

**REPORT ON THE DEPLOYMENT OF RAPID-WAVE
MOORINGS OFF CABO MAYOR AND CABO FINISTERRE:
RAPIDO**

**B. O. CORNIDE DE SAAVEDRA
RADPROF0910 CRUISE 2010
VIGO-SANTANDER, 30 AUGUST-1 SEPTEMBER 2010**

**MIGUEL ÁNGEL MORALES MAQUEDA AND GEOFF HARGREAVES
NATIONAL OCEANOGRAPHY CENTRE**

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INTRODUCTION

This cruise is the second RAPID-WAVE cruise in the Gulf of Biscay and Finisterre. WAVE, which stands for West Atlantic Variability Experiment, is a NERC funded project to study the variability of the Meridional Overturning Circulation in the Northwest Atlantic. Five previous RAPID-WAVE cruises have taken place in the area of the Scotian Slope/Rise in 2004, 2006, 2007, 2008 and 2009. In August 2004, 6 lander Bottom Pressure Recorder (BPR) moorings and 5 MicroCAT moorings were deployed in a line across the shelf break south of St. John's, New Foundland. This line was designated Line A (see report of RRS Charles Darwin cruise CD160). A second line, called line B, was deployed east of Halifax, Nova Scotia. Lines A and B were almost identically instrumented. Additionally, John Loder, from the Bedford Institute of Oceanography (BIO) in Dartmouth, Nova Scotia, deployed two MicroCAT/RCM near bottom moorings in line B. Recovery of these two lines in July-August 2006 was full of difficulties, with losses of 8 MicroCAT moorings and 6 lander BPRs (see report of RRS Discovery cruise D308). As a result, line A was abandoned. In line B, 4 lander BPRs and 2 MicroCAT/BPR moorings were redeployed. To try to prevent further mooring losses, a joint project agreement with BIO was signed in early 2007. This agreement allowed us to return to the Halifax line in September/October 2007 with a Canadian Coast Guards Ship, CCGS Hudson, and BIO support. During this cruise (CCGS Hudson Fall Cruise HUD07045), the MicroCAT/BPR moorings were turned around. In September/October 2008 we carried out a second cruise on the Scotian Slope/Rise during which RAPID-WAVE line B was recovered for the last time and a new BIO/POL collaborative line made of 6 BPR/ADCP/CTD moorings was established in coincidence with the so-called Halifax line, a CTD survey line which is maintained by BIO as part of their contribution to the Atlantic Zone Monitoring Program (see report CCGS Hudson Fall Cruise HUD08037). A recovery and redeployment cruise for this line took place in 2009 (CCGS Hudson Fall Cruise HUD09048).

The main purpose of the new RAPID-WAVE line deployed in 2008 is to measure the bottom pressure variability across the Atlantic's western boundary (AWB). There are strong theoretical arguments to support the notion that variations in AWB bottom pressure can be directly related to variations in the meridional overturning circulation assuming that eastern boundary pressure variability is negligible. In February 2007, a recommendation was made by the RAPID Programme Advisory Group (PAG) that this assumption should ideally be tested by deploying a line of instruments along the shelf slope on the eastern Atlantic at the same latitude of the Halifax line (see "Review and Recommendations for the RAPID MOC Observing System, February 2007"). However, no additional funding was provided for such a deployment at the time. A similar verbal recommendation was made more than one year later during the PAG meeting of October 2008. Soon after the 2008 PAG meeting, it became possible to act upon their recommendation using RAPID-WAVE funds for the period 2004-2008 that remained unspent. To this end, a memorandum of understanding was reached between the Instituto Español de Oceanografía (IEO) and POL to deploy two lander BPRs off Cabo Mayor, north of Santander, and two tube BPRs (see below) on the continental slope in the area of Finisterre, western coast of Galicia. The leaders of this research collaboration are Alicia Lavín on the part of the IEO and Miguel A. M. Maqueda for POL. The deployment operations were part of the IEO cruise RADPROF0809 (RADiales PROFundas 0809) that took place between the 11 and the 22 August 2009 aboard the IEO's Oceanographic Vessel Cornide de Saavedra, with Dr Guillermo Díaz del Río as Chief Scientist.

