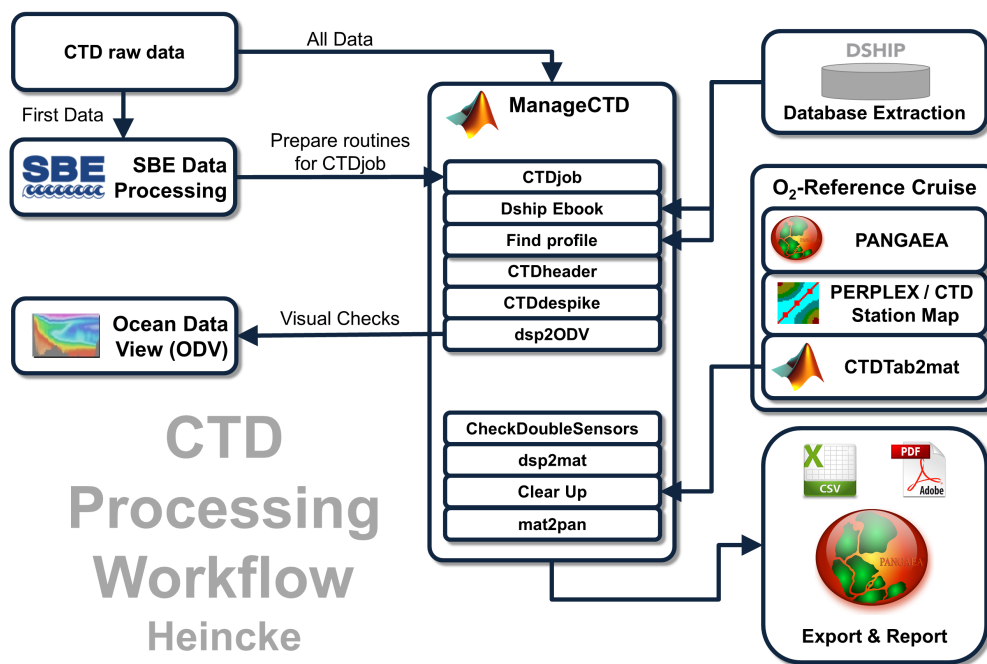
1 Introduction

This report describes the processing of CTD raw data acquired by Seabird SBE 911plus CTD on board RV Heincke during expedition HE449.

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.



**CTD
Processing
Workflow
Heincke**

Figure 1: CTD data Processing Workflow

3 Cruise details

Vessel name RV Heincke
 Cruise name HE449
 Cruise start 01.08.2015 Trondheim
 Cruise end 22.08.2015 Tromsø
 Cruise duration 22 days
 No. of CTD casts 41

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](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

