

ACCLAIM: Sea Level Measurements
in the Drake Passage

RRS James Clark Ross Cruise JR111

1 - 22 December 2004

G.W. Hargreaves

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ABSTRACT <p>ACCLAIM Bottom Pressure Recorders have been used for making measurements of the Antarctic Circumpolar Current (ACC) since 1988, initially in the Scotia Sea and then later across the Drake Passage between the Falkland Islands and the Antarctic peninsula. Some of the Bottom Pressure Recorders (BPRs) are combined with Inverted Echo Sounders (IES).</p> <p>During this cruise the one BPR and one BPR/IES were recovered and re-deployed in the Drake Passage. In addition to this, a third BPR was deployed in between the two existing recording sites.</p> <p>The Sea Level Recorder at Stanley was serviced.</p>	
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CRUISE PERSONNEL

POL Personnel

Principal Scientist	Geoff Hargreaves Jeff Pugh
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BAS Personnel

Johnnie Edmonston
Vsevolod Afanasyev
Paul Tregoing

Ship Personnel

Captain	Jerry Burgan
Chief Officer	Andy Liddel
2nd Officer	Dave King
3rd Officer	Jo Cox
Radio Officer	Mike Gloistein
Bosun	Colin Lang
Bosun's Mate	Dave Peck

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OVERVIEW

The remote island sea level stations provide valuable data for ACCLAIM (Antarctic Circumpolar Current Levels from Altimeter and Island Measurements) which is supplemented by Bottom Pressure Record measurements.

The principal objective is to study variations in the flow of the Antarctic Circumpolar Current (ACC) on large time and space scales; however the ACCLAIM network is also a component of GLOSS (Global Sea Level Observing System). The BPRs have supplied sea level data that has provided knowledge of tidal behaviour in this remote area.

ACCLAIM Bottom Pressure Recorders (BPR's) have been deployed since 1988, initially in the Scotia Sea and then later in the Drake Passage. The data is made available to the international research community through the Permanent Service for Mean Sea Level (PSMSL).

POL CRUISE OBJECTIVES

- 1) To service the Sea Level Recorder at Port Stanley, Falkland Islands.
- 2) To recover the BPR and BPR/IES from the Drake Passage.
- 3) To deploy two BPRs and one BPR/IES in the Drake Passage.
- 4) To test deploy and recover a RAPID Lander.
- 5) To service the Sea Level Recorder at Rothera

SHIP PREPARATION

POL personnel, Geoff Hargreaves and Jeff Pugh, joined RRS James Clark Ross at Stanley, Falkland Islands, on 1/12/2004. The equipment had already been located and arranged in the lab by Steve Mack who had sailed onboard the ship during the previous cruise. The RAPID lander was assembled and tested. Also, the three Bottom Pressure Recorder loggers were started. The ship sailed on the morning of 2/12/2004, heading for Rothera.

STANLEY SEA LEVEL RECORDER 29/11/2004

The system was monitored and the time of the last scan was noted. The data were downloaded and the system then restarted. A mechanical timer clock was fitted to the I-Modem to force a daily reset. This should enable the modem to start functioning again in case it malfunctions and will not respond to commands.

RECOVERY OF DRAKE PASSAGE NORTH CROCUS BPR (POL 8) 3/12/2004

EVENTS

12.00 GMT	Vessel on station
12.03 GMT	Release command transmitted
12.19 GMT	Released from seabed
13.00 GMT	On the surface

Total time on station: 60 minutes

Drake Passage North CROCUS BPR (POL 8) Recovery Summary

The recovery went very smoothly. Acoustic conditions were good and good communication was achieved. The unit was initially enabled and then range readings were taken before sending the release command. After the receipt of the release command, the unit did not respond to ranging attempts for a short while, indicating that the command had been received. When the unit again responded to range enquiries, it responded with a four ping reply.

DEPLOYMENT OF RAPID LANDER BPR 3/12/2004

EVENTS

17.43 GMT	Vessel on station
17.47 GMT	Released into water
18.08 GMT	On the seabed

Total time on station: 25 minutes

RAPID Lander Deployment Summary

The deployment went very well. This unit is a trial deployment of the BPR design used as part of the RAPID Climate Change programme. Acoustic conditions were good and the unit was monitored to the seabed.

