Institut für Meereskunde
an der Universität Kiel

Date: 17.02.2003

Cruise Report

Compiled by: Thomas J. Müller

F.S.Poseidon **Cruise No.: 293/2**

Dates of Cruise: 17.08. - 03.09.2002

Areas of Research: Physical; chemical, and biological oceanography

Port calls: Reykjavik: 15.-17.08.; 26.-27.08.; 03.-06.09.2002

Institute: Institut für Meereskunde, Kiel, Germany

Chief Scientist: Dr. Thomas J. Müller

Number of Scientists: 9 during leg 293/2a, 7 during leg P293/2b

Projects:
- Observations of overflow in Denmark Strait, SFB460 / TPA1
- Implementation of European time series station ANIMATE / CIS

Cruise Report

This cruise report consists of 14 pages including cover:

1. Scientific crew
2. Research programme
3. Narrative of cruise with technical details
4. Scientific report and first results
5. Moorings, scientific equipment and instruments
6. Additional remarks
7. Appendix.
   A. Station list

1. Scientific crew

P293/2a 17.08.-26.08.2002, Reykjavik - Reykjavik
P293/2b: 27.08.-03.09.2002, Reykjavik - Reykjavik

Name		**P293/2a**	**P293/2b**
Müller, Dr. Thomas J.	Chief scientist, IFMK	---------	----------
Briem, Johannes	TA, MRI	---------	
Friedrich, Tobias	Stud., IFMK	---------	----------
Halldorsdottir, Saeunn	Stud., MRI		----------
Homuth, Johannes	Stud., IFMK	-----------	---------
König, Jochen	Stud., IFMK	----------	
Koy, Uwe	TA, IFMK		---------
Link, Rudolf	TA, IFMK		----------
Macrander, Andreas	Phys. Oc. , IFMK	---------	----------
Malien, Frank	TA, IFMK	---------	
Niehus, Gerd	TA, IFMK	---------	
Pinck, Andreas	Eng., IFMK	----------	
Total		**9**	**7**

Institutions-
IFMK Institut für Meerekunde an der Universität Kiel, Kiel, Germany
MRI Marine Research Institute, Reykjavik, Iceland

Chief scientist:
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2. Research programme

Cruise P293/2 was aimed to study the variability of the overflow through Denmark Strait and to invent a time series station southeast of Greenland.

The overflow through Denmark Strait is one major component 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 is investigated using direct measurements of currents and heights of sea surface and overflow layer at the sill depth, and the height of the reservoir in terms of temperature north of the sill. During cruise P293/2, two ADCPs and two inverted echo sounders with pressure sensors (PIES) moored at the sill’s bottom and a mooring with thermistors moored north of the sill were to be exchanged (Array A1 in Fig.1).

Within the EU-funded project ANIMATE, three open ocean time series stations are to be set up north of the Canary Islands (ESTOC), west of Ireland in the Porcupine Abyssal Plain (PAP) and southeast of Greenland in the Central Irminger Sea (CIS, Fig.1). All these stations will be equipped with recently developed sensors to measure CO2-flux, the contents of nutrients, and fluorescence as parameter for chlorophyll *a* in the upper 10 m to 90 m. Also, an inductive-modem based under-water data transfer and a small surface buoy is used to transmit near-real-time data of temperature and salinity from the upper 1000 m through satellite for open use (www.soc.soton.ac.uk/animate) . Cruise P293/2 was to implement station CIS using this new technology.

3. Narrative of cruise with technical details

Part of the scientific crew of IFMK stayed onboard from the preceding leg P293/1 (König, Macrander, Niehus, Pinck), part of it embarked 16 August (Müller, Friedrich, Homuth). Additional scientific equipment was set up in port.

For the 16th August, the German ambassador in Reykjavik, Dr. Dane, had invited for dinner in his home. Six Guests from Iceland represented the Ministry for Fisheries, the Coast Guard, the Fishery Research Institute, and the Marine Research Institute (MRI). From Poseidon, master H. Bruns and the chief scientists Dr. W. Zenk (P293/1) and Dr. T.J. Müller (P293/2) took part.

After embarkation of the Icelandic guest J. Briem from the MRI, the vessel sailed on schedule on 18th August at 09:00 from Reykjavik for cruise P293/2. While heading towards the mooring sites of array A1 in Denmark Strait (Fig. 3.1, Fig. 3.2), underway measurements began outside the 12 nm EEZ of Iceland and Greenland:

- navigational information from an Ashtech GG24 system
- heading, pitch and roll information from a 3-dimensional Ashtech ADU2 system
- vessel mounted current profiling with an 150 kHz ADCP made by RDI
- standard meteorological parameters for the German Weather Service (DWD) through the GTS system

The thermosalinograph to measure sea surface temperature and salinity was out of order since P293/1.

