

PROUDMAN OCEANOGRAPHIC LABORATORY

CRUISE REPORT NO. 38

Inverted Echo Sounders in the Denmark Strait

As part of

FS METEOR CRUISE 50/3

JUNE 21, 2001 – JULY 15, 2001

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2002

DOCUMENT DATA SHEET

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TITLE <p style="text-align: center;">Inverted Echo Sounders in the Denmark Strait, as part of, FS Meteor 50/3, June 21, 2001 – July 15, 2001</p>	
REFERENCE <p style="text-align: center;">Proudman Oceanographic Laboratory, Cruise Report, No 38, 10pp</p>	
ABSTRACT <p>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.</p> <p>The European funded project "Variability of Exchanges in Northern Seas" (VEINS MAS3CT960070) was an attempt to measure variations in the Arctic circulation using modern oceanographic instrumentation. This work is a continuation of that project, leading into a new project ASOF (Atlantic and Sub-Arctic Ocean Fluxes) to further expand upon the work already undertaken.</p> <p>A combined Inverted Echo Sounder and Bottom Pressure Recorder was successfully recovered and re-deployed in the Denmark Strait to measure the thickness of this cold dense water and thus determine transport.</p>	
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KEYWORDS Bottom Pressure Recorder Denmark Strait Inverted Echo Sounder VEINS Sea Level Bottom Water North Atlantic	CONTRACT PROJECT LT310 PRICE £10.00

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ACKNOWLEDGEMENTS

The author would like to thank the Captain, Officers and ship's company of FS Meteor for their help in the recovery and deployment of sea level equipment in the Denmark Strait.

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 at longer time scales.

VEINS (Variability of Exchanges in the Northern Seas) was an EU-MAST project aimed at measuring the variability of ocean fluxes between the Arctic and the North Atlantic for a period of three years. Long-term measurements were made using modern oceanographic instrumentation to determine the variation of the Arctic circulation. Part of this work involves 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 its thickness, and hence get a value for transport for the DSOW, an Inverted Echo Sounder was deployed in 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.

The current work program, funded by organisations in the United States of America, is a continuation of the work done during the VEINS project. The data collected may eventually contribute to a proposed new program Arctic Subarctic Ocean Fluxes (ASOF) which is a collaboration between several European countries, the United States and Canada.

POL CRUISE OBJECTIVES

- 1) To recover an Inverted Echo Sounder in the Denmark Strait
- 2) To deploy an Inverted Echo Sounder in the Denmark Strait

BPR DEPLOYMENTS

SHIP PREPARATION

POL personnel joined FS Meteor at St Johns, Newfoundland on June 19, 2001. The equipment was transferred from the container port and loaded aboard the ship. The ballast weight was lashed on the deck and the rest of the gear placed in the main laboratory and stowed safely.

RECOVERY OF IES/BPR (UK1/IES) 1/7/01

EVENTS

14.15 GMT	Vessel on station.
14.16 and 14.19 GMT	Release command transmitted.
14.32 GMT	Released from the seabed.
15.08 GMT	On the surface.

Total time on station: 53 minutes.

IES/BPR (UK1/IES) Recovery Summary

Acoustic conditions were very good despite the fairly rough sea. Communication with both acoustic releases was definite and immediate. The release command was transmitted to one of the releases and the four-ping acknowledgement was clearly received. There was almost no sea noise being received by the deck unit. To ensure that the frame would successfully release, the release command was transmitted to the second release unit. 16 minutes after the first release transmission, the frame released from the ballast weight.

DEPLOYMENT OF IES/BPR (UK1/IES) 5/7/2001

EVENTS

11.57 GMT	Vessel on station.
12.00 GMT	Release into the water.
12.40 GMT	On the seabed.

Total time on station: 43 minutes

IES/BPR (UK1/IES) Deployment Summary

The ship was acoustically very quiet, so it was possible to achieve excellent communication with both acoustic releases to the seabed.

CONCLUSIONS

All of the POL objectives were fulfilled.

