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NATURAL ENVIRONMENT RESEARCH COUNCIL

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Cruise Report No. 50

RV *Walton Smith* Cruise WS17305

31 OCT - 10 NOV 2017

Miami - Miami

MerMEED microstructure cruise report

Principal Scientist

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2018

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DOCUMENT DATA SHEET

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ABSTRACT

The MerMEED (Mechanisms responsible for Mesoscale Eddy Energy Dissipation) project is a NERC funded project (NE/N001745/1, 2015–2018) to investigate the levels of dissipation associated with eddies at a western boundary, in order to identify the mechanisms responsible. Mesoscale eddies are ubiquitous in the worlds oceans, and can be found in the subtropical Atlantic travelling slowly westward (at 4–5 cm/s), with a radius of about 100 km. These eddies are formed through baroclinic instability or wind forcing across the Atlantic, but when they reach the western boundary (east coast of the USA), they disappear from the satellite altimetry record. This disappearance of eddies occurs throughout the worlds oceans at western boundaries, but from altimetry alone, it is not known whether they disappear because energy is transferred to other wave modes or the mean flow, or whether it is locally dissipated through eddy-topography interactions.

This is the second cruise of the MerMEED project, with the previous being detailed in [Frajka-Williams, 2017]. The purpose of this cruise was to (1) make microstructure temperature and shear measurements in order to measure dissipation at the intersection of an anticyclonic eddy and the steep topography to the east of Abaco, Bahamas, and (2) deploy standard and microstructure Seagliders. Of these, the standard Seagliders were intended to remain in the area for 4 months. During the 10 day cruise, 112 profiles of microstructure data were collected using a tethered microstructure profiler, and a shipboard 75 kHz ADCP collected concurrent measurements of ocean currents. This cruise is the second of several planned cruises for the MerMEED project, and the data collected are intended to complement additional field operations, including moored instruments added to the RAPID array (thermistors and ADCPs on the WB1 mooring) and a second glider deployment in the spring of 2018.

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1 Scientific and Ship's Personnel

Name	*Institute*
Eleanor Frajka-Williams (PSO)	University of Southampton (UoS)
D. Gwyn Evans	UoS
Alex Forryan	UoS
Rob Hall	UEA
Alberto Naveira Garabato	UoS
Paul Provost	National Marine Facilities Division (NMFD)
William Billy Platt	NMFD
Jeremy Jez Evans	NMFD
Ian Murdoch	NMFD

Table 1: Details of science personnel.

Name	*Position*
Shawn Lake	Master
Stewart Bell	1st mate
Kevin Jones	2nd mate
Michael Shoup	Chief engineer
Carol Mandel	Engineer
Denis Ilias	Marine tech
Randal Hughes	Chef

Table 2: Details of ship's crew.

Scientific watches kept

	0–6	6–12	12–18	18–24
Science	Alex	Gwyn	Alberto	Rob
	Gwyn	Alberto	Rob	Alex
Deck ops	Paul	Paul	Billy	Billy
	Jez	Jez	Ian	Ian

Table 3: A list of scientific watches.

2 *RV Walton Smith*

The *RV Walton Smith* is a UNOLS vessel managed by the University of Miami. It is a catamaran, with 3 main levels (lower level with engines and some cabins, main level with dry lab, wet lab, science cabins, galley and working deck, and 01 deck with bridge and captain's quarters). Due to the catamaran shape, the available working space was spacious for a vessel of its length. The back deck has an A-frame, strongpoints on an imperial grid, and both a moonpool and a notch in the stern (the latter two were not used during this cruise). The 01 deck has the winch cabin for the A-frame and two cranes. Power supply included both UPS (more stable) and non-UPS sockets with 110 V and American plugs. Internet was provided with a reasonable speed, but availability depended on the direction the vessel was facing. As a rule-of-thumb, when the vessel was heading east, internet was available.

Power supply to the VMP winches required a few modifications for compatibility. The ship supplied power at 415 V, 3 phase and 60 Hz. The UK power packs had been set up for 208 V, 3 phase and 50 Hz. We used the WHOI power pack, which was set up to be run at 60 Hz. The ship provided hydraulic power but at variable pressure, which was not suitable for the winches.

Operating characteristics were summarised from the www.rsmas.miami.edu website, see Table 4.

Length	96 feet
Beam	40 feet
Draft	7 feet
Laboratories	680 sq. feet
Cruising speed	10 knots*
Fuel capacity	10,000 gallons
Gross Tonnage	97 GRT
Complement	20 berths (7 crew and 12 scientists)

Table 4: Operating characteristics of the *RV Walton Smith*. *The cruising speed was noted as 10 knots, but we were advised to use 8.5 knots for planning purposes.

