Leibniz-Institut für Meereswissenschaften
an der Universität Kiel

Date: 31.07.2004

Cruise Report

Compiled by: T.J. Müller

F.S.Poseidon **Cruise No.: P315**

Dates of Cruise: 26.07. – 31.07.2004

Areas of Research: Physical oceanography

Port Calls: Reykjavik,

Institute: Leibniz-Institut für Meereswissenschaften an der Universität Kiel, Germany

Chief Scientist: Dr. Thomas J. Müller

Number of Scientists: 9

Projects: „Sonderforschungsbereich 460“, University of Kiel

Cruise Report

Contents:

1. Scientific crew

No.	Name		Institution	Function
1.	Müller, Thomas J.	Dr.	IFM-GEOMAR	Chief scientist
2.	Heinitz, Maike	TA	IFM-GEOMAR	Trainee
3.	Koy, Uwe	TA	IFM-GEOMAR	PIES, ADCP
4.	Macrander, Andreas	Dipl.Oz.	IFM-GEOMAR	ADCP, CTD
5.	Nowald, Nicolas	Dipl.-Geol.	MARUM	ROV
6.	Schröder, Marcel	Dipl.-Ing.	MARUM	ROV
7.	Franke, Phillip	PhD Stud.	MARUM	ROV
8.	Smarz, Christopher	TA	IFM-GEOMAR	CTD, vADCP, TSG
9.	Valdimarsson Hedinn	M.Sc.	MRI	Guest

IFM-GEOMAR: Leibniz-Institut für Meereswissenschaften, Kiel, Germany
MARUM: Marine und Angewandte Umwelttechnik, Universität Bremen, Germany
MRI: Marine Research Institute, Reykjavik, Iceland

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2. Research programme

The overflow through the Denmark Strait is one of the major sources to form North Atlantic Deep Water (NADW), and thus plays an essential role in the world-wide thermohaline circulation. Within the „Sonderforschungsbereich 460“ of the German Research Foundation (DFG), the dynamics of its variability and interaction with overlying water masses is investigated.

In Denmark Strait, direct measurements of currents in the overflow layer at the sill were performed as one component of the project. During cruise P293-2 in 2002, a shielded ADCP was moored on the western shelf; this ADCP could not be recovered due to a technical problem one year later during cruise P302. Therefore, during P315 an attempt was made, to recover the ADCP using a small ROV of the MARUM, University of Bremen.

Cruise P315 (maps in Fig 3.1 and 3.2) was aimed to

- recover the shielded ADCP moored during POSEIDON cruise 293/2 in 2002 and which could not be recovered during cruise P302 in 2003
- to recover and re-moor an ADCP of the MRI in Denmark Strait
- to take some CTD casts and ADCP sections across the sill when restricted time allows.

3. Narrative of cruise with technical details

2004

26.07. afternoon, sail from Reykjavik

27.07., 09:30 recover MRI moored ADCP at sill of Denmark Strait

10:07 recovery successfully finished

14:00 at location of moored shielded ADCP;
acoustic trials as expected not successful (batteries down)

18:30 try recovery with ROV; technical problems with ROV

19:45 ROV on deck to solve ROV problem;
steam eastward to avoid ice

28.07., 01:06 start sections with vessel mounted ADCP

09:30 at location of shielded ADCP; re-try recovery with ROV

09:40 finish trial; steam to location of moored (V421-2) and lost PIES further west

11:00 at location of PIES; no contact (batteries are low) as expected;
steam to shielded ADCP

13:05 at location of shielded ADCP; try to recover with ROV;
ROV video shows ADCP shield upside down;
no chance to recover under these circumstances;
stop trial to recover

20:31 ROV on deck; leave eastward to avoid ice during the night
cross sill ADCP sections