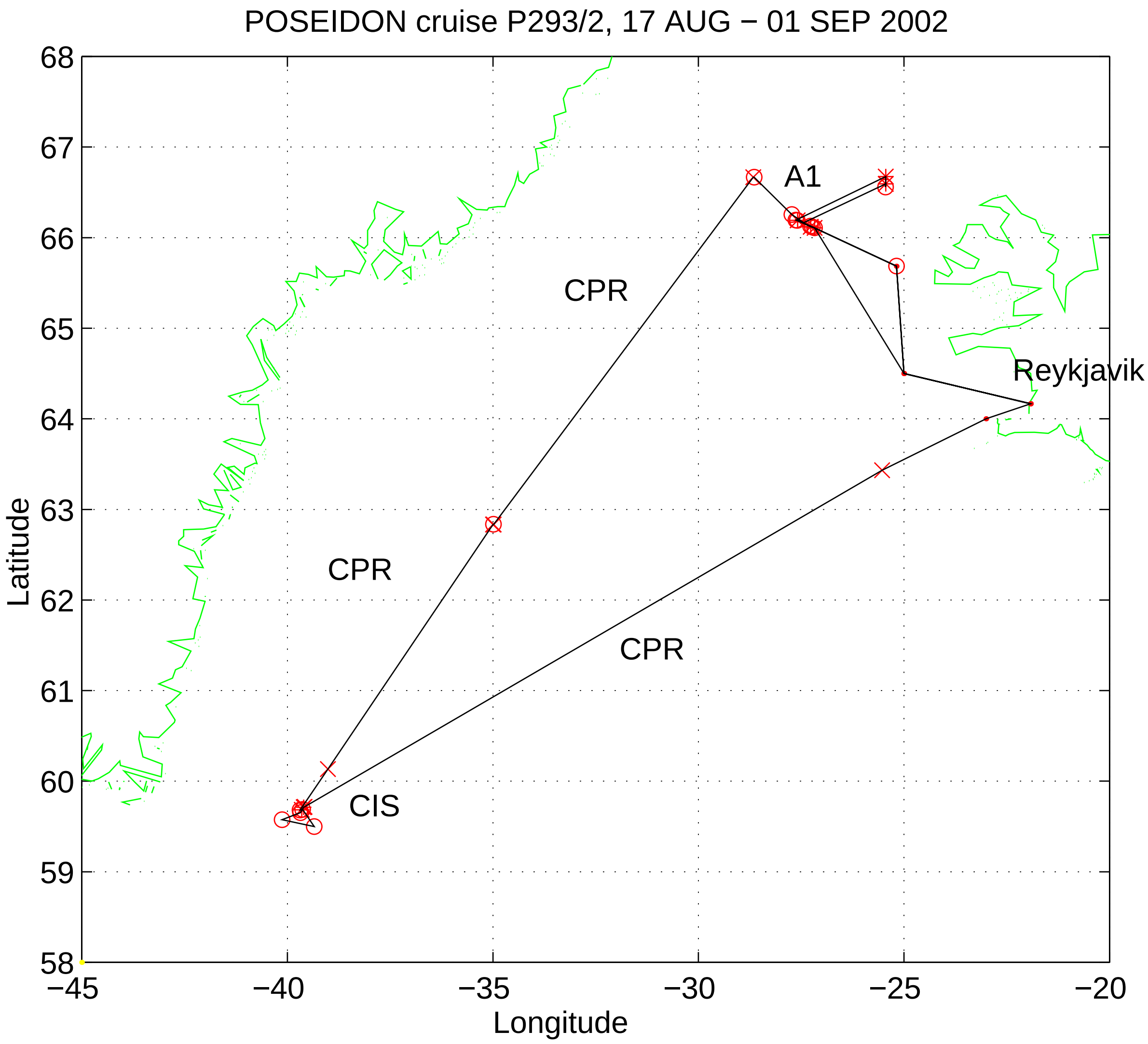

Fig. 3.1: R/V POSEIDON cruise P293/2: mooring array A1 in Denmark Strait, time series station CIS and tracks with the Continuous Plankton Recorder CPR.

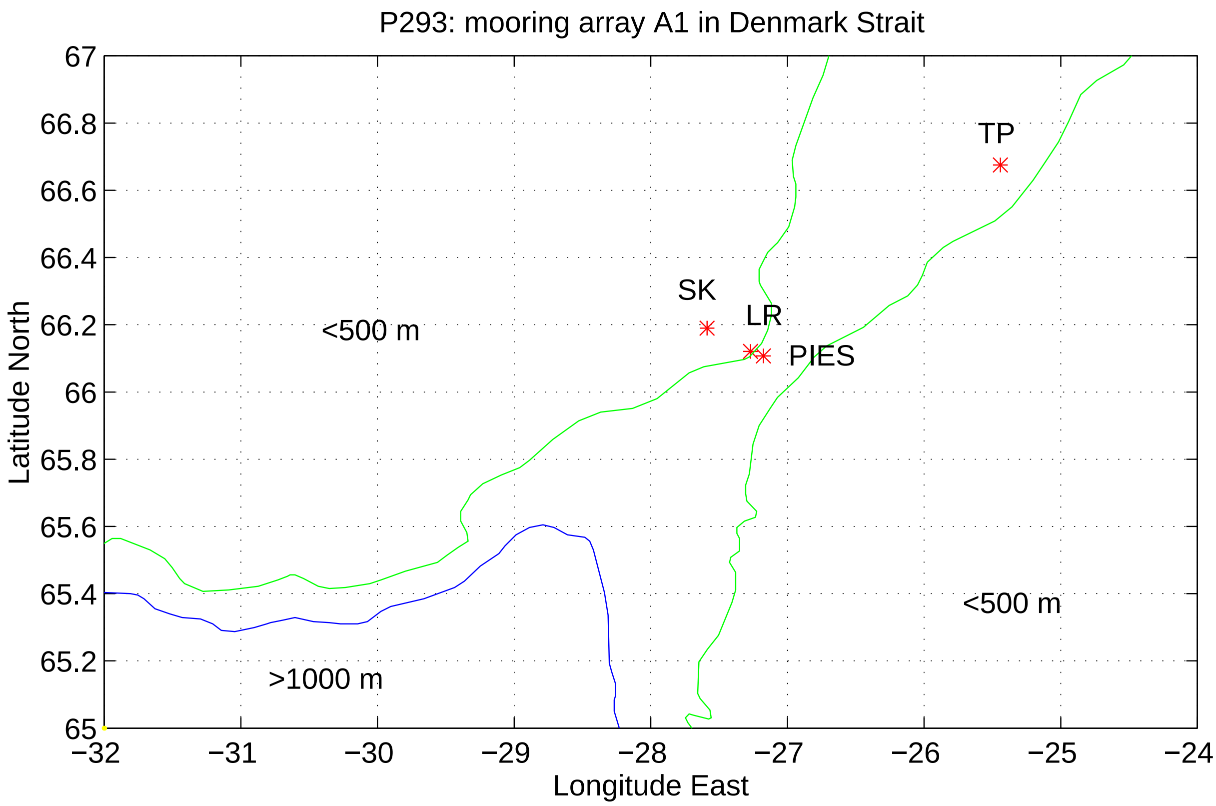

Fig. 3.2: R/V POSEIDON cruise P293/2: details of mooring array A1 in Denmark Strait: bottom moored ADCPs at SK (shielded) and at LR (long ranger); inverted echo sounder with pressure at PIES; T/P recorder for reservoir height at TP

Within the SFB460/TPA1 work, three instruments moored near the bottom were recovered on the 18th of August with no problems: an inverted echo sounder with pressure sensor (PIES05 in mooring V422-02); a long ranging ADCP (V425-02); a shielded ADCP (V423-02/SK). Unfortunately, we were not able to contact PIES06 that was shielded in mooring V421-02; after 4 hours of non-successful trials to release it, this instrument is assumed to be lost.

At the mooring sites, CTD/rosette/lADCP casts were taken down to the bottom. They build a low-resolution section along the sill which was completed far on the Greenlandic shelf (Stat. 659).

From here, we headed southwestward towards the CIS site while a Continuous Plankton Recorder (CPR) owned by the Sir Alister Hardy Foundation, Plymouth, UK, was towed from 18.08.2002, 23:40, 66°40'N, 028°40'W, with one interruption (20-Aug-2002, 08:50 to 10:25 UTC, 62° 50.09'N 034° 59.42'W, 2740 m, Stat. 660, for calibration of MicroCats) until 21.08.2002, 08:25, 60°08'N, 039°01'W.