Computing

The Lenovo Thinkpad `Pstar01` computer was used to collect and process VMP and XCP data. It dual boots to windows (for XCP) and linux (for VMP) and has a Matlab license for processing. A USB dongle was used to transfer raw data from the collection PC (initially provided by NMFD, but then replaced with a second Thinkpad after computer problems) to the processing PC. Daily backups were made to an external harddrive.

A flatbed scanner was brought on the cruise for scanning of hand-written logsheets. The ship was equipped with a colour laser printer that could be used by the science party.

Underway ship data including the vessel mounted ADCP were provided at the end of cruise on a DVD by the Marine Tech.

3 Itinerary

Depart University of Miami dock (4600 Rickenbacker Causeway), 31^{st} of October 2017, arrive University of Miami, 10^{th} November 2017.

4 Introduction

The MerMEED (Mechanisms responsible for Mesoscale Eddy Energy Dissipation) project is a NERC funded project (NE/N001745/1, 2015–2018) to investigate the levels of dissipation associated with eddies at a western boundary in order to identify the mechanisms responsible. The purpose of this cruise was to make microstructure temperature and shear measurements in order to measure dissipation at the intersection of an anticyclonic eddy and the steep topography to the east of Abaco, Bahamas.

This cruise is the first of several planned cruises for the MerMEED project, and the data collected are intended to complement additional field operations, including moored instruments added to the RAPID array (thermistors and ADCPs on the WB1 mooring) and glider deployments planned for the 2017/18 year. The project website is https://generic.wordpress.soton.ac.uk/mermeed/.

4.1 Scientific background

Mesoscale eddies are ubiquitous in the worlds' oceans, and can be found in the subtropical Atlantic travelling slowly westward (at 4–5 cm/s), with a radius of about 100 km. These eddies are formed through baroclinic instability or wind forcing across the Atlantic, but when they reach the western boundary (east coast of the USA), they disappear from the satellite altimetry record. This disappearance of eddies occurs throughout the worlds' oceans at western boundaries, but from altimetry alone, it is not known whether they disappear because energy is transferred to other wave modes or the mean flow, or whether it is locally dissipated through eddy-topography interactions.

The thesis of Louis Clement investigated the behaviour of mesoscale eddies using the RAPID mooring array at $26.5°$N in the Atlantic, including their influence on the meridional overturning circulation [Clément et al., 2014] and observations of finescale shear variance over topography associated with anticyclones [Clement et al., 2016]. They found that shear variance was elevated in anticyclones (clockwise rotating eddies) compared to cyclones (anti-clockwise), suggesting that dissipation is stronger during anticyclones than cyclones. They additional found that in the anticyclones observed during the 18-month study period that bottom velocities were larger than during cyclones, and that there was a slight predominance of upward propagating internal waves over downward propagating lee waves. These strands of evidence could be explained by two phenomena–lee waves generated by flow over rough topography, or the arrest of southward propagating bowundary waves by the northward flowing waters in an anticycylone [Hogg et al., 2011]. The MerMEED project seeks to determine whether observed dissipation at western boundary topography is a leading order term in the energy balance of mesoscale eddies, and also by what mechanisms the dissipation is occurring.

4.2 Fieldwork plans

The process cruises represent one of three approaches used by MerMEED to make observations of eddies, internal waves and mixing east of Abaco. A total of 4 cruises are planned, to capture the observed levels of dissipation during and near the tail end of both an anticyclone and a cyclone. In addition, underwater gliders will be used for a total of 6 months to map the mesoscale eddy and the evolution of its energy (potential energy, from density profiles, and kinetic energy, from geostrophic velocities derived from density profiles). Finally, additional instruments have been added to the WB1 mooring in the RAPID array in 1400 m of water including two 75 kHz profiling ADCPs (to insonify the full water column at a 1 hour time interval and 16 m vertical bins) and RBR thermistors to increase the vertical resolution of temperature data to 50 m (from the 4 MicroCATS included as part of the RAPID array). These observations will enable a finescale parameterization-based estimate of turbulent dissipation at this location, which can be compared to the shear-based estimates at the WBADCP mooring as used in Clement et al. [2016].

We had additionally planned to use Lockheed Martin Sippican XCPs. However, on inspection, it was discovered that the agar gel in the probes had dried and so it was decided not to use them and to order a gel-replacement kit prior to the next cruise.