29.07., 09:05 start CTD section, casts 1 to 3

15:35 start launch moored MRI ADCP

18:06 mooring work completed

18:44 continue CTD section, casts 4 to 7

30.07. 04:30 section completed; steam to Reykjavik

afternoon, call in to Reykjavik

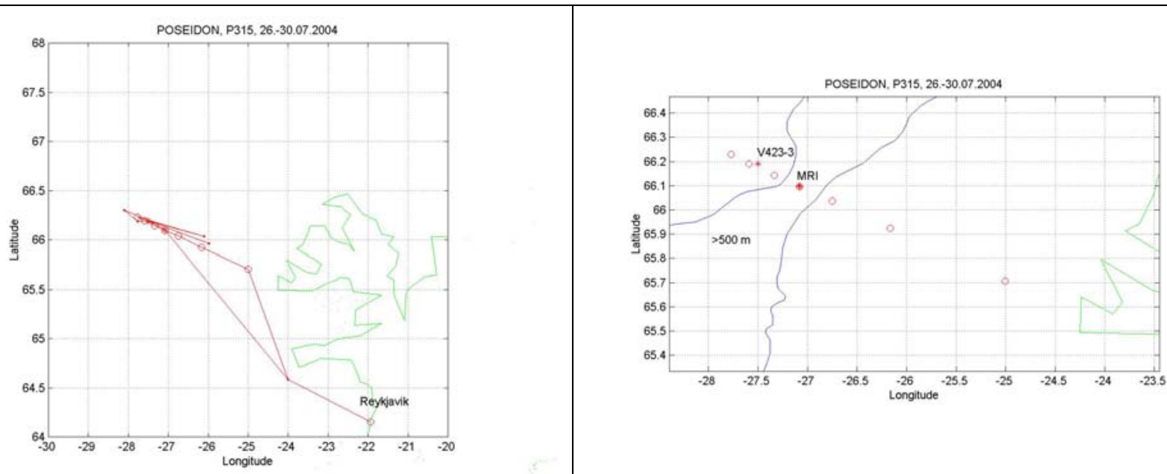

Fig. 3.1: *POSEIDON cruise P315, 27.07.-31.07.2004; (left): general cruise track including vessel mounted ADCP section; (right): detailed station map with locations of moorings (stars) of MRI ADCP and IFM-GEOMAR ADCP (V4321-3) and (circles) CTD casts; here the 500 m bottom contour is included*