On 21st August at noon, we reached the nominal location of the time series station CIS. A bottom deep cast was taken to obtain the actual correction (-24 m) for echo sounding based on 1500 m/s sound velocity. In the afternoon, we launched mooring V434-01/CIS2 at 59°41.0'N, 039°39.0'W, 2781 m wd (corrected). This mooring carries 11 MicroCat CTDs between 10 m and 1000 m depth, which data are telemetered every 2 hours through the ARGOS system ashore. The data are public on the ANIMATE web site.

Due to bad weather with gale up to 9 Bft. we could not work on the following day. Therefore, two of four CTD casts around CIS had to be cancelled. On 23rd August we set the subsurface mooring V433-01/CIS1 at 59°42.7‘N, 039°36.2‘W, 2779 m wd (corrected). It carries a bio-geochemical sensor package at 40 m depth, an upward looking 300 kHz ADCP at 150 m, a particle trap at 2280 m, and two Aanderaa RCM8 current meters at 1000 m depth and 40m below the trap.

At noon, we left the CIS location, launched the CPR again and headed towards Reykjavik. The CPR was hauled after 459 nm on deck two days later on 25th August at 15:40 UTC.

POSEIDON called in to Reykjavik for a short stop early morning on 26th August. Here, part of the scientific crew (J. Briem, J. König, F. Malien, G. Niehus, A. Pinck) disembarked the same day and new members (U. Koy, R. Link, S. Halldorsdottir) embarked the following day, 27th August. Also, three near bottom moorings for the DSOW array including a new shield for the ADCP mooring V423-03 were mounted.

Poseidon sailed from Reykjavik on 27th August at 15:00 to set the moorings in Denmark Strait and to obtain hydrographic and ADCP sections (Fig. 2). After the first CTD station (with release test) on the cross strait section we had to stop work for two days due to gale with Bft 8-9 and high swell. On 30th August wind and swell calmed down, and during the evening it was possible to launch three moorings: PIES05 (mooring V422-03) and the long ranging ADCP (V425-03) in Denmark Strait / Greenland Sound, and a shielded ADCP (V423-03) at the bottom of the Greenland shelf.

The following day, 31st August we reached the nominal position of the thermistor cable mooring V424-01. This mooring was to be recovered in summer 2001; however, due to thick pack-ice it was not possible at that time to reach the location. Also, the thickness of the pack-ice at that time of up to 15 m above sea level, i.e. probably more than 40 m below the surface, would have made possible to damage the mooring with its top element at 20 m depth severely or even driven it away from its nominal position. Therefore, it was no surprise that the acoustic release did not respond, and that we had to give up this mooring. Close by, we launched mooring V424-02 on 31st August; it has the top element at 90 m, and 10 recorders for temperature and pressure distributed down to 700 m depth

Later in the evening, we again reached the NW corner location of the cross sill section. Unfortunately, due to a storm warning from the Met Office, Bracknell, UK, for the following day we were only able to obtain just 2 CTD casts on this section, however to complete it with vADCP in the morning of 01st September. Under severe winds with up to 10 Bft we called in to Reykjavik on 01st September at 21:00 UTC.

4. Scientific report and first results

4.1 The overflow across the sill of Denmark Strait

Earlier field investigations (Girton et al., 2001) and results from a high resolution process model (Käse and Oschlies, 2000) have shown that the strength of the overflow is coupled to regional and large scale processes:

- mesoscale eddies with a strong barotropic component control the cold water overflow once it has passed the sill, and the overflow may have a non-negligible component not only in the deep sill but also on the neighboring deeper shelf
- the amount (height) of the reservoir of cold water in the Greenland Sea may be a measure of the overflow's strength
- the large scale wind field over the sub polar gyre and Nordic seas intensifies overflow through Denmark Strait (and weakens it across the Iceland Faroe Ridge and through the Faroe Bank Channel) in case of strong atmospheric cyclonic forcing.

The array of moorings deployed in the Strait in summer 2001 and to be exchanged in 2002 during this cruise, therefore covers not only the deeper part of the sill but also reaches onto the Greenlandic side of the shelf, and in addition aims to measure the height of the overflow reservoir north of the sill (see sect. 5.1). The hydrographic section (with few stations only due to bad whether) obtained across the sill onto the Greenlandic side of the shelf passes the two moored ADCPs (LR and SK in Fig. 4.1.1). It clearly displays the coldest water (Fig. 4.1.1a) with relative high salinity (Fig. 4.1.1b) and largest density (Fig. 4.1.1c) in the deepest part of the channel. However, the hydrographic structure also reveals overflow water over the deeper part of the shelf. This is confirmed by the measurements with the vessel mounted vADCP where in the actual realization during P293/2 the core of the southwestward flow is found between the two moored ADCPs, LR and SK (Fig. 4.1.2).

That this is some kind of quasi-permanent structure is shown in Fig. 4.1.3 where we display the southward (blue) component from direct current measurements (low-pass filtered, 40 h cut-off period) with the two bottom moored ADCPs on the shelf (450 m depth, upper panel, SK) and at the western edge of the deep sill (550 m depth, lower panel, LR). Both show southwestward flow of up to 80 cm/s at the bottom of the deep channel and 40 cm/s on the shelf bottom, strong barotropic component and few northeastward reversals only. The dynamic coupling to atmospheric forcing and reservoir height in the North will be topic of future scientific analysis.