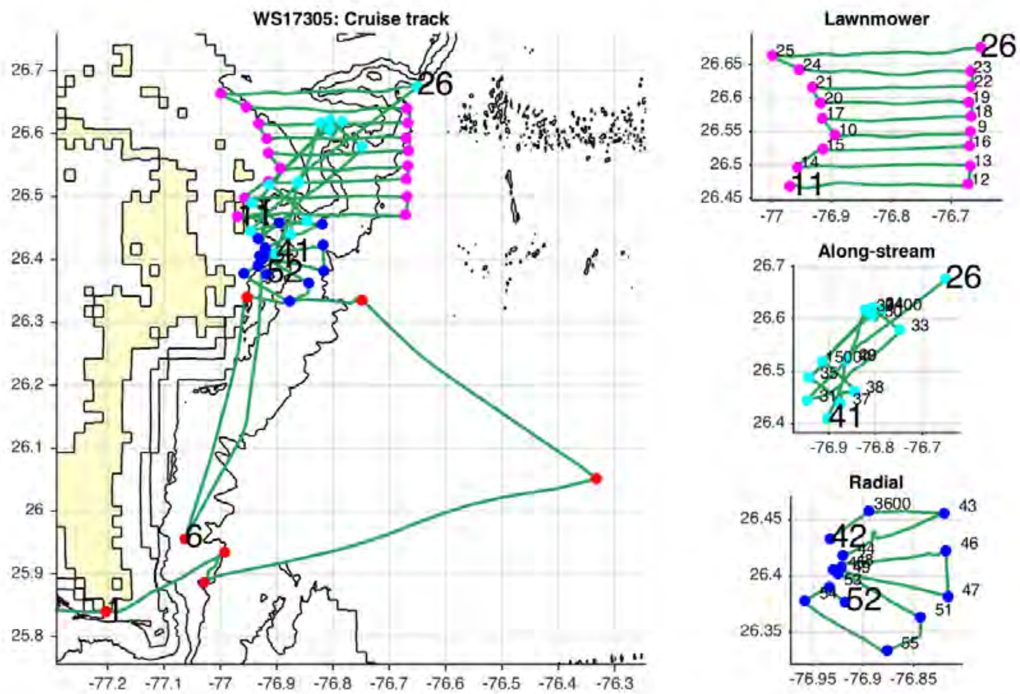

Figure 1: Cruise trackfrom the 75 kHz ADCP data feed. Bathymetry is contoured in 1000 m intervals, and waypoints are marked with filled circles. Insets show more detail in the lawnmower survey, along-stream sections, and the radial survey.

5 Diary of Events

Eleanor Frajka-Williams.

Times are reported in GMT. The cruise track is plotted in Fig. 1, with waypoints given in Table 5. See also the Event Log (§B)

Sunday, October 29 - Travel The NMFD technicians arrived in Miami on Oct 28. Gwyn, Alex, Alberto, Rob and Eleanor arrived on Sunday the 29th.

Monday, October 30 - MOB day 1 Just past 9am, scientists and technicians arrived at University of Miami, 4600 Rickenbacker Causeway. The day was spent moving items which had been shipped from their storage places. The power pack from WHOI was retrieved from shipping and receiving at RSMAS. The Seagliders, originally to be deployed from the Bahamas, were redirected to Miami after failing to receive diplomatic clearance and import/export exceptions for the equipment. As of Monday, they were still in customs in Miami. By the afternoon, they arrived at the vessel and were loaded.

Tuesday, October 31 - MOB day 2 Seagliders (2 from MARS and 1 from UEA) were run through initial self-tests. All tests failed to get iridium connections. One glider was tested on the dockside and still failed. The decision was made to set sail either way. In the early afternoon, we had the safety briefing and joined the ship. By 6pm, all were onboard for an evening departure.

Wednesday, November 1 - Clearing in/out of the Bahamas and transit We arrived at Bimini in the early hours and awaited the immigration office opening for 9am. The captain and tech departed the ship around 12:17gmt for shore. We departed Bimini for Abaco by 14:15. Motion was a bit rocky, and several passengers felt unwell. We paused in deep water enroute to Abaco at 21:02 for a VMP test dip of both the primary and secondary VMP (S1 and S2, respectively) during daylight hours. The dips were completed by 22:09.

Thursday, November 2 - Glider deployments We arrived at WP1 and started with an ADCP survey (07:40) as it was before daylight. At WP2 by 10:19 for glider deployment. The first glider was deployed at 11:42, where we stayed within visual range until it finally dived at 13:10. The vessel was repositioned to the south by 13:22, and sg533 was deployed at 14:11 (dove at 14:20). Repositioning again to the south, we deployed sg642 (the UEA glider) at 14:46 (dived at 14:55). We departed to continue the first ADCP transect at 15:50. The vessel was progressively slowed from 6 kts to 5 kts due to wind and rocky conditions contaminating the ADCP data. The ADCP transect was completed by 18:45. The next ADCP section (to WP4) was carried out through the rest of the day, completing at 04:19.