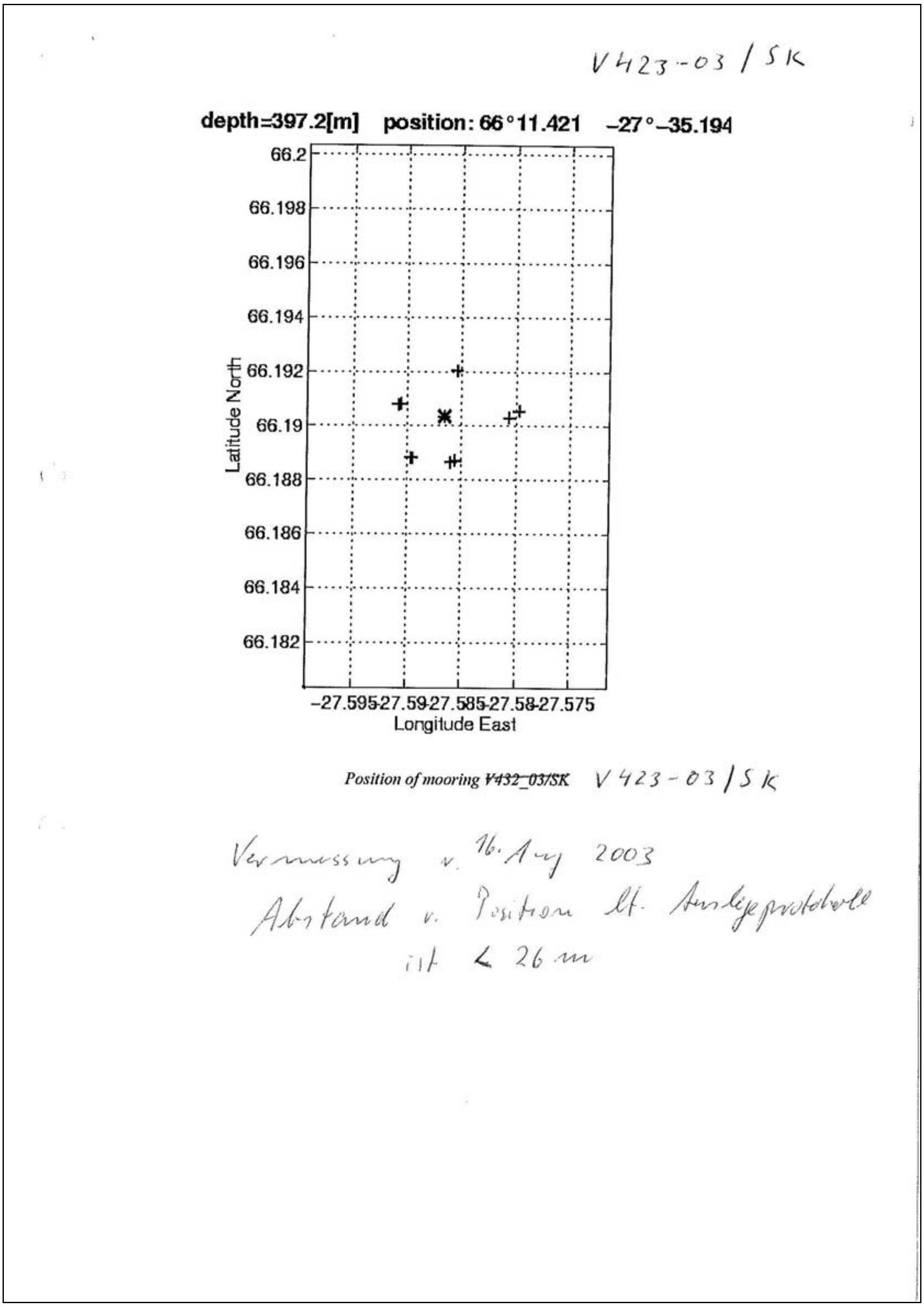

Fig. 3.2: *Location (centre star) of the shielded ADCP, mooting V423-3, launched in August .2002 during POSEIDON cruise P293-2; mooring could not be recovered during P302 in 2003, but located precisely during P302; new attempt to recover the ACDP with ROV during this cruise P315.*

4. Scientific report and first results

This cruise was designed as a technical cruise for mooring recovery; therefore no preliminary scientific results are given.

5. Scientific equipment: moorings and instruments

5.1 Moorings

Table 5.1.1: *Summary of mooring work*

Mooring ID	Latitude Longitude Water depth (sounding at 1500 m/s)	Date and cruise of launching	Date and cruise of recovery	Instruments	Remarks
MRI mooring	66°05.9’N 027°05.0’W 654 m	November 2003 Icelandic ship	27.07.2004 P315	Long ranging ADCP on frame 1 m above bottom	Recovered
V423-3 / SK	66°11.4’N 027°35.3’W 497 m	30.08.2002 Poseidon 293/2	16.-18.08.2003 Poseidon 301 attempt failed	ADCP s/n 925, 1 m above bottom, shielded	Viewed with ROV; not recovered
V421-2 / PIES-73	66°13.95’N 027°46.29’W 474 m	10.11.2002 A. Frideriksson	16.-18.08.2003 Poseidon 301 attempt failed	PIES 73, 1 m above bottom, shielded	No acoustic contact given up
MRI mooring	66°06.0’N 027°04.9’W 664 m	29.07.2004 P315	Icelandic ship	Long ranging ADCP on frame 1 m above bottom	Moored