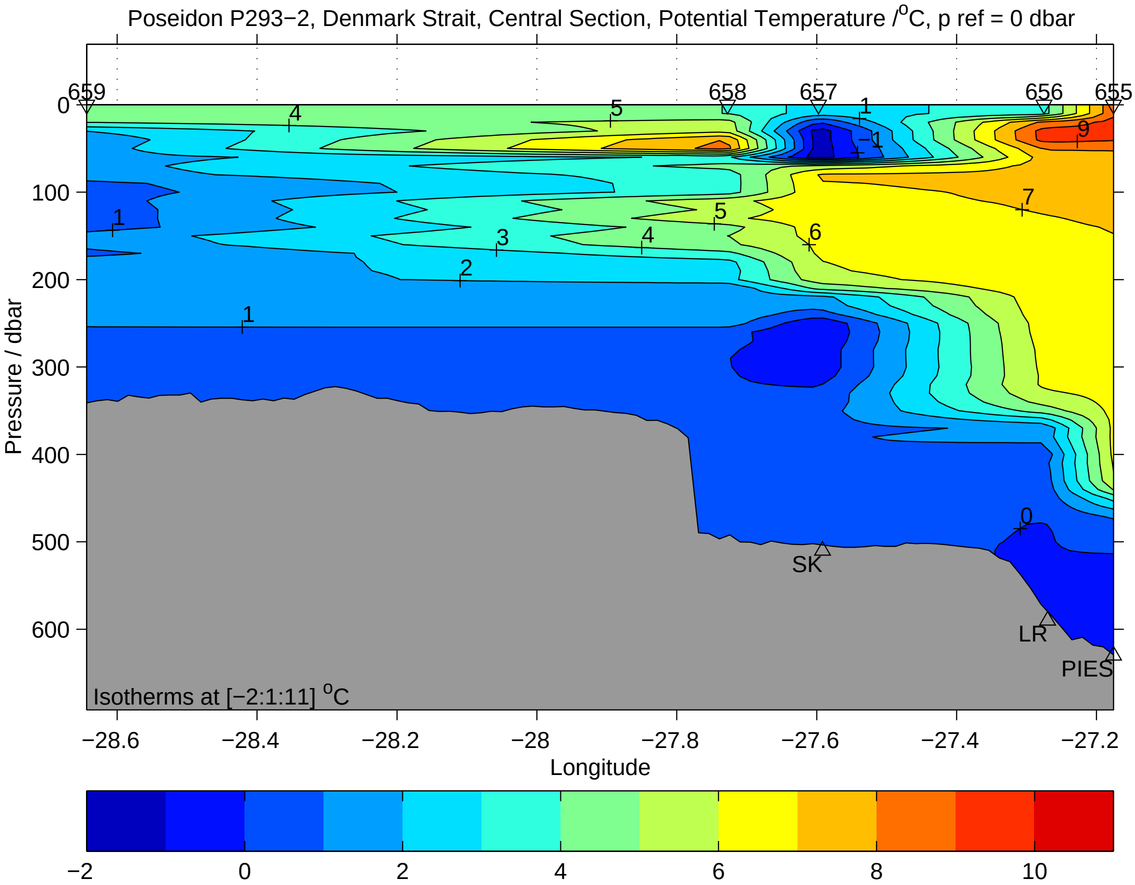

Fig 4.1.1a: Distribution of potential temperature across the sill. LR and SK denote the position of bottom moored ADCPs.

