Draft ANDRILL Moored Data 2006 Report Richard Limeburner, Robert Beardsley and Sean Whelan

January 4, 2007

Introduction

A current meter mooring was deployed on October 25, 2006 on the frozen surface ice of the Ross Sea in support of the ANtarctic DRILLing (ANDRILL) project by Richard Limeburner (Woods Hole Oceanographic Institution), David Harwood (University of Nebraska), and Peter Webb (Ohio State University). The mooring site is located at the SMS site 77° 45.157' S and 165° 29.372' E, approximately 18 miles west northwest of McMurdo Station, Antarctica. The SMS mooring site is normally covered with seasonal sea ice, but at present the region has been permanently frozen for the past 10 years (Figure 1).



Figure 1. Location of the ANDRILL SMS 2006 mooring site labeled ADCP1 above..

The purpose of these moored measurements is to characterize the ocean currents from the near surface (under the 7-m surface ice) to the ocean bottom at a depth of approximately 520-m. These moored observations will be critical to the installation of an ANDRILL drilling platform planned for 2007 at the SMS site.

Mooring Deployment on the Ross Sea Ice

We departed McMurdo Station at 0400 GMT on Saturday October 21, 2006 with the mooring equipment, ice melting equipment, and food and camping supplies loaded on a "Piston Bully" track vehicle towing a medium size container-like box on skis and a Skidoo (Figure 2).

Air temperatures on the Ross Sea ice were generally in the range of -40° to -15° C during October and winds over 25 m/s were common. We arrived at the mooring site after a 4 hour transit in whiteout conditions. The next morning we set up a wooden gantry with blocks and cleats to facilitate the deployment. We then began melting a 24" diameter hole centered on the gantry in the sea ice. The hole melting process was slow





Figure 3. Schematic of the ANDRILL mooring.

and was done by placing a copper coil heated with glycol on the ice. The coil was attached with 2 pressure hoses to a pump and boiler. Equipment failures were frequent due to the cold harsh operating conditions. Finally, on October 25 the melt hole reached the underlying seawater at a depth of 7-m. We then began deploying the mooring as shown in the schematic in Figure 3. A summary log of the mooring deployment is given next.

0130UTC	- begin deployment				
0144	- anchor in water				
0148	- WHADCP #5091 in water (500-m)				
	- Mcat #3406 in water (499-m)				
0203	- AquaDopp #1497 in water (480-m)				
0224	- AquaDopp #1495 in water (400-m)				
0234	- AquaDopp #1487 in water (300-m)				
0247	- AquaDopp #1489 in water (200-m)				
0259	- AquaDopp #0877 in water (100-m)				
0424	- Mcat #2035 in water (26-m)				
0424	- WHADCP #1698 in water (25-m)				
0500	- mooring secure				
	0130UTC 0144 0148 0203 0224 0234 0247 0259 0424 0424 0500				

Mooring Recovery

The mooring was recovered by Sean Whelan (WHOI), David Harwood and Franck Rack (ANDRILL SMO at UNL) on 12/5/06. The upper part of the mooring line was slack and frozen in the surface ice. After remelting the recovery hole the seawater was clear, but when the 25-m ADCP came to the surface the melt hole suddenly filled with platelet ice. Table 1 shows the log of the recovery operations and the time differences of the instruments and UTC after recovery.

ANDRILL 2006 Antartica RECOVERY											
			TIME CHECK				DATA				
					UTC					-	
Instrument	Depth	Out of Water	UTC Time	UTC Date	Internal Time	Internal Date	Delta	Stop Sampling	Records	File	
ADCP 1698	25	12/5/06 8:50	4:43:00	12/07/06	5:43:19	12/07/06	1:00:19	4:44:30	4805695	AND1_000.000	
SBE37 2035	25	12/5/06 8:50	3:41:00	12/07/06	3:40:47	12/07/06	0:00:13	3:44:30	13921		
NORTEK 0877	100	12/5/06 12:26	5:37:37	12/07/06	6:38:08	12/07/06	1:00:31	5:37:30	669102		
NORTEK 1489	200	12/5/06 13:16	7:59:00	12/07/06	8:59:26	12/07/06	1:00:26	5:42:30	638262		
NORTEK 1487	300	12/5/06 14:28	6:28:34	12/07/06	7:29:00	12/07/06	1:00:26	6:28:30	679308		
NORTEK 1495	400	12/5/06 15:01	6:36:34	12/07/06	7:36:57	12/07/06	1:00:23	6:36:30	637968		
NORTEK 1497	480	12/5/06 15:40	6:43:34	12/07/06	7:43:59	12/07/06	1:00:25	6:43:30	654462		
ADCP 5091	500	12/5/06 15:51	4:23:00	12/07/06	5:20:55	12/07/06	0:57:55	4:24:30	4802943	AND2_000.000	
SBE37 3406	500	12/5/06 15:51	3:13:00	12/07/06	4:13:00	10/31/06	888:00:00	3:17:30	13917		
Anchor 280 Lbs	502	12/5/06 16:04									
Ice Thickness Water Depth	Reported Reported	d 7m d 520m									
3/8 Braided Yalex 7/16 Jacketed Wire Rope		6,000 Lbs Break 20,000 Lbs Break		1200 Lbs Safe Working Loa 4lbs/100 Ft .304lbs/Ft		60lbs					
NOTES:											
Start Melting Hole Start Recovery Frazil Ice Encount End Recovery	tered	12/5/06 1:20 12/5/06 8:40 12/5/06 11:00 12/5/06 16:04									