In May 2010, we received news that the top part of the shallow Finisterre mooring (radiobeacon, current meter and buoyancy elements) had been found floating about by a Portuguese fishing vessel and taken to maritime authorities near Oporto. We presume that the mooring was dragged by a bottom trawler until the line snapped, or that the mooring line was accidentally cut by a fishing line.

In the present cruise which just precedes the IEO cruise RADPROF201009, we plan to:

1. Recover the deep mooring of the Finisterre line. The mooring will not be redeployed nor replaced.
2. Recover/rescue the shallow mooring of the same line. The mooring will not redeployed nor replaced.
3. Recover and redeploy the two lander BPRs deployed in 2009 off Santander.

We sailed from Vigo on the 30th August 2010 and arrived in Santander on the 1st September 2010. The cruise PSO was Dr Alicia Lavín Montero.

SHORT CRUISE NARRATIVE

30th August 2010

Geoff Hargreaves and Miguel Maqueda embarked on the Cornide de Saavedra at approximately 8 : 00 Z on the 30th August 2010.

The RAPIDO gear was already on board. All aluminium boxes and two flight cases each containing one BPR were taken to the main laboratory. The 2 ballast weights, a bag with additional weights, three cages and a pallet were left on the main deck aft.

Sailed for the Finisterre moorings and 11:45 Z. Fine weather slight north-easterly breeze. Waves well below half a meter in height.

On shallow Finisterre mooring station at 18:00 Z. The ship's echo sounder was turned off to avoid interference with the Benthos acoustics. Enabled command was transmitted several times but no reply was obtained. No ranging was possible as the release was not responding. Left station at 18:15 Z.

On deep Finisterre mooring station at 18:41 Z. Echo sounder off. The enable command was sent several times without response. No ranging was possible as the release was not responding. Left station at 18:58.

A meeting took place between the Captain, Guillermo Díaz, Alicia Lavín y Miguel Maqueda to decide on an overnight mooring search strategy. A search along a circle of 2.5 nm radius centred on the shallow Finisterre mooring was agreed. Along this circle, several short stops were made to descend the over-side transducer into the water and send enable and ranging commands to the mooring. Subsequently, the search radius was expanded to 5 nm. The search lasted until 4:30 Z on the 31st August and was unsuccessful.

31st August 2010

Deep Finisterre mooring. Again on station at 5:58 Z. Sent enable and release commands. No ranging was possible as the release was not responding. However, the mooring top floats were seen at the surface at 6:23 Z and the whole mooring was recovered soon afterwards. Very bad acoustic performance of recovered release, which **SHOULD NOT BE USED EVER AGAIN**.

Shallow Finisterre mooring. Back on station at 7:49 Z. Several attempts at releasing the mooring failed. It is not clear whether the mooring was there or not. Abandon station at 8:49 Z. Mooring not recovered.

1st September 2010

Recovered both shallow and deep RAPID landers off Santander without major problems. We initially had problems during the recovery of RL14 (Mareógrafo #1) as the lander's acoustics gave no indication that they had received the release command, that was first sent at 14:57 GMT. However, after repositioning the ship, the release command was sent again at 15:39 GMT, and this time the signal was received. There were not problems during the recovery of RL09 (Mareógrafo #2). Deployment of two replacement RAPID landers took place without incidents.

SUMMARY OF EQUIPMENT DEPLOYED IN THE PREVIOUS CRUISE

SITE	LATITUDE (N)	LONGITUDE (W)	DATE & TIME DEPLOYED (Z)	DEPTH (m)	INSTRUMENT TYPE & S.N.
Mareógrafo #1	43 43.777	03 45.489	11-08-2009, 13:30/13:50	1113 (unc.)	BPR/RL14 DQ93170
Mareógrafo #2	43 45.60	03 45.50	11-08-2009, 12:37/13:01	1749 (unc.)	BPR/RL09 DQ93160
Mareógrafo #3	43 00.142	09 34.577	16-08-2009, 02:28	1129 (unc.)	BPR/TRL03 DQ92918
Mareógrafo #4	43 00.237	09 40.866	16-08-2009, 03:29	1736 (unc.)	BPR/TRL02 DQ43118

Table 1. BPR lander deployment summary. Of the two deployment times, the first is the time when the instrument was launched into the water and the second is the time when the lander hit the seabed (Mareógrafos #3 and #4 were not followed to the bottom). The instrument type entry also includes the serial number of the sensor used.