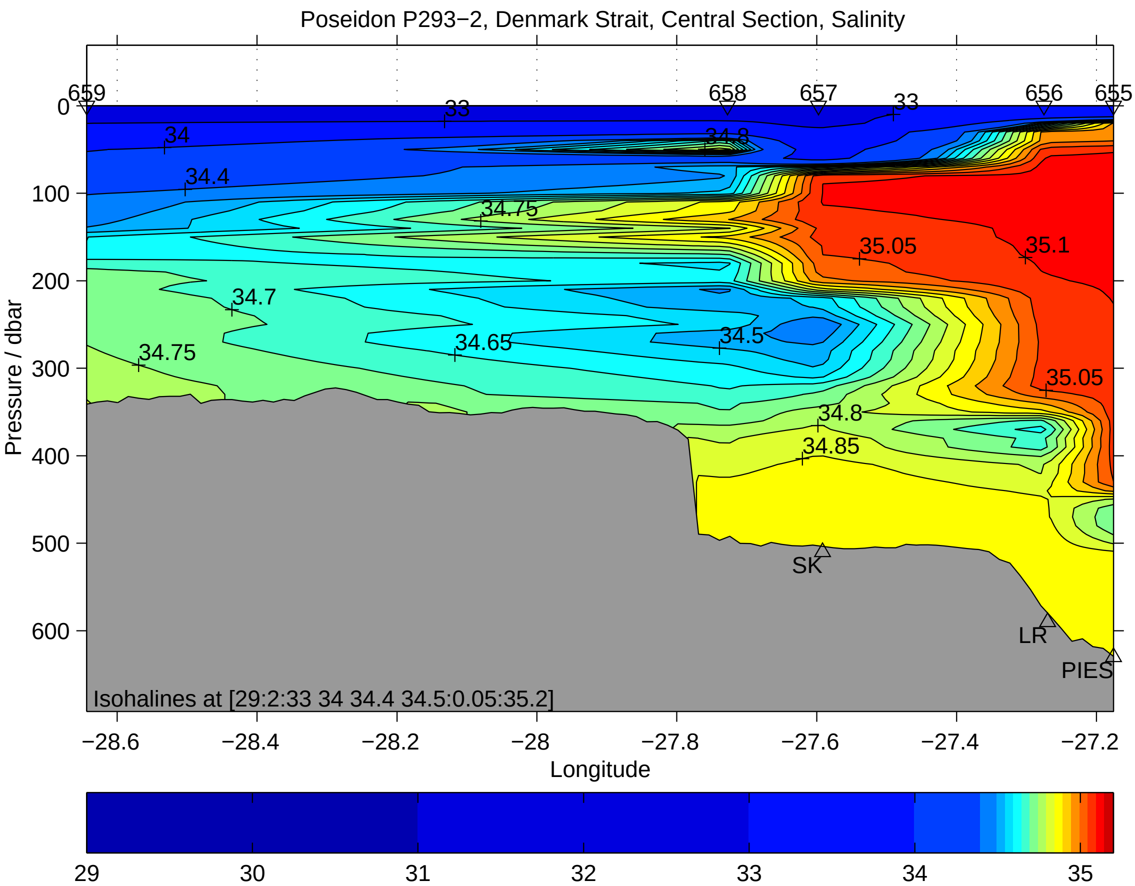

Fig 4.1.1b: as Fig. 4.1.1a for salinity

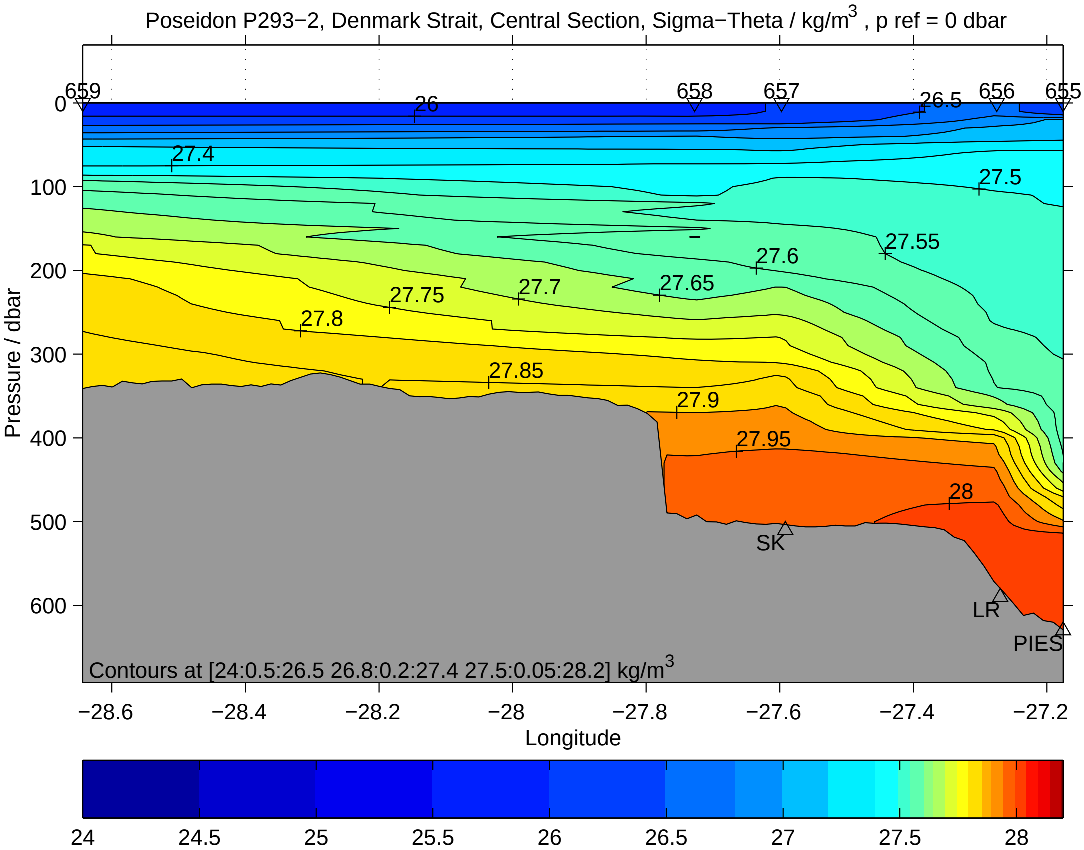

Fig 4.1.1c: as Fig. 4.1.1a for potential density

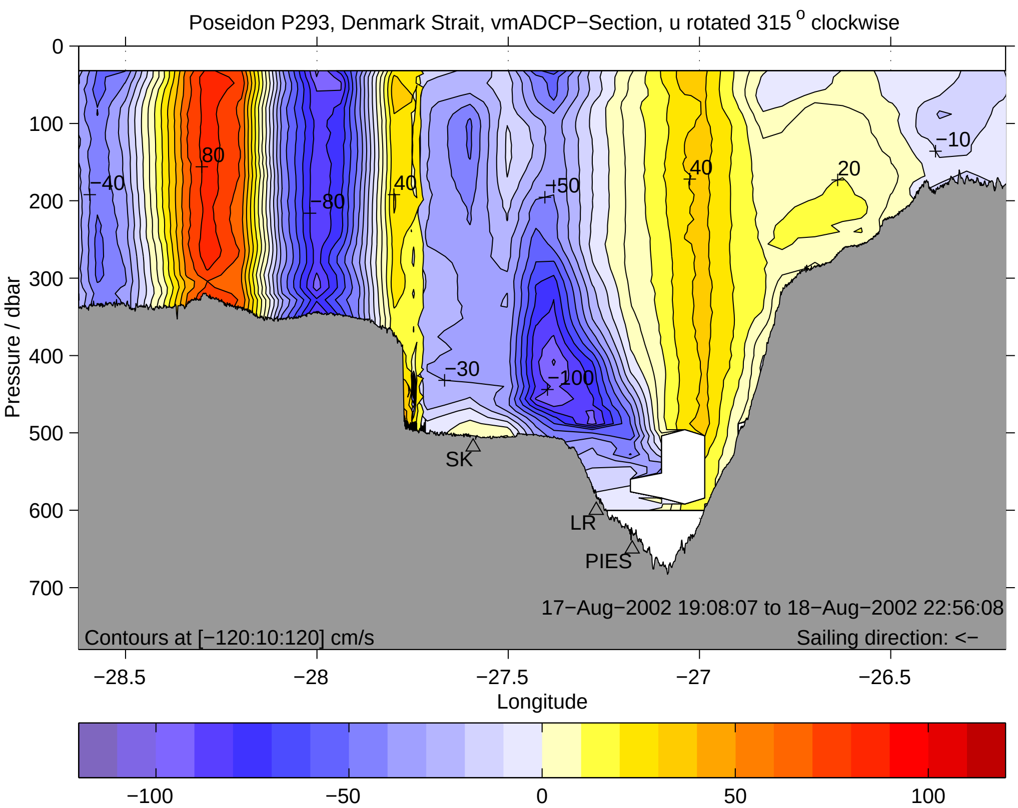

Fig 4.1.2: Distribution of the southwestward component of flow on the sill. LR and SK denote the position of bottom moored ADCPs.

4.2 Set-up of the European Central Irminger Sea time series station (CIS)
The position of time series site CIS in the center of the Irminger Sea cyclonic gyre was chosen for two major reasons: first, together with site PAP in the Porcupine Abyssal Plain it forms a pair to calculate the net geostrophic inflow of warm water into the nordic seas east of Greenland. Second, this region maybe important for water mass formation deep convection in winter. The invention of inductive data transmission along the mooring wire and ashore through satellite makes possible to display the first months of records from temperature and salinity measurements in the upper 1000 m, 21.08.2002 until 07.02.2003, when the telemetry stopped transmitting.

As an example, real-time temperature and density distribution are shown (Fig. 4.2.1). Clearly, the winter decrease of near surface (10 m) temperature and corresponding increase in density can be identified. For both parameters, isolines of the 10 m record merge at the end of the record in February with the isolines of the sixth indrument (counted from top) at 302 m depth; this resembles the convection depth at this time of the winter.

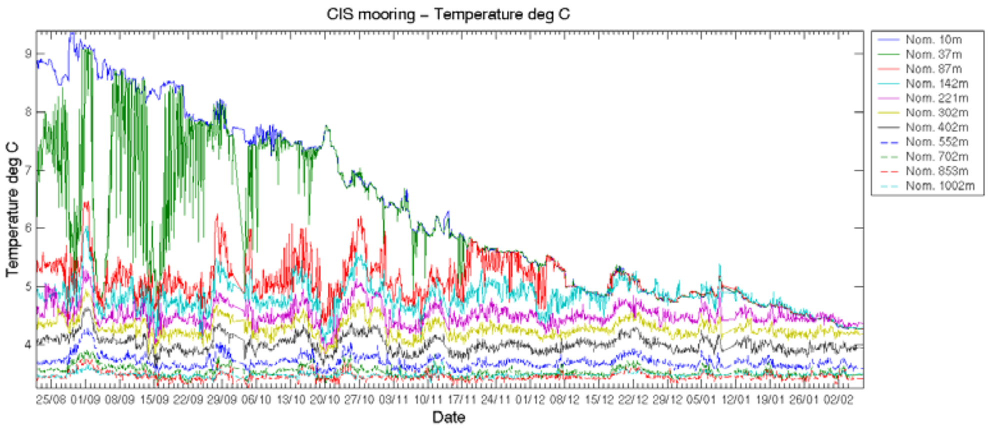

Fig. 4.2.1a: Time series station CIS: development of temperature distribution with depth in in autumn and early winter 2002 / 2003.