DEPLOYMENT OF DRAKE PASSAGE CENTRE BPR (POL 9) 6/12/2004

02.13 GMT	Vessel on station
02.21 GMT	Released into the water
03.35 GMT	On the seabed

Total time on station: 1 hour 23 minutes

Drake Passage Centre BPR (POL 9) Deployment Summary

The deployment went smoothly. The frame is fitted with two acoustic releases, an old style Benthos XT6000 and a new style Benthos XT6001. The unit was monitored to the seabed using the XT6000 as the XT6001 did not respond to range enquiries. It was realised later that

the XT6001 is equipped with a timeout and should have been enabled before the deployment.

RECOVERY OF DRAKE PASSAGE SOUTH (POL 6) 7/12/2004

EVENTS

15.44 GMT	Vessel on station
15.47 GMT	Released from the seabed
16.10 GMT	On the surface

Total time on station: 26 minutes

Drake Passage South (POL 6) Recovery Summary

One of the acoustic releases worked ok and was used to recover the BPR, but there was no response from the second acoustic release. It was later discovered that a small quantity of water had entered the sphere causing the failure.

DEPLOYMENT OF DRAKE PASSAGE SOUTH (POL 6) 7/12/2004

EVENTS

16.47 GMT	Vessel on station
16.49 GMT	Released into the water
17.10 GMT	On the seabed

Total time on station: 23 minutes

Drake Passage South (POL 6) Deployment Summary

One of the acoustics was monitored to the seabed using the waterfall display system. Once on the seabed, the second acoustic release was tested but could not be contacted.

PORT LOCKROY AND ROTHERA

The ship arrived at Port Lockroy on 9/12/2004 and deposited three personnel ashore to operate the base as a museum of Antarctic exploration history during the summer. The ship spent a few hours at the base unloading supplies and then sailed for Rothera. The ice reports being received by the ship were not favourable and when it got near to Adelaide Island the extent of the sea ice became clear. The ship would have to travel 150 miles through consolidated pack ice in order to reach Rothera.

The ship entered the ice and through finding leads, managed to make reasonable progress until after about 70 miles had been travelled when the progress slowed. The Twin Otter aircraft from Rothera were sent on scouting missions to try and guide the ship to any leads in the ice. On Monday 13/12/2004, the decision was made to return to Stanley, Falkland Islands as the ice conditions were too bad to attempt further progress.

ATTEMPTED RECOVERY OF RAPID LANDER 18/12/2004

EVENTS

09.17 GMT	-	Vessel on station
09.18 GMT	-	Release command transmitted
09.25 GMT	-	Release command transmitted
09.49 GMT	-	Release command transmitted
10.40 GMT	-	Leave station

RAPID Lander Attempted Recovery Summary

The sea conditions were very good. After each release transmission, the deck unit receive light flickered several times indicating that the release command has been received. For some unknown reason, the unit did not release from the seabed

DEPLOYMENT OF DRAKE PASSAGE NORTH BPR (POL 8) 18/12/2004

EVENTS

12.57 GMT	-	Vessel on station
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- 13.02 GMT - Released into the water
- 13.26 GMT - On the seabed

Drake Passage North BPR Deployment Summary

The sea conditions were very good. Communication was achieved with both of the acoustic releases to the seabed.

CONCLUSIONS

The ice conditions prevented the ship from reaching Rothera and thus it was not possible to service the sea level recorder. The other objectives were successfully completed except the recovery of the test RAPID lander. The reason for the non-return of the lander is not known, however it is likely to be a mechanical problem. The electronic acoustic systems appeared to be functioning correctly, so it is suspected that the magnesium corrodible bolts used to ensure a safe deployment had not fully corroded by the time a recovery was attempted.

APPENDIX 1 - BPR TECHNICAL INFORMATION

STANLEY SEA LEVEL RECORDER INFORMATION

The system at Stanley consists of a tide logger storing samples every fifteen minutes to a Static Random Access Memory (SRAM) card and also a wave/tide recorder that is sampling every one second and is storing data to a compact flash memory card. This logger is connected to a telephone line via two modems and can be contacted from the UK.

Before POL staff left the UK to service this Sea Level Recorder it was known that the outgoing email communication from the wave/tide had stopped and it was believed to be a modem fault. The gauge had been serviced a few weeks earlier by Steve Mack during a visit to Stanley..

Timebase scan

Expected	Actual
12.45.00 GMT on 29/11/2004	12.44.59 GMT on 29/11/2004

The calibrated and raw data were downloaded from the memory card and stored as stan291104.cal and stan2010raw respectively.