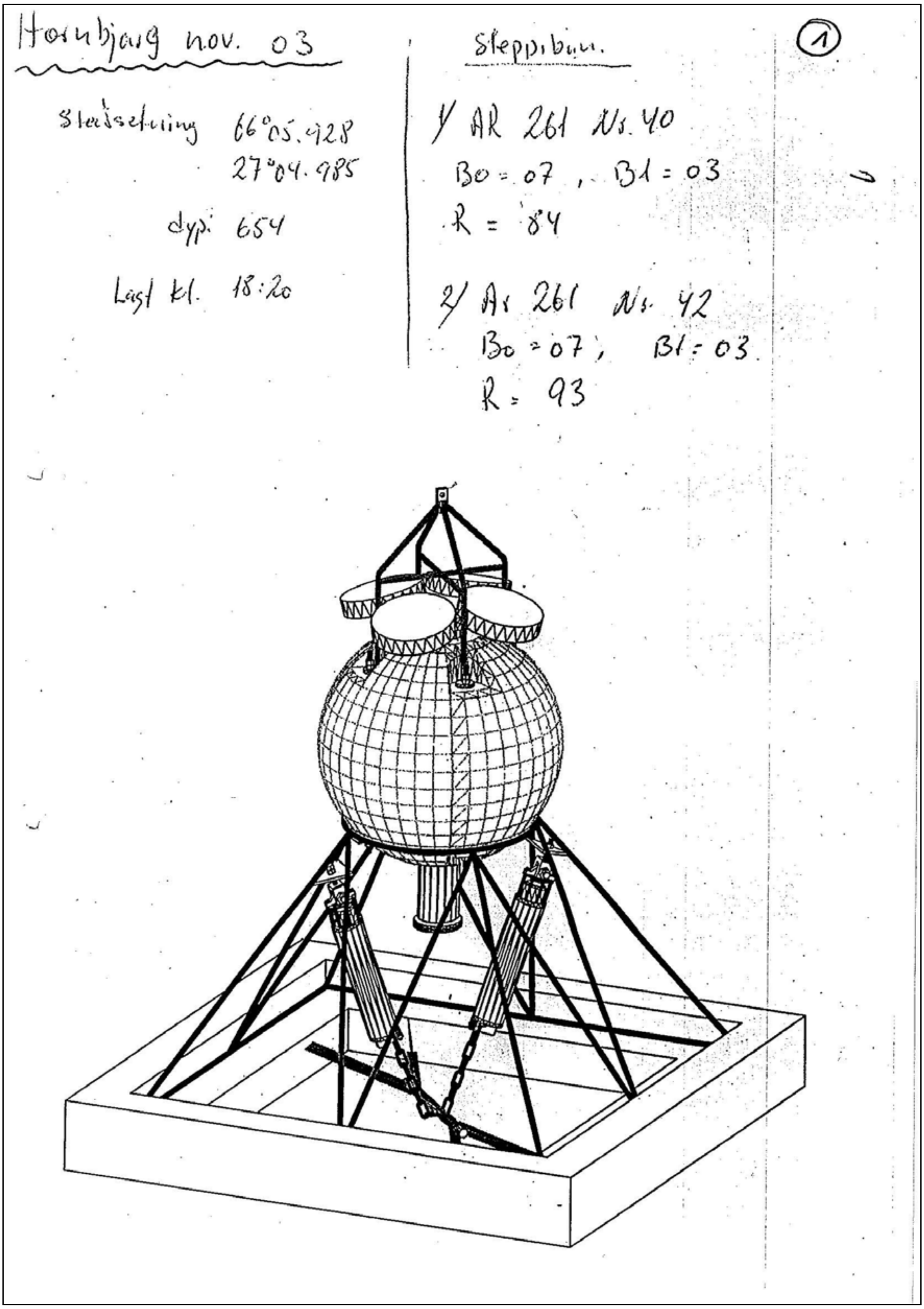

Fig.5.1.1: *Design of MRI moored bottom frame with long ranging ADCP*

Fig. 5.1.2: *shielded ADCP during the launching procedure during POSEIDON cruise P293; ADCP is housed below the orange top cap of the shield; double release inside the xxx shield; launching frame above the shield; the shield was viewed upside down on the bottom by the ROV's video camera system during P315.*

5.2 CTD

Seven CTD casts were obtained across Denmark Strait sill (Fig. 3.1). Table 5.1.1 shows the CTD's type, sensors, set-up, calibration and processing steps. Figures 5.2.1-5.2.3 show the calibration of CTD values while sampling bottle salinity with the attached rosette.

Tab. 5.1.1: *POSEIDON cruise P315, CTD set-up, calibration and processing steps for*

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P315_CTD.txt

POSEIDON cruise P315, July 2004, Denmark Strait

1) CTD used:
- SBE 911, internal ID of IFM-GEOMAR: SBE3

- Sensors:
# sensor 0 = Frequency  0  temperature, 03P-4051, 12 January 2001
# sensor 1 = Frequency  1  conductivity, 04C-2537, 30 January 2001, cpcor = -
9.5700e-08
# sensor 2 = Frequency  2  pressure, 82991, 18 December 2000
# sensor 3 = Extrnl Volt  0  Oxygen, SBE, primary, 43-0631, 31 January 2004
# sensor 4 = Extrnl Volt  2  Dr Haardt, chlorophyll a, 14010