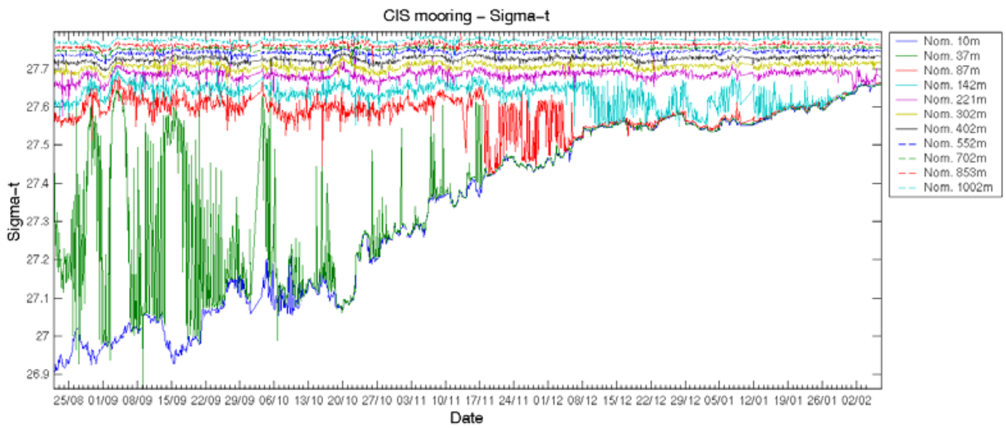

Fig. 4.2.1a: Time series station CIS: development of density distribution with depth in in autumn / early winter 2002 / 2003.

5. Scientific equipment: instruments and moorings

5.1 Moorings

During P293/2, the DSOW array in Denmark Strait sill with 3 near bottom instruments (2 ADCPs, 1 PIES) were exchanged (moorings V422, V423, V425), one PIES (V421-02) was lost (Tab. 1). Thermistor cable mooring V424-01 also was lost, probably due to pack-ice in summer 2001 which may have hit the top element at 20 m depth; this mooring was replaced by mooring V424-02/TP with 10 recorders for temperature and pressure, now with the top element deeper than before, at 90 m depth.

In the Irminger Sea, the time series station CIS was implemented (Tab 1). One mooring (CIS2) carries 11 MicroCats in the upper 1000 m which data are telemetered on-line through a surface buoy and the ARGOS system. The other mooring (CIS1) is sub-surface with a bio-chemical sensor package at 40 m depth (SAMI CO2, NASE-nutrients, HS2 fluorometer, MicoCat CTD), a 300 kHz ADCP at 150 m, a MacLean type sediment trap at 2500 m, and 2 RCM8 Aanderaa current meters at 1000 m and 2540 m depth.

Table 1: *P293/3 moorings recovered (R) and launched (L) with combined inverted echo sounder and pressure sensor (PIES); acoustic Doppler profiling current meter (150kHz ADCP; 300 kHz WH); thermistor cable (TK); temperature and depth recorder (MTD); moored MicroCat CTDs (MC); Aanderaa current meters (RCM8); McLean particle trap.*

Array ID	**Date 2002**	**Position**	**Sounding**	**Instruments**	**Remarks**
DSOW / A1					
V421-02 / PIES	18.08. and 30.08.	66°14.00'N 027°45.00‘W	487	PIES06	Lost
V422-02 / PIES	18.08.	66°06.50‘N 027°10.50‘W	625	PIES05	R
V423-02 / SK	18.08.	66°11.60‘N 027°35.50‘W	498	ADCP	R
V424-01 / TK	31.08.	66°35.59‘N 025°26.45‘W	664	TK400	Lost
V425-02 / LR	18.08.	66°07.60‘N 027°16.20‘W	582	Long ranging ADCP	R
V422-03 / PIES	30.08.	66°06.45‘N 027°10.55‘W	623	PIES05	L
V423-03 / SK	30.08.	66°11.4‘N 027°35.3‘W	497	ADCP, S/N 925	L
V424-02 / TP	30.08.	66°40.5‘N 025°26.5‘W	800	10xMTD	L
V425-03 / LR	30.08.	66°07.25‘N 027°16.20‘W	578	ADCP S/N 1181, long ranger	L
ANIMATE / CIS					
V433-01 / CIS1	23.08.	59°42.7’N 039°36.2’W	2779	CO2, nuts, Cl_a, MC, WH_ADCP, 2xRCM8, trap	L
V434-01 / CIS2	21.08.	59°41.0‘N 039°39.0‘W	2806	Telemetry, 11xMC	L

5.2 CTD and rosette bottle sampling

5.2.1 CTD and bottle salinity

For the CTD-measurements, a SeaBird SBE 911 (IFMK internal code SBE2) was used. Sensor calibration and data processing follow the procedure described by Müller (1999). Calibration for pressure and temperature sensors was performed at IFM Kiel in December 2001, respectively. Water samples for CTD salinity calibration routinely were taken from near the bottom and near the surface. The samples were analyzed on a Guildline AUTOSAL model 8400A (back-up, courtesy to IFM Hamburg) using IAPSO standard seawater batch P139 (K15=0.99993, S=34.9973) for instrumental calibration. As the laboratories onboard are not stable in temperature, the estimated accuracy of individual bottle salinities after removing outliers is not better than 0.003 on the ISS78 scale, slightly worse than usual.

Post-cruise laboratory calibration of the pressure and temperature sensors was not possible before publishing this report. Therefore, the expected accuracies of these sensors (as known from observed possible drifts in the calibration history) maybe less than usual, 0.003 K in temperature and 3 dbar at full pressure scale, respectively. Salinity calibration as compared to bottle salinities will be not affected by these small scale uncertainties in pressure and temperature accuracies; also, errors due to non-stable laboratory temperature are expected to be removed by averaging the calibration over all stations. Thus, final accuracy it is expected to be better 0.003 on the IPSS78-scale.