The tide logger was left running and wasn't reset.

Sensors fitted.

Full Tide	DQ 47594
Half Tide	DQ 47598
Barometer	DQ 39239

A mechanical time clock was fitted to modem power supply to force a power down and reset once a day. It is believed that resetting the modem every day will correct any potential future problems associated with the modem not sending e-mails.

The wave/tide logger was found to be in an error condition. The left LED was flashing green at 1 sec intervals but the right LED was permanently lit green. The power was cycled to the logger and the start-up monitored on the laptop via a serial port. This seemed to reboot normally, finishing with the left LED flashing green at 1 sec intervals and the right LED not lit.

DRAKE PASSAGE NORTH CROCUS BPR (POL 8) RECOVERY INFORMATION

Location details - *Latitude 54° 56.59' S*
Longitude 058° 21.41' W
Depth 1148m

On station - 12.00 GMT on 3/12/2004
Release command transmitted - 12.03 GMT
Released from seabed - 12.19 GMT
On the surface - 12.19 GMT

Acoustic Information

Benthos TR7000 (61199) - ID 05, Tx 12.0 kHz, Rx 11.0 kHz, Enable A,
Disable B, Release C, Pinger D

The release is a burnwire mechanism that gives a four ping acknowledgement once the burn command has been received.

Logger

Logger P3 with sensor DQ 68485

Timebase scan

Expected	Actual
17.15..00 GMT on 4/12/2004	17.14.01 GMT

The timebase is 59 seconds fast.

Data were downloaded to dpn0304.raw.

Data Arrangement

The raw data are made up of six columns

Column

1
2
3
4
5
6

Data

Scan number
Time
Pressure (DQ 68485)
Temperature (DQ 68485)
Blank
Blank

Recovery Equipment

Benthos radio beacon - 154.585MHz Channel A

RAPID LANDER BPR DEPLOYMENT INFORMATION

Location details - *Latitude* 55°02.86' S
Longitude 058°18.70' W
Depth 1865m

On station - 17.43 GMT on 3/12/2004
Released into the water - 17.47 GMT
On the seabed - 18.08 GMT

Acoustic Information

Benthos XT6001 - Tx 12.0 kHz, Rx 10.5 kHz, Release D

Logger

Logger RL21 with sensor DQ 91142

Logger started at 18.40.30 GMT on 30/11/2004

Sampling interval – 15 minutes

Logger automatically configures itself to operate at the correct time.

Recovery equipment

Novatek radio transmitter - 154.585 MHz

DRAKE PASSAGE MIDDLE (POL 9) BPR DEPLOYMENT INFORMATION

Location details - *Latitude* 58°22.01' S
Longitude 056°15.22' W
Depth 3981m

On station - 02.13 GMT on 6/12/2004
Released into the water - 02.21 GMT
On seabed - 03.35 GMT

The deployment went very smoothly and it was possible to monitor the acoustic release to the seabed.

Acoustic Information

Benthos XT6000 (63803) - Tx 12.0 kHz, Rx 10.5 kHz, Release A

Benthos XT6001 (70772) - Tx 12.0 kHz, Rx 11.0 kHz, Enable A, Release D

Logger

Logger D2 with sensor DQ 92985

Temperature frequency 172.013 kHz

Pressure frequency 33.157 kHz

Timebase started at 22.30.00 GMT on 4/12/2004

First scan at 22.45.00 GMT

CTD Equipment

Seabird Microcat - Serial number 37SMP34870-3023
Sample interval – 900 seconds
Samples to average – 4
First sample taken at 14.30.00 GMT on 4/12/2004

Recovery Equipment

Benthos radio beacon - Nominal frequency - 154.585 MHz
S/N 40 - Actual frequency – 154.587 MHz
Channel A

New Battery Information

Logger battery - 14.70V

DRAKE PASSAGE SOUTH BPR/IES (POL 6) RECOVERY INFORMATION

Location details - *Latitude* **60° 51.00' S**
Longitude **054° 42.77' W**
Depth **1000m**

On station - 15.44 GMT on 7/12/2004
Release command transmitted - 15.47 GMT
On the surface - 16.10 GMT

Acoustic Information

Benthos XT6000 (46421) - Tx 12.0 kHz, Rx 14.0 kHz, Release D
Benthos XT6000 (46481) - Tx 12.0 kHz, Rx 14.5 kHz, Release C

Logger

Logger SSDL2 with sensors, QD 49187, DQ 46251, DQ 43513

Timebase scan

Expected	Actual
13.30.00 GMT on 11/12/2004	13.31.12 GMT on 11/12/2004

Timebase was 72 seconds slow.