2) Nearest-to-cruise lab calibration of pressure and temperature sensors:
pre-cruise : 2003, April; corrections are of order -2 mK and -1 dbar
post-cruise: 2005, January; correctiomns are of order -1 mK and -1 dbar

3) in-situ samples for calibration:
- rosette files *.btl merged to get p315hiev.dat

- bottle salinity file P315_sal_mri.dat of MRI edited to get
matrix [station cast bottle sref]; result in sali.inp

- oxygen and chlorophyll: no samples taken

4) Rosette file created and reference bottle salinity added
- temperature sensor calibration corrected using pre- and postcruise
lab calibration

- pressure sensor  calibration corrected using pre- and postcruise
lab calibration

- coefficients for correction of conductivity sensor calibration
determined using conductivity from in-situ bottle salinity,
corrected temperature and corrected pressure


5) Variables & units chosen for processing & archiving in ASCII:
SBE SeaSoft programme DATCNV used with output of lowering part (no processing):
# name 0 = prDM: Pressure, Digiquartz [db]
# name 1 = depSM: Depth [salt water, m]
# name 2 = t090C: Temperature [ITS-90, deg C]
# name 3 = c0mS/cm: Conductivity [mS/cm]
# name 4 = sal00: Salinity [PSU]
# name 5 = flag

As no in-situ calibration samples were taken for oxygen and chlorophyll,
data of the respective CTD sensors were omitted.

6) Processing
CTDOK.M used with 4 steps along the procedure described by Müller (1999):

% 1st level:
% - the first cycle (often bad) is removed from the data set
% - range check for P, T, C,
% - pressure offset determination and correction
% - transfer of (almost) raw data to CTDOK MAT format
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```
% 2nd level:
% - graphic editor to remove stabilization part at start of each cast
% - automatic de-spiking(median criterion, 9 cycles)
% - static calibration of P, T using combined laboratory calbrations
%   and of C (S) using in-situ bottle salinities (see section 4)
% - monotonize w/r to P
%            minimum pressure 0.5 dbar

% 3rd level:
% - monotonized w/r to P
% - low pass filter over 9 cycles (ca 0.5 dbar)
% - cubic interpolation to 0.1 dbar

% 4th level:
% - monotonize w/r to P
% - stability check, 0.005 kg/m^3 boundary for median spike detector
%   monotonize w/r to potential density
% - low pass filter over 19 cycles
% - cubic interpolation to 1.0 dbar
% - recalculate salinity


7) Check & edit header information
missing water depths added using P315_spec.m

8) RODB
transfer [P T PT S STH] to RODB formatted ASCII files for implementation into
the data bank of Physical Oceanography at IFM-GEOMAR)
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References

Müller, T.J., 1999: Determination of Salinity. In: Methods of Seawater Analysis, Grasshoff, K., K. Kremling, M. Ehrhardt (editors), Wiley, 600 pp.

UNESCO, 1983: Algorithms for computation of fundamental properties of seawater, UNESCO technical papers in marine science, 44

Compiled: 12-JAN-2011, Thomas J. Mueller, IFM-GEOMAR

Tab. 5.2.: *Linear corrections for CTD values; correction=a0 + a1*CTD value*

Sensor	**correction=a_0 + a_1*CTD value**		**Remark**
	a_0	**a_1**	
temperature	-0.0011	0	combined laboratory APR-2004 & JAN-2005
pressure	0	-0.00058	combined laboratory APR-2004 & JAN-2005
conductivity	-0.0019	0.00031484	P315 cruise *in-situ*