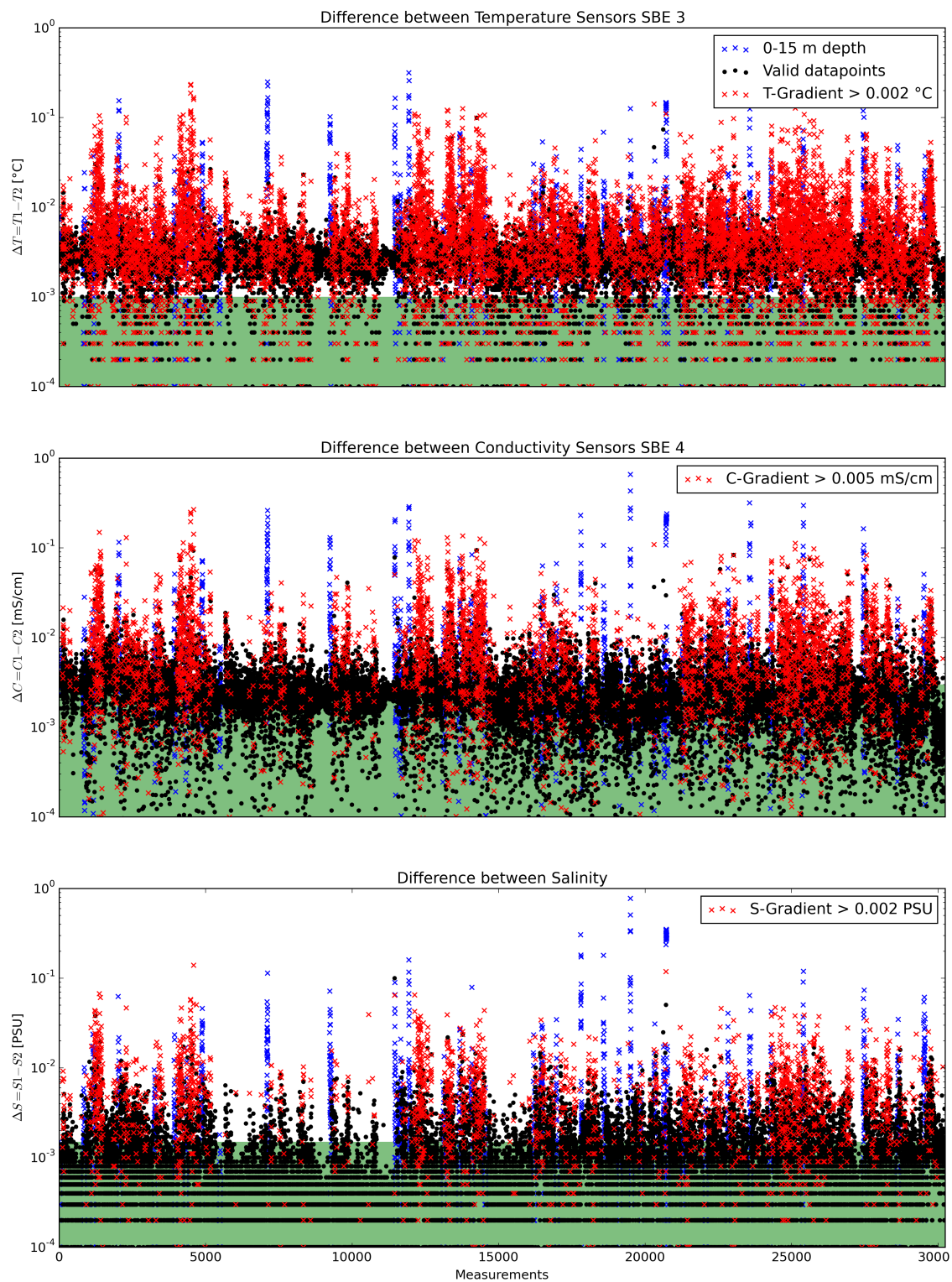


Figure 2: Data accuracy of sensor pairs HE449

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	$\pm 0.001^{\circ}C$	36.09%	6.86%
Conductivity	$\pm 0.003mS/cm$	20.29%	73.11%
Salinity	$\pm 0.0015PSU$	14.56%	80.87%

Comments

- 41 CTD/RO "on ground" entries in DShip station book
- 40 CTD raw data sets delivered
- 1 station book entry without data
- 1 casts with just 14 data points (5m] deleted
- 39 CTD casts processed and uploaded
- of these 39 processed CTD casts:
 - 14 oxygen profiles deleted (spiky and not matching to reference casts)
 - 1231 data points interpolated
 - 32 data points erased

Result files

Text File (HE449_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-HE449-report.pdf):

This PDF document.