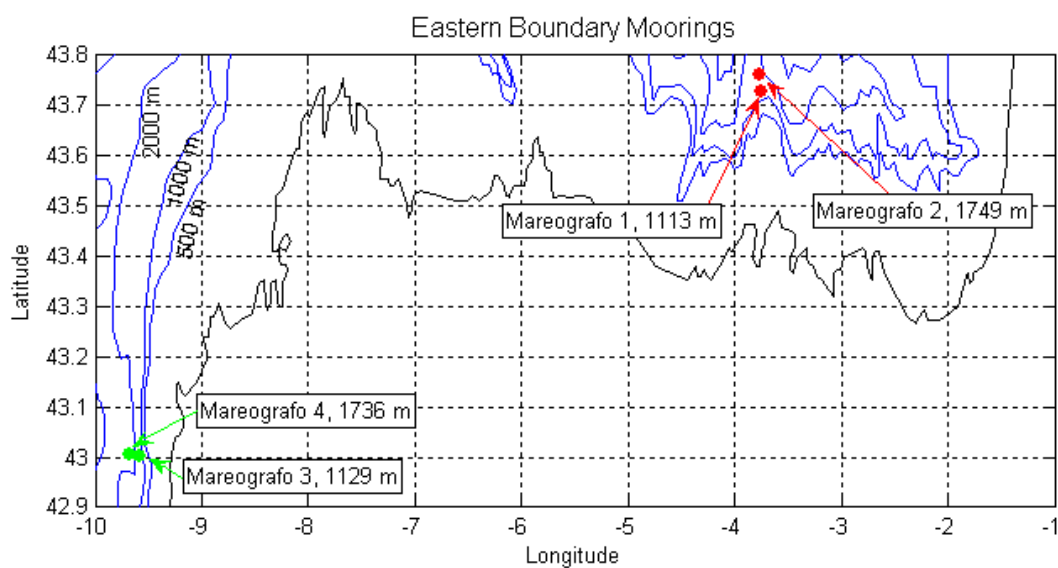


Figure 1. Locations and depths of the four BPR moorings deployed during RADPROF0809. Red: BPR deployments in the Santander line. Green: BPR deployments in the Finisterre line.

SUMMARY OF EQUIPMENT RECOVERED

SITE	LATITUDE (N)	LONGITUDE (W)	DATE & TIME RECOVERED (Z)	DEPTH (m)	INSTRUMENT TYPE & S.N.
Mareógrafo #1	43 43.777	03 45.489	01-09-2010, 16:00	1113 (unc.)	BPR/RL14 DQ93170
Mareógrafo #2	43 45.60	03 45.50	01-09-2010, 16:59	1749 (unc.)	BPR/RL09 DQ93160
Mareógrafo #3	43 00.142	09 34.577	Not recovered	1129 (unc.)	BPR/TRL03 DQ92918
Mareógrafo #4	43 00.237	09 40.866	31-08-2010, 06:23	1736 (unc.)	BPR/TRL02 DQ43118

Table 2. BPR lander recovery summary. The recovery time corresponds to the approximate time when the lander reached the surface. The instrument type entry also includes the serial number of the sensor used.

SUMMARY OF EQUIPMENT DEPLOYED

SITE	LATITUDE (N)	LONGITUDE (W)	DATE & TIME RECOVERED (Z)	DEPTH (m)	INSTRUMENT TYPE & S.N.
Mareógrafo #1	43 43.405	03 45.555	01-09-2010, 20:07	1120 (unc.)	BPR/RL22 DQ 43513
Mareógrafo #2	43 45.558	03 45.644	01-09-2010, 19:28	1748 (unc.)	BPR/RL06 DQ 91146

Table 3. BPR lander deployment summary. The deployment times are the times when the instrument was launched into the water. No time at seabed were recorded. The instrument type entry also includes the serial number of the DigiQuartz sensor used.