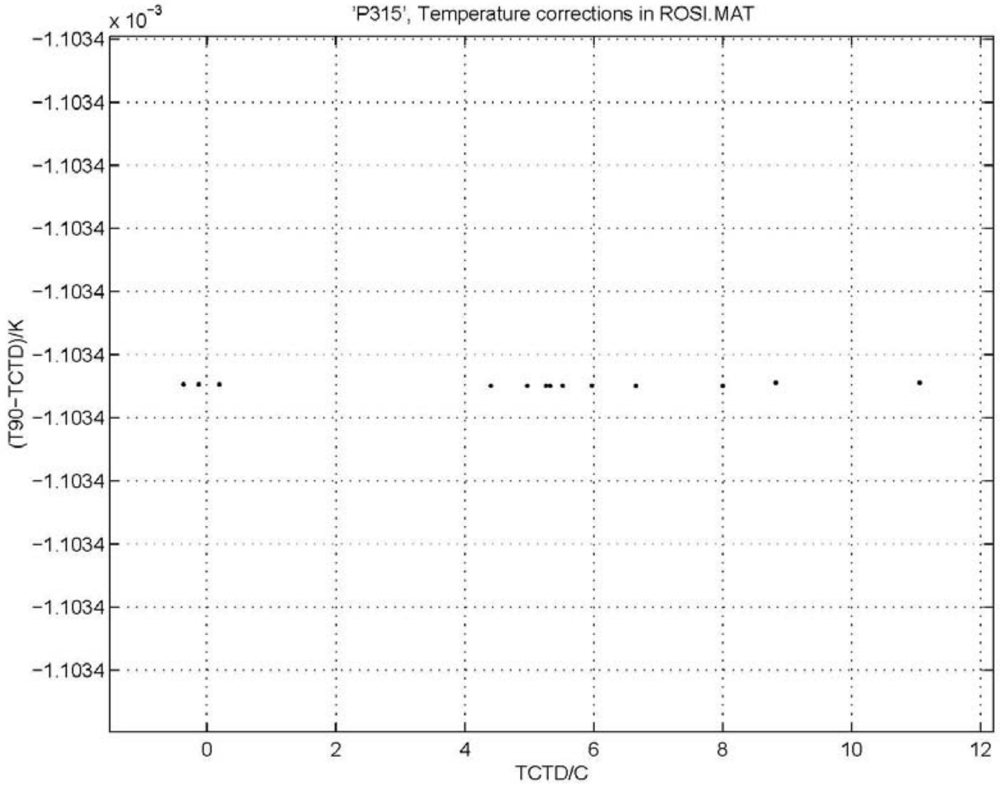

Fig. 5.2.1: *temperature sensor corrections in rosette data as derived from combined pre- and post cruise laboratory calibrations in April 2003 and January 2005*