Station	Gear	Date	Time	Position Latitude	Position Longitude	Depth [m]	File	Sensor pair	Temp	Sal	Trans	Fluor	Oxy	complete	Oxygen reference cruise/sss-cc	Offset	Comments		
HE449/ Abbr.									Interp	Interp	Interp	Interp	Interp	Interp	dist. (km)				
									erased	erased	erased	erased	erased	erased					
0001-1	CTD/RO	04.08.2015	16:27	75° 30.43' N	17° 26.13' E	166.5	01_1.*	1	8	14	8	8	8	46	0 HE333/28-2	127.06	~0.1		
0002-1	CTD/RO	05.08.2015	8:25	76° 47.39' N	20° 41.27' E	62.9	02_1.*	1	2	2	2	2	8	8	0 HE333/04-1	33.88		oxygen deleted	
0003-1	CTD/RO	05.08.2015	10:08	76° 43.19' N	19° 49.45' E	176.1	03_1.*	1	6	10	6	6	6	34	0 HE333/28-1	25.13	~0.1		
0004-1	CTD/RO	05.08.2015	14:45	76° 38.86' N	18° 3.65' E	240.9	04_1.*	1	6	6	6	6	6	30	0 HE333/28-2	26.22	~0.3		
0005-1	CTD/RO	06.08.2015	6:21	76° 52.84' N	14° 37.45' E	138.4	05_1.*	1	5	6	5	5	21	0 HE333/27-1	75.57		oxygen deleted		
0006-1	CTD/RO	06.08.2015	10:06	76° 53.30' N	14° 9.56' E	76.1	06_1.*	1	2	10	2	2	16	0 HE333/27-1	86.49		oxygen deleted		
0007-1	CTD/RO	06.08.2015	12:33	76° 52.23' N	13° 30.71' E	110.4	07_1.*	1	10	29	6	6	51	0 HE333/27-1	102.75		oxygen deleted		
0008-1	CTD/RO	06.08.2015	14:28	76° 52.91' N	14° 37.31' E	138.3	08_1.*	1	3	11	3	3	20	0 HE333/27-1	75.59		oxygen deleted		
0009-1	CTD/RO	07.08.2015	6:16	76° 50.98' N	12° 59.78' E	331.0	09_1.*	1	12	24	12	12	72	0 HE333/27-1	115.93	~1.2			
0010-1	CTD/RO	07.08.2015	11:12	77° 3.14' N	13° 22.58' E	440.5	10_1.*	1	20	20	20	20	100	0 HE333/27-1	102.64	~1.3			
0010-2	CTD/RO	07.08.2015	12:29	77° 3.07' N	13° 22.78' E	445.7	10_2.*	1	7	2	7	2	35	10 HE333/27-1	102.57	~1.2			
0010-3	CTD/RO	07.08.2015	13:06	77° 3.07' N	13° 22.53' E	445.3	10_3.*	1	3	5	1	1	10	0 HE333/27-1	102.67		oxygen deleted		
0011-4	CTD/RO	07.08.2015	13:34	77° 3.11' N	13° 22.99' E	441.8	10_4.*	1							HE333/27-1	102.48		only 14 datapoints (~5m depth); cast deleted	
0012-1	CTD/RO	09.08.2015	9:16	76° 40.78' N	18° 49.46' E	63.5	11_1.*	1	2	2	2	2	10	0 HE333/28-2	12.15	~0.7			
0013-1	CTD/RO	10.08.2015	9:02	76° 38.87' N	18° 3.65' E	241.6	13_1.*	1	10	33	10	10	73	0 HE333/28-2	26.22	~0.8			
0015-1	CTD/RO	11.08.2015	8:49	76° 48.05' N	14° 9.75' E	107.3	15_1.*	2	1	13	1	1	17	0 HE333/27-1	89.65	~1.2			
0017-1	CTD/RO	11.08.2015	13:08	76° 52.21' N	13° 56.18' E	89.3	17_1.*	1	5	6	5	5	26	0 HE333/27-1	92.46	~1.2			
0018-1	CTD/RO	11.08.2015	16:06	76° 59.28' N	13° 33.50' E	99.5	18_1.*	1	4	4	4	4	20	0 HE333/27-1	98.9	~1.3			
0021-1	CTD/RO	12.08.2015	17:27	77° 34.78' N	11° 3.52' E	337.4	21_1.*	2	8	8	8	8	40	0 HE333/30-1	97.18	~0.1			