Friday, November 3 - VMP and ADCP sections, sg641 recovery The first VMP section (S03) began at 04:19 (WP4 to WP5), completing at 13:55. There were a few bad casts to start with, due to problems with the power. During this time, it was determined that sg641 was rebooting during dives, likely due to problems with the integration of the microPod sensors. We returned to WP6 to recover the glider (17:03), then headed back towards WP11 to carry on with the VMP work. VMPs from WP11 to WP12 (S04) from 22:35 to 05:51 on Nov 4.

Saturday, November 4 - VMP and ADCP sections, lawnmower Completed VMP section S04 (WP11 to WP12), then moved to WP14 for ADCP transect to WP15, completed at 10:50. Started VMP section S05 (WP9 to WP10), completed at 21:50. Transited to WP17 for ADCP section to WP18.

Sunday, November 5 - VMP and ADCP sections, lawnmower Completed ADCP section (WP17 to WP18) at 00:44. Started VMP section S06 (WP19 to WP20) at 00:58. Completed at 11:35. ADCP section from WP20 to WP21, completed at 12:02. VMP section S07 (WP23 to WP24) started at 15:07.

Monday, November 6 - northeast to southwest VMP section, glider sounding Completed VMP section S07 (ending at WP24) at 03:59. Started VMP S08 from WP25, completed at 20:20 at WP26. Started ADCP section. Started VMP S09 from WP30 at 22:36.

Tuesday, November 7 - Lost VMP, switch to backup Sounded for glider sg533 at 00:28 gmt. In the early hours (local time, 04:30 gmt) of Tuesday, Nov 7, we lost the primary VMP. We were working on the northeast to southwest VMP section, approximately along flow, across the bump near 26.5°N, when the VMP comms were lost. It was at about 400 m of cable out, and 185 m deep, when the cable suddenly lost tension. Spooling in the wire, the cut looked sharp, without any other marks on the wire above.

Date	Time	WP	Lat [N]	Lon [W]	Date	Time	WP	Lat [N]	Lon [W]
02-Nov-2017	06:28	1	25°50.38′	77°12.19′	07-Nov-2017	05:55	31	26°26.69′	76°56.74′
	10:19	2	25°56.02′	76°59.51′		10:48	33	26°34.78′	76°44.93′
	15:18	0	25°53.15′	77°1.68′		11:16	34	26°37.3′	76°48.3′
	22:40	3	26°3.12′	76°19.92′		14:52	35	26°29.36′	76°56.61′
03-Nov-2017	04:12	4	26°20.08′	76°44.96′		18:43	37	26°26.37′	76°52.49′
	13:12	5	26°20.36′	76°57.12′		20:02	38	26°27.66′	76°50.7′
	16:48	6	25°57.35′	77°3.74′		22:55	1500	26°31.11′	76°54.81′
	22:33	11	26°28.07′	76°58.2′	08-Nov-2017	00:00	50	26°36.36′	76°48.4′
04-Nov-2017	06:57	12	26°28.27′	76°40.31′		03:00	3400	26°37.17′	76°47.04′
	07:19	13	26°29.96′	76°40.09′		05:31	39	26°37.03′	76°49.4′
	10:19	14	26°29.82′	76°57.39′		11:16	40	26°31.32′	76°51.73′
	10:48	15	26°31.41′	76°54.88′		15:28	41	26°24.57′	76°54.11′
	13:19	16	26°31.69′	76°40.18′		15:50	42	26°25.98′	76°55.96′
	13:33	9	26°32.98′	76°40.05′		16:33	3600	26°27.46′	76°53.65′
	21:50	10	26°32.72′	76°53.63′		17:52	43	26°27.33′	76°49.16′
	22:04	17	26°34.18′	76°54.89′		22:55	44	26°25.07′	76°55.2′
05-Nov-2017	00:43	18	26°34.35′	76°39.97′		23:11	48	26°24.47′	76°55.31′
	00:57	19	26°35.62′	76°40.22′	09-Nov-2017	01:04	47	26°22.87′	76°48.96′
	11:42	20	26°35.54′	76°55.05′		01:26	46	26°25.35′	76°49.08′
	11:57	21	26°36.97′	76°55.89′		06:07	45	26°24.34′	76°55.77′
	14:41	22	26°37.03′	76°40.01′		06:14	49	26°24.11′	76°55.49′
	14:55	23	26°38.37′	76°40.07′		11:16	51	26°21.79′	76°50.6′
06-Nov-2017	04:00	24	26°38.56′	76°57.2′		11:42	55	26°20.02′	76°52.6′
	04:36	25	26°39.79′	76°59.91′		15:00	54	26°22.69′	76°57.47′
	20:12	26	26°40.51′	76°39.05′		15:14	53	26°23.4′	76°56.01′
07-Nov-2017	01:19	29	26°31.4′	76°51.67′		15:53	52	26°22.6′	76°55.08′

