PROUDMAN OCEANOGRAPHIC LABORATORY

CRUISE REPORT NO. 32

VEINS:
Inverted Echo Sounders in the Denmark Strait

As part of

FS VALDIVIA CRUISE 173

AUGUST 13, 1998 - SEPTEMBER 2, 1998

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VEINS: Inverted Echo Sounders in the Denmark Strait, as part of,
FS Valdivia Cruise 173, August 13, 1998 – September 2, 1998

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ABSTRACT

The overflow of cold dense water from the Denmark Strait is one of the key elements of the north Atlantic thermohaline circulation and has important consequences for global climate change. It is important to measure the transport of this water and to understand its variability on seasonal and at longer time scales.

The European funded project "Variability of Exchanges in Northern Seas" (VEINS MAS3CT960070) is an attempt to measure variations in the Arctic circulation using modern oceanographic instrumentation.

Two combined Inverted Echo Sounder and Bottom Pressure Recorders were successfully recovered and re-deployed in the Denmark Strait to measure the thickness of this cold dense water and thus determine transport.

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CONTENTS

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OVERVIEW

The overflow of cold dense water from the Denmark Strait is one of the key elements of the north Atlantic thermohaline circulation and has important consequences for global climate change. It is important to measure the transport of this water and to understand its variability on seasonal and longer time scales.

The European funded project "Variability of Exchanges in Northern Seas" (VEINS) is an attempt to measure variations in the Arctic circulation using modern oceanographic instrumentation. Part of this work is in the Denmark Strait where an array of current meters is in place to measure the strength of the Overflow Water (DSOW). CTD surveys provide knowledge of the physical properties.

To measure the thickness of the DSOW, and hence get a value for transport, Inverted Echo Sounders were deployed at the core of the current with a view to detecting the echo from the interface between the cold bottom water and the overlying intermediate layer.

POL CRUISE OBJECTIVES

1) To recover two Inverted Echo Sounders in the Denmark Strait
2) To deploy two Inverted Echo Sounders in the Denmark Strait

BPR DEPLOYMENTS

Ship Preparation

POL personnel joined FS Valdivia at St Johns, Newfoundland on August 13, 1998. The equipment was located onboard the ship, unpacked and stowed safely.

RECOVERY OF IES/BPR (G1/IES) 21/8/1998

EVENTS

14.52 GMT Arrive on station.

15.06 GMT Released from the seabed.

16.08 GMT On the surface.

Total time on station: 1 hour 16 minutes.

IES/BPR (G1) Recovery Summary

Acoustic reception was not very good when using the DS7000 deck unit, however an older model TDU-210 deck unit had no problem communicating with the sea unit. The IES/BPR was monitored to the surface using both sets of acoustics.

RECOVERY OF IES/BPR (UK1/IES) 21/8/1998

EVENTS

17.38 GMT Arrive on station.

18.13 GMT Released from the seabed.

19.05 GMT On the surface.

Total time on station: 1 hour 27 minutes.

IES/BPR (G1) Recovery Summary

The TDU-210 deck unit communicated well with the sea unit. Once the unit was confirmed as having released, the acoustics were monitored with the DS7000 deck unit, which gave fairly good results. The IES/BPR was monitored to the surface using both sets of acoustics.

DEPLOYMENT OF IES/BPR (UK1/IES) 24/8/1998

EVENTS

16.30 GMT Arrive on station.

16.46 GMT Released into the water.

17.17 GMT On the seabed.

Total time on station: 52 minutes

IES/BPR (UK1) Deployment Summary

One acoustic unit is fitted with a burnwire release mechanism and the other is fitted with a pyrolease device. Fitted to this frame is a WS Oceans water sampler belonging to CEFAS.

DEPLOYMENT OF IES/BPR (G1/IES) 24/8/1998

EVENTS

18.12 GMT Arrive on station.

18.17 GMT Released into the water.

19.13 GMT On the seabed.

Total time on station: 1 hour 1 minute

IES/BPR (G1) Deployment Summary

One of the acoustic units is fitted with a pyrolease unit and the other unit is fitted with a burnwire mechanism. Both acoustics were successfully monitored to the seabed.

CONCLUSIONS

All of the POL cruise objectives were fully achieved.