The data were downloaded to dps9899.raw.

Data Arrangement

The raw data are made up of eight columns

Column	Data
1	Time
2	Date
3	Temperature (QD 49187)
4	Pressure (QD 49187)
5	Temperature (DQ 46251)
6	Pressure (DQ 46251)
7	Temperature (DQ 43513)
8	Pressure (DQ 43513)

Inverted Echo Sounder

IES woke up at 17.29.40 GMT on 10/12/2004 and would have chirped at 17.30.00 GMT except the disk drive was full of data, so it did no chirp.

The data were recovered and stored in the file dps0204.v12

Number of datafiles recorded to disk is 6280. The IES is fitted with a Hitachi 1.4Gb disk and is storing two samples per datafile.

Recovery Equipment

Benthos radio beacon - 154.585MHz Channel A

DRAKE PASSAGE SOUTH DEPLOYMENT (POL 6) INFORMATION

Location details - *Latitude 60° 51.03' S*
Longitude 054° 42.80' W
Depth 1090m

On station - 16.47 GMT on 7/12/2004
Release into the water - 16.49 GMT
On the seabed - 17.10 GMT

Acoustic Information

Benthos XT6000 (63801) - Rx 11.5kHz, Tx 12.0kHz, Release B
Benthos XT6001 (69675) - Rx 13.5kHz, Tx 12.0kHz, Enable F, Release D
Both acoustics fitted with a burnwire release system.

Logger

Logger D3 with sensors DQ 93161

Timebase started at 14.15.00 GMT on 30/11/2004

First scan at 14.30.00 GMT on 30/11/2004

CTD Equipment

Seabird Microcat - Serial number 37SMP34870-3024

Inverted Echo Sounder

IES fitted with POL ADC board and Hitachi 1.4Gb disk drive.

IES started at 13.59.40 GMT on 6/12/2004

First Chirp at 14.59.58 GMT on 6/12/2004

Set-up parameters

Chirp interval	60 minutes
Samples per datafile	2
Lockout time (1/100 s)	0
Start file number	1
Serial number	11
Deployment number	4
Comment	Drake South 2004-2005

Recovery Equipment

Benthos radio beacon - Nominal frequency - 154.585 MHz,
Actual frequency - 154.597 MHz
Channel A.

New Battery Information

Logger - 14.69V

RAPID LANDER BPR ATTEMPTED RECOVERY

Location details - *Latitude* 55° 02.86' S
Longitude 058° 18.70' W
Depth 1865m

On station - 09.17 GMT
Release command transmitted - 09.18 GMT, 09.25 GMT, 09.49 GMT

This unit was not recovered. The receive light on the deck unit flashed several times after the release command was transmitted. The acoustics seemed to be working correctly but it did not release from the seabed.

DRAKE PASSAGE NORTH BPR (POL 8) DEPLOYMENT INFORMATION

Location details - *Latitude* 54° 56.59' S
Longitude 058° 21.41' W
Depth 1090m

On station - 12.57 GMT on 18/12/2004
Released into the water - 13.02 GMT
13.26 GMT

Acoustic Information

Benthos XT6000 (46457) - Tx 12.0 kHz, Rx 15.0 kHz, Release B.
Benthos XT6001 (69675) - Tx 12.0 kHz, Rx 13.0 kHz, Enable F, Release D

Logger

Logger SSDL2 with sensors QD 49187, DQ 46251, DQ 43513
Timebase started at 18.30.00 GMT on 13/12/2004
First scan at 18.45.00 GMT