0022-1	CTD/RO	13.08.2015	6:02	77° 44.51' N	13° 9.83' E	57.2	22_1.*	1	1	3	1	1	7	6 HE333/30-1	116.87		oxygen deleted		
0023-1	CTD/RO	13.08.2015	8:03	77° 41.08' N	12° 25.86' E	106.1	23_1.*	1	5	5	5	5	20	0 HE333/30-1	107.77		oxygen deleted		
0024-1	CTD/RO	13.08.2015	10:14	77° 37.60' N	11° 40.67' E	172.8	24_1.*	1	8	18	8	8	42	0 HE333/30-1	100.77		oxygen deleted		
0025-1	CTD/RO	13.08.2015	14:39	77° 38.68' N	14° 14.18' E	159.0	25_1.*	1	7	17	7	7	45	0 HE333/27-1	100.68	~1.1			
0026-1	CTD/RO	14.08.2015	10:05	77° 45.07' N	15° 1.41' E	109.0	26_1.*	1	4	4	4	4	20	0 HE333/15-3	94.28	~0.4			
0027-1	CTD/RO	14.08.2015	11:48	77° 47.93' N	15° 50.16' E	84.5	27_1.*	1	8	8	8	8	40	0 HE333/15-3	75.65	~0.4			
0028-1	CTD/RO	14.08.2015	14:02	77° 49.73' N	16° 38.53' E	72.9	28_1.*	1	3	3	3	3	15	5 HE333/15-3	57.68	~0.2			
0029-1	CTD/RO	14.08.2015	16:33	77° 45.04' N	15° 1.32' E	108.6	29_1.*	1	6	2	6	2	30	10 HE333/15-3	94.32	~0.4			
0029-3	CTD/RO	15.08.2015	6:13	77° 45.11' N	15° 1.35' E	109.6	29_3.*	1	6	6	6	6	30	0 HE333/15-3	94.31	~0.4			
0029-4	CTD/RO	15.08.2015	6:36	77° 45.05' N	15° 1.19' E	107.3	29_4.*	2	1	1	1	1	5	1 HE333/15-3	94.37	~0.4			
0029-5	CTD/RO	15.08.2015	7:05	77° 45.09' N	15° 1.09' E	108.2	29_5.*	1					0	0 HE333/15-3	94.41		oxygen deleted		
0029-7	CTD/RO	15.08.2015	7:56	77° 45.08' N	15° 1.38' E	108.3	no data										no data		
0030-1	CTD/RO	15.08.2015	10:16	77° 45.14' N	14° 48.40' E	109.8	30_1.*	2	5	5	5	5	25	0 HE333/27-1	98.59	~0.6			
0031-1	CTD/RO	15.08.2015	15:20	77° 57.90' N	12° 30.26' E	161.6	31_1.*	1	6	13	6	6	31	0 HE333/30-1	90.37		oxygen deleted		
0032-1	CTD/RO	16.08.2015	6:07	77° 53.52' N	10° 33.23' E	158.9	32_1.*	1	3	5	3	3	17	0 HE333/30-1	61.33	~0.2			
0033-1	CTD/RO	16.08.2015	8:12	77° 55.98' N	11° 31.87' E	155.3	33_1.*	1	6	10	6	6	34	0 HE333/30-1	73.61	~0.2			
0034-1	CTD/RO	16.08.2015	10:51	78° 0.94' N	13° 12.29' E	139.9	34_1.*	1	5	5	5	5	20	0 HE333/62-1	106.39	~0.3			
0035-1	CTD/RO	17.08.2015	6:05	78° 10.87' N	13° 37.91' E	216.7	35_1.*	1	6	10	6	6	34	0 HE333/30-1	110.65		oxygen deleted		
0036-1	CTD/RO	17.08.2015	8:16	78° 8.89' N	13° 42.69' E	424.8	36_1.*	1	17	17	17	17	68	0 HE333/30-1	109.01		oxygen deleted		
0037-1	CTD/RO	17.08.2015	10:26	78° 6.58' N	13° 44.21' E	240.7	37_1.*	1	11	11	11	11	44	0 HE333/30-1	110.65		oxygen deleted		
0038-1	CTD/RO	17.08.2015	14:00	78° 24.99' N	15° 58.57' E	186.7	38_1.*	1	10	10	10	10	50	0 HE333/17-1	77.19	~0.5			
0039-1	CTD/RO	18.08.2015	8:39	78° 35.68' N	16° 31.30' E	153.2	39_1.*	2	5	5	5	5	25	0 HE333/17-1	72.37	~0.5			
			237						8	373	8	231	5	231	5	159	6	1231	32