APPENDIX 1 - BPR TECHNICAL INFORMATION

IES/BPR (UK1/IES) RECOVERY INFORMATION

<i>Location details</i>	-	<i>Latitude</i>	<i>63 °28.54' N</i>
		<i>Longitude</i>	<i>036 °17.28' W</i>
		<i>Depth</i>	<i>2002m</i>
On station	-		14.15 GMT on 1/7/2001
Release command transmitted	-		14.16 and 14.19 GMT
Released from seabed	-		14.32 GMT
On surface	-		15.08 GMT

Acoustics fitted were 46457 (Rx 15.0 kHz, Tx 12.0 kHz, Release B) and 46428 (Rx 14.5 kHz, Tx 12.0 kHz, Release D), both using the burnwire release. The release command was initially transmitted to acoustic unit 46457. This responded with four pings and then when interrogated further, responded with five pings, clearly indicating that the burn process was underway. The release command was then transmitted to the second release. With both acoustic releases it was possible to detect the five pings indicating the burn process was active. Acoustic conditions were excellent despite the sea being fairly rough and the wind blowing Force 6-7. Once on the surface, the ships direction finder radio receiver located the radio beacon signal and the frame was recovered.

Logger

Timebase

Expected Scan

16.00.00 GMT on 2/7/2001

Actual Scan

15.59.22 GMT on 2/7/2001

Timebase is 38 seconds fast.

Data were downloaded to UK1BPR0001.RAW

Data Arrangement

The raw data are made up of eight columns

Column	Data
1	Time
2	Date
3	Temperature (DQ 36573)
4	Pressure (DQ 36573)
5	Temperature (DQ 38175)
6	Pressure (DQ 38175)
7	Blank
8	Blank

Inverted Echo Sounder

The IES pinged at 10.07.43 GMT on 2/7/2001
Number of data files stored was 3946.
The data were downloaded to UK1IES0001.V12

Acoustic Release

S/N 46428

Acoustic battery voltage	-	Red	12.41V
		Orange	12.40V
Burnwire voltage	-		26.77V

S/N 46457

Acoustic battery voltage	-	Red	12.65V
		Orange	12.62V
Burnwire voltage	-		26.75V

IES/BPR (UK1/IES) DEPLOYMENT INFORMATION

<i>Location details</i>	-	<i>Latitude</i>	<i>63 ° 28.69' N</i>
		<i>Longitude</i>	<i>036 ° 18.81' W</i>
		<i>Depth</i>	<i>1990m</i>
On station	-		11.57 GMT on 5/7/2001
Released into the water	-		12.00 GMT
On seabed	-		12.40 GMT

The deployment went very well in perfect conditions. Both acoustics were monitored to the seabed and gave a slant range reading of 1985 m when on the seabed. It was only noticed after the deployment that the IES had been deployed in the wrong position. The IES should have been deployed in the nominal position of 036° 17.30' W. The deployment position was confused with the neighbouring UK1 current meter mooring. The UK1 mooring was then deployed in the position normally occupied by the IES.

Logger

Logger fitted is SSDL 5 with sensors DQ 36573 and DQ 38175

Channels

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

Sensor Frequencies

DQ 36573	-	Temperature	170.983 kHz
		Pressure	32.842 kHz
DQ 38175	-	Temperature	170.495 kHz
		Pressure	33.329 kHz

Timebase started at 20.15.00 GMT on 2/72001

First scan at 20.30.00 GMT on 2/7/2001

Battery installed in the logger was not new but had previously been used in logger C1 for 12 months in the Weddell Sea. There should be enough power in the pack to operate for another 12 months.

Logger	-	14.78V
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Inverted Echo Sounder

IES - Chirp IES with POL ADC board
Hard disk size is 1.4Gb

The IES was started at 14.59.40 GMT on 2/7/2001
First Chirp at 16.59.59 GMT on 2/7/2001

When setting the real time clock, it was noticed that it would not accept a year date 01, but it would however accept 00. Upon further investigation, the range of acceptable dates for year was 97, 98, 99 and 00. The date was thus set to 1997 since it was not known what effect the date stamp will have on the rollover from 00 to 01.

IES parameters - Chirp Interval 120 minutes
Samples per datafile 1
Sampling Rate fast
Lockout time 0
Start File 1
Serial Number 5
Deployment Number 5

These parameters give a deployment duration of 523 days.