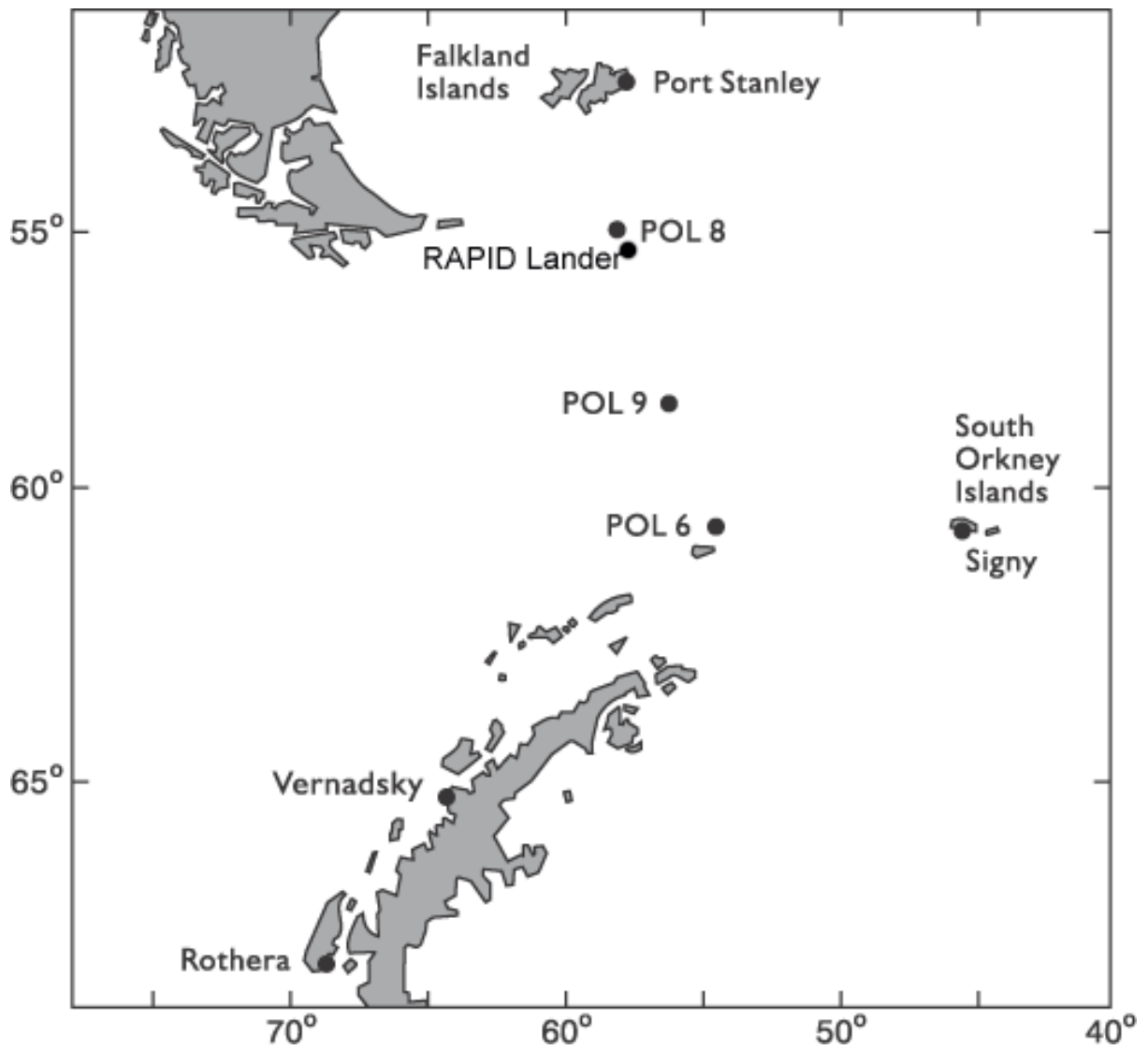
CTD Equipment

Seabird Microcat - Serial number 37SMP34870-3025

Radio Beacon

Benthos radio beacon - Nominal frequency - 154.585 MHz
Actual frequency – 154.596 MHz
Channel A

MAP OF DEPLOYMENT POSITIONS



GLOSSARY

ACCLAIM	-	Antarctic Circumpolar Current levels from Altimeter and Island Measurements
ADC	-	Analogue to Digital Converter
BPR	-	Bottom Pressure Recorder
CROCUS	-	Capsule for the Recovery of Ocean Circulation Under the Sea
EPROM	-	Erasable Programmable Memory
FIPASS	-	Falkland Islands Passenger and Sea Service
GMT	-	Greenwich Mean Time
IES	-	Inverted Echo Sounder
POL	-	Proudman Oceanographic Laboratory
SLR	-	Sea Level Recorder
SRAM	-	Static Random Access Memory
TDS	-	Triangle Digital Services