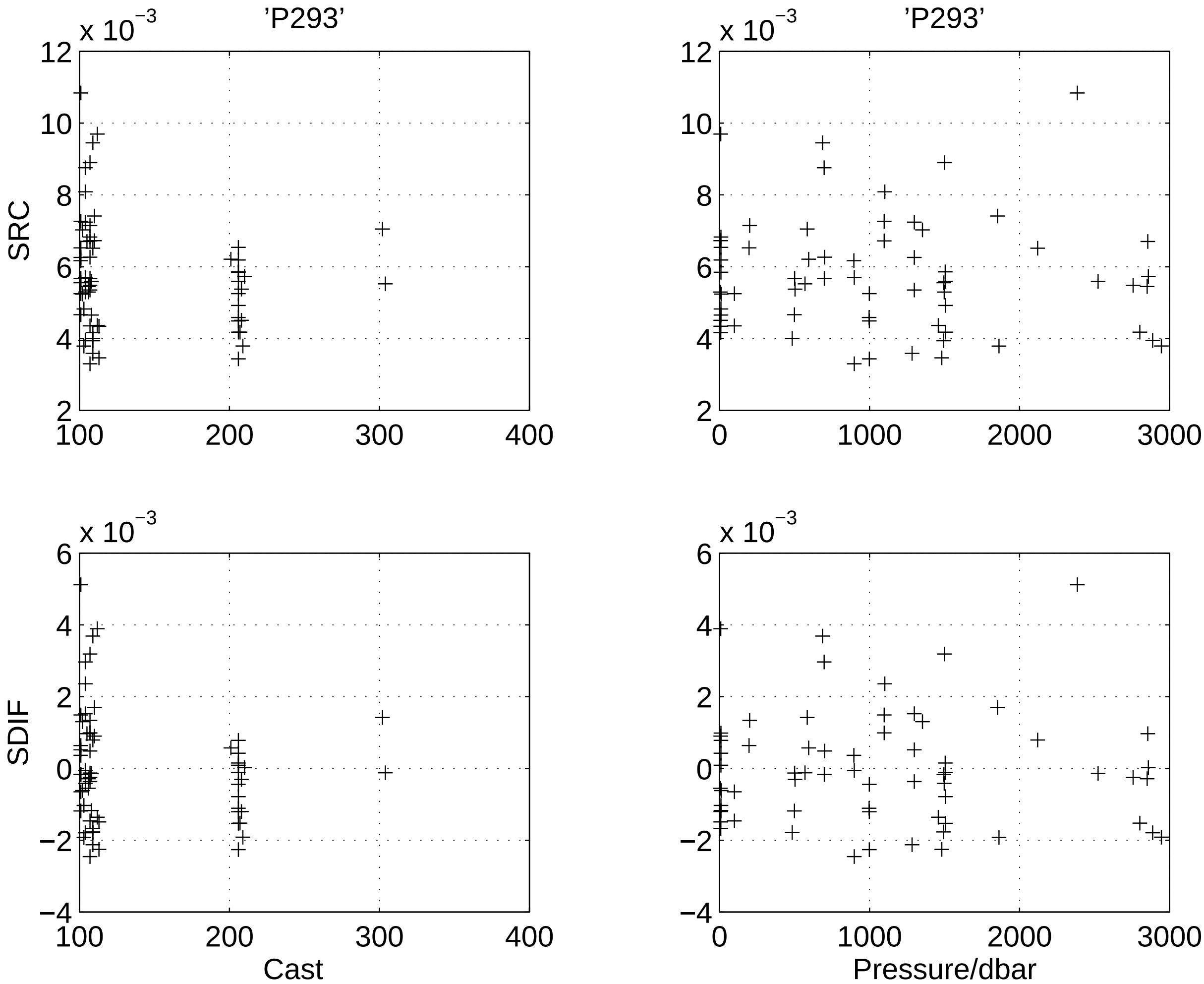

Fig. 5.1.1.1: in-situ salinity calibration. SRC (upper panel) is pre-calibration correction; SDIF (lower panel) is the final error SDIF between bottle (reference) and calibrated CTD salinity after applying a linear correction to

conductivity (Müller, 1999); the overall standard deviation of SDIF is less 0.002 on the ISS78 scale. Note, this calibration is also valid for cruise P293/1.

5.2.2 Sampling for nutrients, CO_2 and chlorophyll *a* at CIS

All samples were taken according to JGOFS and WOCE standards (WOCE, 1991). Those for nutrients and chlorophyll were deep frozen, those for CO_2 stored cool and dark. Samples were transferred either via the Marine Research Institute, Reykjavik, or via the up-coming Poseidon cruises to the responsible groups for sample analysis at ICCM (nutrients, double samples at IFMK), chlorophyll (SOC) and CO_2 (IFMK).

5.3 Underway measurements

5.3.1 Navigational data

An Ashtech made GG24 unit merges positioning from high rate GPS data with high precision GLONASS data. A problem occurred with the date from GG24 which is offset into the past. This offset is constant (23.12.1982 on 20.08.2002, i.e. 7180 d correction) and can be removed. The UTC time is ok.

Three dimensional GPS data from an Ashtech ADU2 are used to estimate heading, pitch and roll. A check of the September 1997 antenna calibration while in port during a later cruise, between P261 and P262 in July 2000, gave no corrections.

Both, GG24 and ADU2 data are input for the standard vmADCP data acquisition and for the underway logging system PC-Log (see 5.3.2)

5.3.2 PC-Log

A PC-based programme package, PC-Log, is used to log consecutively the data streams from navigational units, the ship's meteorological sensors, the deep sea echo sounder and from the thermosalinograph. Standard output format is binary, but ASCII transformation is an option .

5.3.3 Meteorological data

The meteorological sensors (wind speed and direction, temperature, humidity, surface air pressure, near surface water temperature) are set up and maintained by the German Weather Service (DWD), Seewetterdienst, Hamburg, Germany. Data are transferred on a regular scale into the Global Telecommunication System (GTS) for analysis by WMO partners. The digital output is also transferred to the PC-Log system. The sensors were maintained in late December 2001 before Poseidon sailed from Kiel.

5.3.4 Deep sea echo sounder

A 12 kHz echo sounder by ELAC provides depth information, both as standard graph on paper and as digital output. The sound velocity converting travel times to sounding depths was 1500 m/s. The signal is not corrected for the transducer‘s depth (4 m). The digital output was input to the PC-Log system.

5.3.5 Thermosalinograph

The digital output of the thermosalinograph raw data is transferred to the PC-Log system where it is converted to physical units for temperature and salinity. The accuracy is 0.05 K and 0.2 for temperature and salinity, respectively. Corrections with near surface CTD data while on station, improve the accuracy estimates to 0.02 K and 0.15 for temperature and salinity, respectively. During P293/1 and P293/2a, the power supply failed, and no data were stored for this time period. The failure was repaired for P293/2b.

5.3.6 vmADCP

The vessel mounted ADCP used *en route,* was a standard 150 kHz instrument made by RDI. Data from the ADCP were merged with the navigational data from the GG24 and the 3-dimensional ADU2, using RDI's data acquisition software DAS (RDI, 1990). Final processing used the CODAS programme package (Firing et al., 1993).

6. Additional remarks

Captain Heinrich Bruns and his crew advised and helped during this cruise in the same professional way we had experienced during earlier cruises. All members of the scientific party would to acknowledge this in particular in view of the uncertain perspectives of the managing owner R/F on the medium sized German research vessels.

7. Appendices

A. Station list

8. References

Firing, E., Ranada, J. and P. Caldwell (1993): Processing ADCP Data with the CODAS Software System, Version 3.1. Intern. Rep. Univ. Hawaii & NODC.