Acoustic Releases

S/N 46428

Acoustic battery voltage - Red 14.55V
Orange 14.55V
Burnwire voltage 28.54V

S/N 46457

Acoustic battery voltage - Red 14.54V
Orange 14.55V
Burnwire voltage - 28.65V

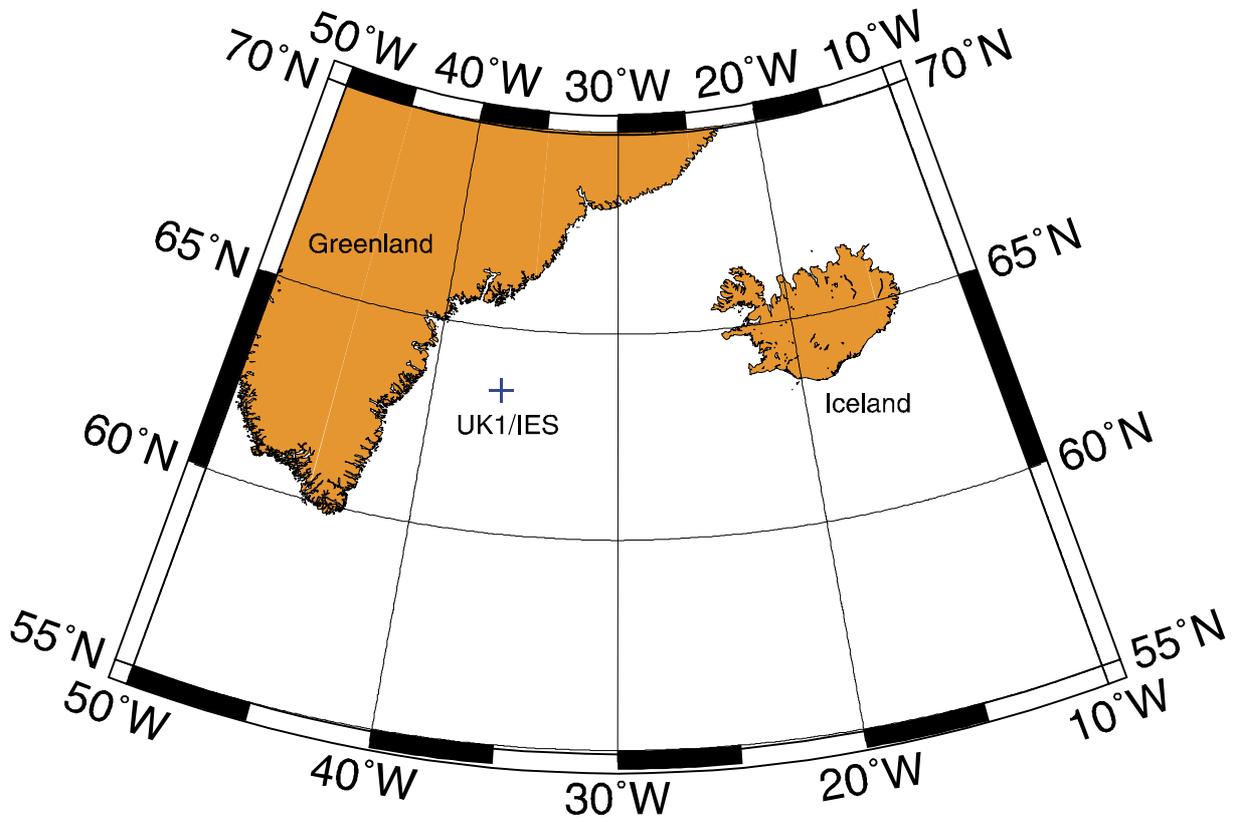
Acoustic Information - XT 6000 Acoustics, S/N 46428
Rx 14.5 kHz, Tx 12.0 kHz, Release D
- XT6000 Acoustics, S/N 46457
Rx 15.0 kHz, Tx 12.0 kHz, Release B

Both of the acoustic units are using a burnwire release mechanism.

Radio Beacon - Benthos 154.585 MHz
Channel A

The batteries were not replaced in the radio beacon because none were available. The existing batteries should last for another 12 months.

MAP OF IES/BPR DEPLOYMENT POSITION



GLOSSARY

ADC	-	Analogue to Digital Converter
ASOF	-	Arctic Subarctic Ocean Fluxes
BPR	-	Bottom Pressure Recorder
CEFAS	-	Centre for the Environment, Fisheries and Aquaculture Science
CTD	-	Conductivity, Temperature and Depth Profiler
DSOW	-	Denmark Strait Overflow Water
FiMR	-	Finnish Institute of Marine Research
GMT	-	Greenwich Mean Time
IES	-	Inverted Echo Sounder
IfMH	-	Institut für Meereskunde, Hamburg University
IfMK	-	Institut für Meereskunde, University of Kiel
POL	-	Proudman Oceanographic Laboratory
UBU	-	University of Bremen
VEINS	-	Variability of Exchanges in Northern Seas