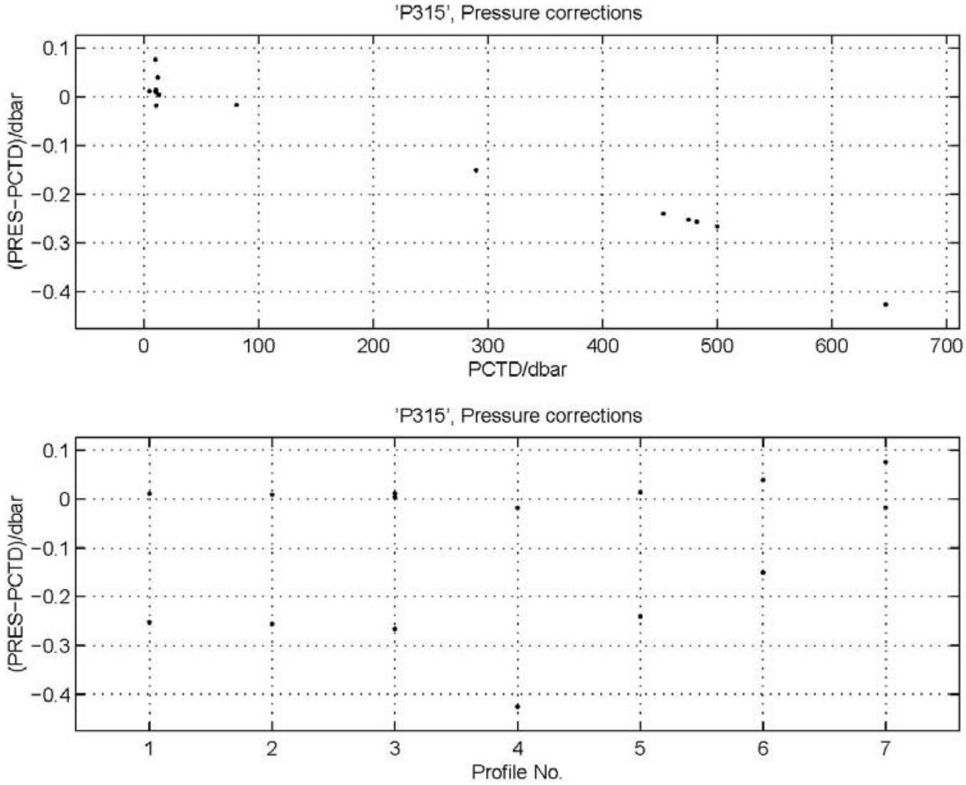

Fig. 5.2.2: *pressure sensor corrections in rosette data as derived from combined pre- and post cruise laboratory calibrations in April 2003 and January 2005 asa function of CTD readings (upper panel) and CTD cast (profile) number (lower panel).*

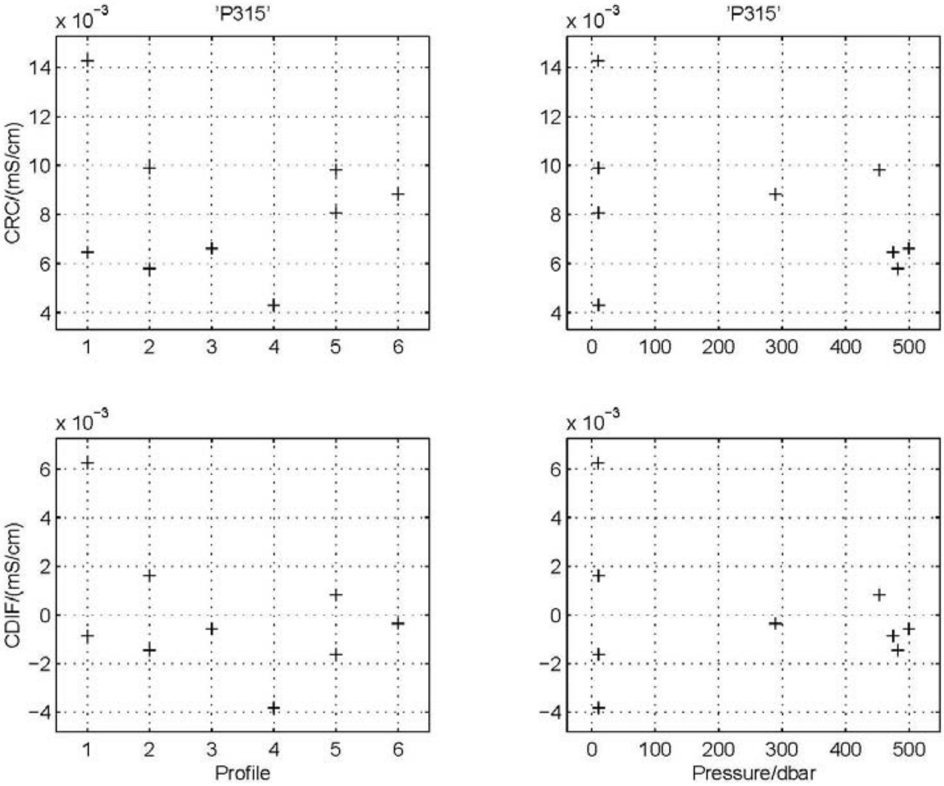

Fig. 5.2.3: *conductivity cell corrections in rosette data as derived from the in-situ calibration during the cruise; corrections (upper panel) and residuals (lower panel) versus cast no. and pressure*

5.3 Routine underway measurements

No data recorded during this cruise

5.4 Vessel mounted ADCP

As the major scientific topic is the dynamics of the overflow, the 150 kHz ADCP with a range of 300 m is not adequate; therefore no data were processed.

6. Acknowledgements

We thank the MARUM centre for their excellent work done to get a video view of the shielded ADCP using their ROV CHEROKEE and the master and the crew for their qualified assistance.