Figure 3: CTD data Processing Summary HE449
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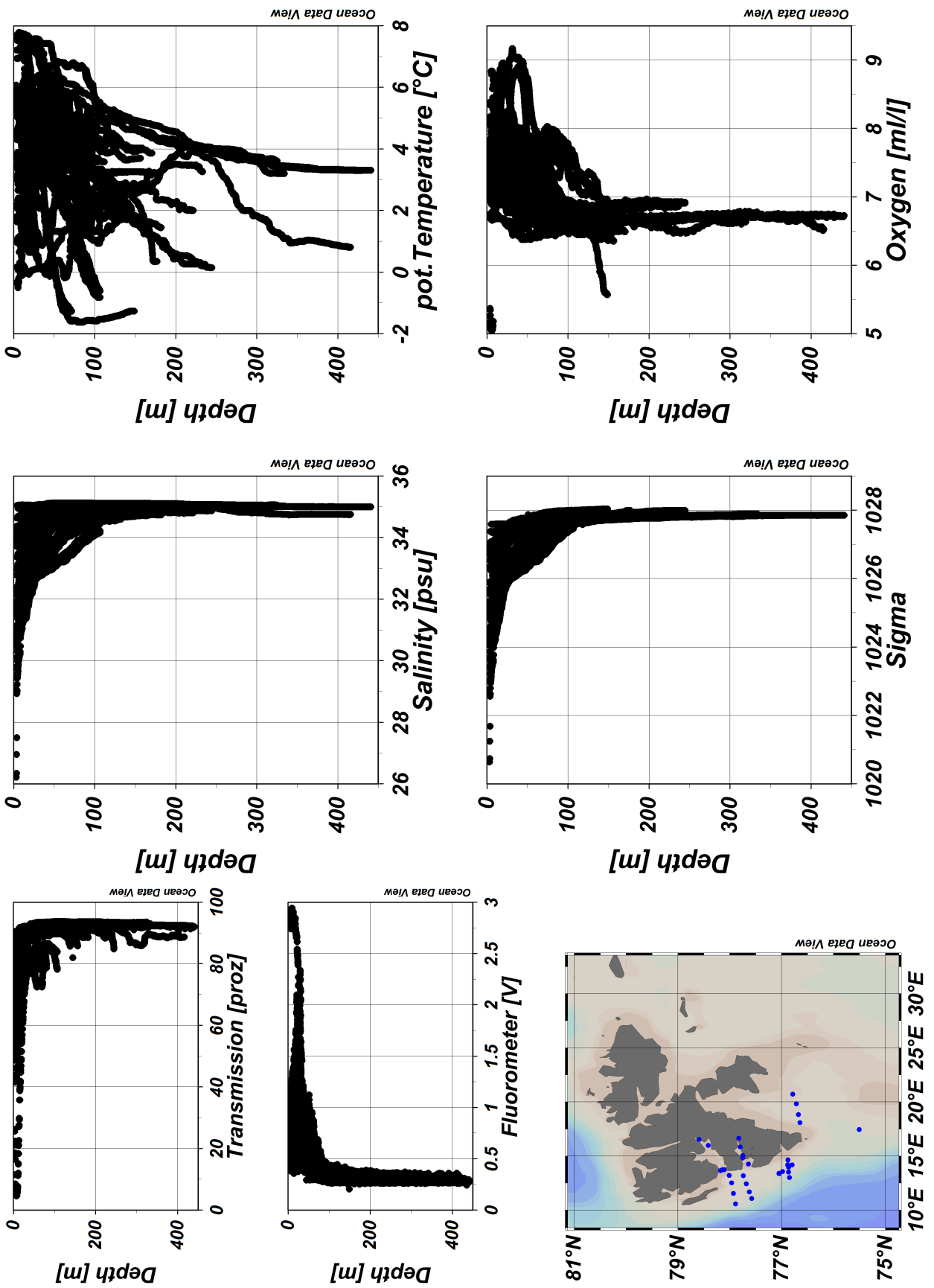


Figure 4: ODV Screenshot of HE449 CTD data
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