Girton, J.B., T.B. Sanford and R.H. Käse (2001): Synoptic sections of the Denmark Strait Overflow. Geophys. Res. Lett., 28, 8, 1619-1622.

Käse, R.H. and A. Oschlies (2000): Fow through Denmark Strait. Journ. Geophys. Res., 105, 28,527-28,546.

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

RD Instruments (1990): User's Manual for the RD Instruments Data Acquisition Software (DAS). RD Instruments, San Diego, CA, U.S.A.

WOCE (1991): WOCE Operations Manual, Vol. 3, sect. 31., part 3.1.3: WHP Operations and methods. July 1991, WHOI, MA, USA.

Appendix A: POSEIDON cruise 293/2: cruise log

POSEIDON 293/2 station and sample log
Status: 2-SEP-2002, 14:00

List of abbreviations:
St : Station no.
C : CTD cast no., monotonically increasing during the cruise;
all casts to near bottom if not indicated else
Wd : Sounding, 1500 m/s
Instr : Type of instrumentation or mooring or equipment
x 1 mooring
x 2 SBE : Sea-Bird 911 plus with 12x10 l GO bottle rosette
x 4 vADCP : vessel mounted RDI ADCP, 150 KHz
x 4 PC-LOG : on-line log of GPS date, time, position, pitch & roll;
x near-surface T, S; meteorological data
x 5 CPR : continuous Plankton-Profiler

Additional sensors on and samples taken from CTD/rosette:
S salt (standard)
N nutrients
CO2 CO2
Cla chlorophyll a
MC calibration of MicroCats

Date Time year 2002 UTC MM DD hhmm	St	C	Latitude North DD MM.MM	Longitude East DDD MM.MM	Wd m	Inst. depth m	Inst. type	Samples / remarks
08 17 0900	-9	-9	64 10.00	-021 -55.00	-9	-9	4	sail from Reykjavik
08 17 1100	-9	-9	64 30.00	-025 -00.00	-9	4	4	WP1 Reykjavik
08 17 1900	-9	-9	-99 99.99	-999 -99.99	-9	4	4	start vADCP and PC-log
08 18 0630	655	-9	66 06.50	-027 -10.50	625	625	4	recover V422-02/PIES05
08 18 0753	655	201	66 06.50	-027 -10.57	618	618	2	CTD/Ro/lADCP
08 18 0905	656	-9	66 07.60	-027 -16.20	582	582	4	recover V425-02/LR/ADCP
08 18 0923	656	202	66 07.62	-027 -16.47	567	566	2	CTD/Ro/lADCP
08 18 1105	657	-9	66 11.60	-027 -35.50	498	498	4	recover V423-02/SK/ADCP
08 18 1033	657	203	66 11.42	-027 -35.86	494	494	2	CTD/Ro/lADCP
08 18 1535	658	-9	66 09.92	-027 -26.28	487	487	4	start search for V421-02/PIES06
08 18 1936	658	-9	66 09.92	-027 -26.28	487	487	4	end search for V421-02/PIES06
08 18 1848	658	204	66 15.29	-027 -43.57	484	485	2	CTD/Ro/lADCP
08 18 2303	659	205	66 40.01	-028 -38.66	335	335	2	CTD/Ro/lADCP
08 18 2340	-9	-9	66 40.00	-028 -40.00	-9	-9	5	shot CPR
08 20 0850	-9	-9	62 50.00	-034 -59.00	-9	-9	5	haul CPR
08 20 0857	660	206	62 50.09	-034 -59.42	2740	2740	2	CTD/Ro/lADCP, MCs
08 20 1025	-9	-9	62 50.00	-035 -00.00	-9	-9	5	shot CPR
08 21 0825	-9	-9	60 08.00	-039 -01.00	-9	-9	5	haul CPR
08 21 1246	661	207	59 40.93	-039 -41.54	2802	2802	2	CTD/Ro/lADCP, Cla,
08 21 1606	662	-9	59 41.00	-039 -39.00	2806	2806	1	V434-01/CIS2/telemetry deployed
08 21 2140	663	208	59 41.32	-039 -37.81	2809	2809	2	CTD/Ro/lADCP first try failed
08 22 0001	664	209	59 30.00	-039 -20.96	2945	2945	2	CTD/Ro/lADCP
08 22 0454	665	210	59 34.47	-040 -07.84	-9	-9	2	CTD/Ro/lADCP
08 23 0550	666	211	59 39.15	-039 -41.08	2827	2827	2	CTD/Ro/lADCP
08 23 0810	667	-9	59 42.70	-039 -36.20	2800	2800	1	V433-01/CIS1 deployed
08 23 1123	-9	-9	59 43.00	-039 -35.00	-9	-9	5	shot CPR
08 25 1540	-9	-9	63 26	-025 -32	-9	-9	5	haul CPR
08 25 1700	-9	-9	64 00.00	-024 -00.00	-9	4	4	WP2 Reykjavik
08 26 0700	-9	-9	64 10.00	-021 -55.00	-9	-9	4	call in to Reykjavik
08 27 1500	-9	-9	64 10.00	-021 -55.00	-9	-9	4	sail Reykjavik
08 27 1700	-9	-9	64 30.00	-025 -00.00	-9	4	4	WP1 Reykjavik
08 28 0402	668	301	65 41.12	-025 -10.77	77	77	2	CTD/rosette, test releases
08 30 1953	669	-9	66 06.45	-027 -10.55	623	623	1	mooring V422-03/PIES05 deployed
08 30 2044	670	-9	66 07.25	-027 -16.20	578	568	1	mooring V425-03/LR deployed
08 30 2210	671	-9	66 11.4	-027 -35.3	497	497	1	mooring V423-03/SK deployed
08 30 2300	-9	-9	66 09.92	-027 -26.28	487	487	4	start search for V421-02/PIES06
08 18 2345	-9	-9	66 09.92	-027 -26.28	487	487	4	mooring V421-02/PIES06 given up
08 31 0830	672	-9	66 35.59	-025 -26.45	664	-9	1	search mooring V424-01/TK, lost
08 31 1032	674	302	66 33.54	-25 -27.00	617	617	2	CTD/rosette, TP calibration cast
08 31 1357	675	-9	66 40.5	-025 -26.5	800	-9	1	mooring V424-02/TP deployed
08 31 2038	676	303	66 11.53	-027 -37.64	492	492	2	CTD/rosette, start section
08 31 2236	677	304	66 07.09	-027 -13.62	614	614	2	CTD/rosette
08 31 -9	-9	-9	65 41	-025 -11	-9	-9	4	stop vADCP section
09 01 1900	-9	-9	64 30.00	-025 -00.00	-9	4	4	WP1 Reykjavik
09 01 2100	-9	-9	64 10.00	-021 -55.00	-9	-9	4	call in to Reykjavik