7. References

Müller, T.J., 1999: Determination of Salinity. *In: Methods of Seawater Analysis, Grasshoff, K., K. Kremling, M. Ehrhardt (editors), Wiley, 600 pp.*

UNESCO, 1983: Algorithms for computation of fundamental properties of seawater, *UNESCO technical papers in marine science,* ***44***

7. Appendix: science log

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POSEIDON cruise 315, 26 JUL 2003 - 30 JUL 2004
Reykjavik - Reykjavik

Station and sample log



List of abbreviations:
St    : Station no.
C     : CTD cast/file no., monotonically increasing during the cruise;
        all casts to near bottom if not indicated else
Wd    : Water Depth
Wl    : length of wire, instrumental depth
It    : Type of instrumentation or mooring or equipment with symbol
          It
  VXXX  : 1  mooring
  NB2   : 2  Neil Brown CTD, IFMK code NB2 with 12x12 l bottle rosette
  SBE3  : 2  SeaBird 911 CTD; IFMK code SBE3 with a 12x5 l bottle rosette from IFMH
  TSG    : 4  Ship's thermosalinograph, 4 m, made by Meerestechnik Elektronik, Kie, Germany
  vADCP : 4  vessel mounted RDI ADCP, 150 KHz, 4 m
  PC-LOG: 4  on-line log of GPS date, time, position, pitch & roll (ASHTEC GPS/GLONASS &
ADU2),
       near-surface T, S by TSG; meteorological data of the ship's meteorological sensors

Additional sensors on, and samples taken from CTD/rosette:
   OC :   2 oxygen sensor on CTD (Beckmann type with oxygen current and temperature)
   N  :   5 nutrient samples
   Cl :   6 chlorophyll samples
   S  :   7 salinity samples
   CO2:   8 Alkalinity profile for CO2 system
   Th :   9 Thorium samples
   SF6 : 10 SF6 samples
   CFC : 11 CFC samples
Year 2004
Date  Time  St    C  Latitude  Longitude     Wd  Wl It   Instrument / Remarks
UTC    UTC
MM DD hh mm          GG MM.MM  GGG MM.MM     m    m
x-----------------------------------------------------------------------
07 26 -9 -9  -9  -9  64 09.18 -021 -56.16    -9   -9 2   sail from Reykjavik;
                                                         begin of P315
07 26 -9 -9  -9  -9  64 35    -024 -00.00    -9   -9 4   WP Reykjavik NW
07 27 09 31 471  -9  66 05.9  -027 -05.0    661   -9 1   MRI moored ADCP, recovery
07 27 13 58 472  -9  66 11.4  -027 -30.1    495   -9 1   V423-3, trial to recover with ROV07
28 01 06  -9  -9  65 57.7  -025 -59.2     -9   -9 4   WP ADCP section
07 28 09 32 474  -9  66 11.4  -027 -30.1    495   -9 1   V423-3, trial to recover with ROV
07 28 09 40 475  -9  66 11.4  -027 -30.1    495   -9 1   V423-3, trial finished, continue ADCP
07 28 11 01  -9  -9  66 11.3  -027 -46.3    493   -9 4   V421-2/PIES, no acoustic contact
07 28 21 12  -9  -9  66 17.9  -028 -06.5    349   -9 4   WP ADCP
07 29 00 00  -9  -9  66 10.7  -027 -24.3    495   -9 4   WP ADCP
07 29 03 51  -9  -9  66 02.1  -026 -06.0    200   -9 4   WP ADCP
07 29 09 05 478   1  66 13.7  -027 -46.2    485  487 2   CTD
07 29 11 09 479   2  66 11.4  -027 -35.3    495  492 2   CTD
07 29 13 00 480   3  66 08.6  -027 -20.0    504  499 2   CTD
07 29 18 02 481  -9  66 06.0  -027 -04.9    664   -9 1   MRI ADCP moored
07 29 18 46 482   4  66 05.7  -027 -04.7    680  660 2   CTD
07 29 21 04 483   5  66 02.2  -026 -44.9    444  455 2   CTD
07 29 23 56 484   6  65 55.4  -026 -09.9    299  296 2   CTD
07 30 04 03 485   7  65 42.4  -025 -00.2    140   82 2   CTD
07 30 -9 -9  -9  -9  64 35    -024 -00.00    -9   -9 4   WP Reykjavik NW
07 30 -9 -9  -9  -9  64 09.18 -021 -56.16    -9   -9 2   arrival at Reykjavik, end of P302
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