APPENDIX 1 – IES/BPR TECHNICAL INFORMATION

IES/BPR (G1/IES) RECOVERY INFORMATION

Location details	-	***Latitude***	***63°21.97' N***
		Longitude	***036°03.88' W***
		Depth	***2209m***
On station	-	14.52 GMT on 21/8/1998	
Released from the seabed	-	15.06 GMT	
On the surface	-	16.08 GMT	

Acoustics fitted were 46428 (Rx 14.5 kHz, Tx 12.0 kHz, Release D) and 46457 (Rx 15.0 kHz, Tx 12.0 kHz, Release B). The release command was transmitted to acoustic 46457 that was using a burnwire. The release command was not transmitted to the other unit since the pyrolease was to be re-used.

Logger
Timebase scan

Expected scan	Actual scan
16.15.00 GMT on 22/8/1998	16.13.54 GMT

Timebase is 66 seconds fast.

Data downloaded to G1BPR.raw

Data Arrangement
The raw data are made up of six data columns.

Column	**Data**
1	Time
2	Date
3	Temperature (DQ36573)
4	Pressure (DQ36753)
5	Temperature (DQ38175)
6	Pressure (DQ38175)

Inverted Echo Sounder

IES chirped at 00.10.55 GMT on 23/8/98
IES woke up at 14.10.36 GMT

The data were offloaded without any problem and stored as G1IES.dat

IES/BPR (UK1/IES) RECOVERY INFORMATION

Location details	**-**	***Latitude***	***63°28.73' N***
		Longitude	***036°17.87' W***
		Depth	***1991m***

On station	-	17.38 GMT on 21/8/1998
Released from the seabed	-	18.13 GMT
On the surface	-	19.05 GMT

Acoustics fitted were 47166 (Rx 13.5 kHz, Tx 12.0 kHz, Release B) and 58172 (Rx 14.0 kHz, Tx 12.0 kHz, Release A). The burnwire release command was transmitted at 17.44 GMT, at 17.55 GMT and finally at 18.09 GMT. The release command was transmitted twice to 47166 and then finally to 58172, since it was not certain that the previous commands had been received properly. Upon examination of the burnwire devices after recovery, both units had burned through.

Logger

Timebase

Expected scan	Actual scan
12.45.00 GMT on 22/8/1998	12.44.11 GMT

Timebase is 49 seconds fast.

Data downloaded to UK1BPR.raw

Data Arrangement

The raw data are made up of eight data columns.

Column	**Data**
1	Time
2	Date
3	Temperature (QT119016)
4	Pressure (QT119016)
5	Temperature (DQ38173)
6	Pressure (DQ38173)
7	Temperature (DQ46279)
8	Pressure (DQ46279)

Inverted Echo Sounder

The data were downloaded to UK1IES.dat

No measurements of the IES were possible since the battery was drained upon recovery. The data were downloaded from the hard disk and there was a full years worth of data. The reason for the battery discharging is unknown.
During the downloading process there were disk errors, the result of a fault with Toshiba 2½-inch disk drives. The disk drive signals that it has written the data stored in its buffer to disk, thus allowing the power to be removed, before it has finished writing the data. Therefore the power to the drive is turned off whilst the disk is still writing the contents of its data buffer to the disk. The majority of the data stored to disk was downloaded well with only a few IES samples corrupted.

IES/BPR (UK1/IES) DEPLOYMENT INFORMATION

Location details	-	***Latitude 63°28.56' N***
		Longitude 036°17.57' W
		Depth 2001m
On station	-	16.30 GMT on 24/8/98
Released into the water		- 16.46 GMT
On seabed	-	17.17 GMT

Acoustic Servicing

S/N 46457

Old battery voltage	-	Red 12.49V
		Orange 12.46V
New battery voltage	-	Red 14.28V
		Orange 14.28V
Old burnwire release voltage	-	26.50V
New burnwire release voltage	-	28.00V

The stainless steel clamp around the glass sphere is corroded and will need replacing before the next deployment of this unit.

S/N 46428
This unit is fitted with a pyrolease device.

Old battery voltage	-	Red 12.27V
		Orange 12.27V
Release batteries	-	9.50V

The old batteries were refitted since they should last another year.