Data Calibration

One hour was subtracted from the time data of all the instruments to correct the time to UTC except for Sea Bird Microcat 2035 that needed no correction. Since the instruments averaged over periods of 5-10 minutes the data was centered over the averaging interval by adding $\frac{1}{2}$ the averaging period to the time word. Magnetic direction recorded by the current meters was corrected to true direction (variation +145° E) by adding 145°.

Total pressure data measured by the Nortek AquaDopps was corrected to water pressure by subtracting the pressure data recorded by the instruments just prior to deployment when the instruments were lying on the ice surface and recorded atmospheric pressure. The pressure corrections to remove predeployment atmospheric pressure were:

- 1. 100m pressure correction -16.2 db; corrected deployed pressure=99db
- 2. 200m pressure correction -24.0 db; corrected deployed pressure=198db
- 3. 300m pressure correction -26.6 db; corrected deployed pressure=300db
- 4. 400m pressure correction -26.3 db; corrected deployed pressure=400db
- 5. 480m pressure correction -30.0 db; corrected deployed pressure=474db

Acknowledgements

This research has been supported by the ANDRILL McMurdo Ice Shelf Project program NSF-OPP 0342484 to David Harwood and Peter Webb, and by the University of Nebraska 395995.05 to Richard Limeburner and Sean Whelan. We would like to thank the entire ANDRILL team for their support and special thanks to Randy Sliester of Raytheon Polar Services for his continuing assistance with the field work. Peter Webb provided an incredible perspective and reference to the historical US and NZ Antarctic Programs and also proved to be the best cook. Finally, the success of the moored program was primarily due to the efforts of David Harwood. David confronted endless organizational demands, paid strong attention to extreme cold weather mooring/camping/logistical details, and took primary responsibility and leadership in melting the 24" diameter x 24' deep hole through the Ross Sea Ice. Thank you David. Your efforts made this project succeed.

Data Plots Nortek 0877 100-m design depth

- 1. Subtracted one hour to correct time to UTC.
- 2. Added 2.5 minutes to center the data during the sampling interval.
- 3. Calculated true north magnetic variation 143° E (05/06), rotate +145 degrees, the magnetic variation east.
- 4. Pressure (db) correction -16.2 db from deployment atmospheric pressure.



Start pressure = 99 db; Mean east = -8.20 cm/sec; Mean north = 3.46 cm/sec

Nortek 1489 200-m design depth

- 1. Subtracted one hour to correct time to UTC.
- 2. Added 2.5 minutes to center the data during the sampling interval.
- 3. Calculated true north magnetic variation 143° E (05/06), rotate +145 degrees magnetic variation east.
- 4. Pressure (db) correction -24.0 db from deployment atmospheric pressure.



Start pressure = 198 db; Mean east = -6.88 cm/sec; Mean north = 2.60 cm/sec

Nortek 1487 300-m design depth

- 1. Subtracted one hour to correct time to UTC.
- 2. Added 2.5 minutes to center the data during the sampling interval.
- 3. Calculated true north magnetic variation 143° E (05/06), rotate +145 degrees magnetic variation east.
- 4. Pressure (db) correction -26.6 db from deployment atmospheric pressure.



Start pressure = 300 db; Mean east = -4.39 cm/sec; Mean north = 0.12 cm/sec

Nortek 1495 400-m design depth

- 1. Subtracted one hour to correct time to UTC.
- 2. Added 2.5 minutes to center the data during the sampling interval.
- 3. Calculated true north magnetic variation 143° E (05/06), rotate +145 degrees magnetic variation east.
- 4. Pressure (db) correction -26.3 db from deployment atmospheric pressure.



Start pressure = 400 db; Mean east = -1.05 cm/sec; Mean north = -3.59 cm/sec

Nortek 1497 480-m design depth

- 1. Subtracted one hour to correct time to UTC.
- 2. Added 2.5 minutes to center the data during the sampling interval.
- 3. Calculated true north magnetic variation 143° E (05/06), rotate +145 degrees magnetic variation east.
- 4. Pressure (db) correction -30.0 db from deployment atmospheric pressure.



Start pressure = 474 db; Mean east = -3.46 cm/sec; Mean north = -5.11 cm/sec









RDI Workhorse ADCP