Acoustic Information	-	XT 6000 Acoustics, S/N 46457 Rx 15.0 kHz, Tx 12.0 kHz, Release B
	-	XT6000 Acoustics, S/N 46428 Rx 14.5 kHz, Tx 12.0 kHz, Release D

Radio Beacon	-	Benthos 154.585 MHz
Logger	-	SSDL 5

Logger Information

Sensors	-	DQ 36573
		DQ 38175

Timebase Channels

1	-	Temperature	DQ 36573
2	-	Pressure	
3	-	Temperature	DQ 38175
4	-	Pressure	

Sensor Frequencies

DQ 36573	-	Temperature	- 170.998 kHz
	-	Pressure	- 32.844 kHz
DQ 38175	-	Temperature	- 170.510 kHz
	-	Pressure	- 33.332 kHz

SSDL 5 timebase started at 22.15.00 GMT on 22/8/1998
First scan at 22.30.00 GMT on 22/8/1998

Battery Voltages

Logger	-	14.71 V

Inverted Echo Sounder Information

IES	-	Chirp IES with POL ADC Board
		Hard disk size 1.4Gb

The IES was upgraded to have a larger storage capacity. The 540Mb disk drive was replaced with a 1.4Gb one and the firmware EPROM was replaced with a new version

IES parameters	-	Chirp Interval	120 minutes
		Samples / Datafile	1
		Sampling Rate	Fast
		Lockout Time	0
		Start File	1
		Serial Number	5
		Deployment Number	4

These parameters give a deployment duration of 523 days.

First wakeup was at 18.59.40 GMT on 23/8/1998
First Chirp at 20.59.58 GMT on 23/8/1998

IES/BPR (G1/IES) DEPLOYMENT INFORMATION

Location details	-	***Latitude 63°21.78' N***
		Longitude 036°03.73' W
		Depth 2206m
On station	-	18.12 GMT on 24/8/1998
Released into the water		- 18.17 GMT
On seabed	-	19.13 GMT

Acoustic Servicing

S/N 47166

Old battery voltage	-	Red 12.07V
		Orange 12.07V
New battery voltage	-	Red 14.29V
		Orange 14.29V
Old burnwire release voltage	-	26.10V
New burnwire release voltage	-	27.90V

S/N 58172

Old battery voltage	-	Red 11.59V
		Orange 11.59V
Old burnwire release voltage	-	26.40V

The batteries were not replaced in this unit.

Acoustic Information	-	XT 6000 Acoustics, S/N 47166
		Rx 13.5 kHz, Tx 12.0 kHz, Release B
	-	XT6000 Acoustics, S/N 58172
		Rx 14.0kHz, Tx 12.0 kHz, Release A

Both acoustic units are using a burnwire release mechanism.

Radio Beacon	-	Novatek 154.585 MHz

The antenna thread is damaged on this radio beacon and needs replacing.

Logger	-	SSDL 4

Logger Information

Sensors	-	QT 119016
		DQ 38173
		DQ 46279

Timebase Channels

1	-	Temperature	QT 119016
2	-	Pressure	
3	-	Temperature	DQ 38173
4	-	Pressure	
5	-	Temperature	DQ 46279
6	-	Pressure	

Sensor Frequencies

QT 119016	-	Temperature	- 45.611 kHz
	-	Pressure	- 21.570 kHz
DQ 38173	-	Temperature	- 169.933 kHz
	-	Pressure	- 33.353 kHz
DQ 46279	-	Temperature	- 172.401 kHz
	-	Pressure	- 32.849 kHz

SSDL 4 timebase started at 08.00.00 GMT on 23/8/1998
First scan at 08.15.00 GMT on 23/8/1998

Battery Voltages

Logger	-	14.70 V

<u>Inverted Echo Sounder Information</u>

IES	-	Chirp IES with LDEO ADC Board
		Hard disk size 540Mb

The IES was powered up and the time set to 09.37.40 GMT on 24/8/1998

IES parameters	-	Chirp Interval	240 minutes
		Samples / Datafile	1
		Sampling Rate	Fast
		Lockout Time	0
		Start File	1
		Serial Number	10
		Deployment Number	4

These parameters give a deployment duration of 373 days.

First wake up at 10.39.40 GMT on 24/8/1998
First Chirp at 13.40.00 GMT on 24/8/1998

This IES was due to have been upgraded in order to have a larger data store of 1.4Gb. However the design of the IES is that from Lamont Doherty and it would not support the larger disk drive, even with modified firmware. Thus the original configuration had to be re-installed.

MAP OF IES/BPR DEPLOYMENT POSITIONS

GLOSSARY

ADC	-	Analogue to Digital Converter
BPR	-	Bottom Pressure Recorder
CEFAS	-	Centre for the Environment and Aquaculture Science
CTD	-	Conductivity, Temperature and Depth Profiler
DSOW	-	Denmark Strait Overflow Water
EPROM	-	Erasable Programmable Memory
IES	-	Inverted Echo Sounder
LDEO	-	Lamont Doherty Earth Observation Unit
PML	-	Plymouth Marine Laboratory
POL	-	Proudman Oceanographic Laboratory
VEINS	-	Variability of Exchanges in Northern Seas