Table 5: Date and time (gmt) that waypoints were achieved, and the actual lat/lon of the ship at that waypoint. Waypoints 1–6 were the initial survey & glider deployments/recovery. Waypoints 11–26 were the lawnmower pattern over the bathymetry around the RAPID moorings. Waypoints 29–41 included both along-stream, cross isobath sections and sections across the 'whirlpool' and around the southern topography (at 26.4°N). Waypoints 42–52 were the radial sections around the southern topography.

Continued with an ADCP survey from WP31 to WP36, completing at 06:00. Carried out a test of the second VMP (S10) at 06:55 to 08:50. Then transited to WP33. More intensive sounding for the glider from 15:00, using 2 frequencies (13 kHz and 11.5 kHz) at 3 locations (the location it was lost, 26°29.076'N, 76°56.326′W, and at 26°29.232′N, 76°56.558′W). Completed at 15:37, turning the ADCP back on. Transited WP35 to 37 to 38 to 15, arriving at 23:01. Transited to 34, arriving at midnight gmt.

Wednesday, November 8 - VMP survey in a radial pattern around the southern topography At 00:00, carried out VMP S11 at WP50, near sg534. At 01:41, sg534 called in. Carried out two more VMP casts at 03:00 (WP39, near 26°37.20′N, 76°47.05′W). Steamed to WP39 at 05:15. Started VMP section S12 at 05:48 (WP39). End VMP at WP40 at 09:35. Continued with ADCP WP40 to 41. Replaced planned VMP section with another ADCP section 42 to 43, then from 18:00, VMP S13 from WP43 to 44. The secondary winch drum was noted to be buckling under the tension (around 20:32) so at the completion of the cast, the VMP was recovered and the section was completed as an ADCP section (from 22:08). VMP modifications then took place, swapping secondary fish to primary winch, due to damage to the secondary winch.

Thursday, November 9 - End VMP survey Carried out VMP section (S14) from WP46 to WP45 (completed 06:05), then transited to WP49 for the next VMP section (S15). Ended at 11:38 at WP51. Transited to WP55 for VMP section (S16) to WP54. Completed section around 15:00. Science completed at 16:05 gmt after checking a short additional radial section for interesting velocity structure. We finished work around 11:05 local in the morning, and headed back to RSMAS. The crossing was relatively calm.

Friday, November 10 We arrived at RSMAS shortly after lunch. It was discovered that British folks would still need to travel downtown to complete immigration, but RSMAS did not have vehicles available. We rented a minivan from Hertz on Key Biscayne, and went through immigration. In the meantime, the vessel was unloaded and items sorted for outbound shipment.

Saturday, November 11 Depart Miami for London.

6 Sea level anomaly and satellite geostrophic velocities

Eleanor Frajka-Williams.

Gridded maps of sea level anomaly and geostrophic velocity were used target eddies approaching the MerMEED study region. Near-real time maps for mean sea-level anomaly (MSLA) and geostrophic velocity anomalies (UV) were accessed via CMEMS - Copernicus Marine Environment Monitoring Service using data from `Core/SEALEVEL_GLO_PHY_L4_NRT_OBSERVATIONS_008_046/dataset-duacs-nrt-global-merged-allsat-phy-l4-v3/nrt_global_allsat_phy_l4_20171105_20171105.nc.gz` on a regular basis in the months leading up to WS17305. This analysis identified an anticyclonic mesoscale eddy (positive MSLA; Figure 2) at the study region, and extending east of the region. According to the lifespan of previous eddies, should remain for 2–3 months [Clement et al., 2016]. What we observed was that from altimetry, the eddy deformed, possibly split, and left a smaller anticyclone in the region during the time of the cruise. The SLA at the start of WS17305 shows a lower amplitude anticyclonic anomaly east of the Bahamas (Figure 2). This anticyclone was not as large in magnitude as the one 2 months prior, nor as the one observed during WS16336. Nevertheless, velocities were strongly northward in the *in situ* observations, with larger magnitudes that what might be expected based on these satellite maps. ADCP transects and VMP stations were again planned along the shelf.

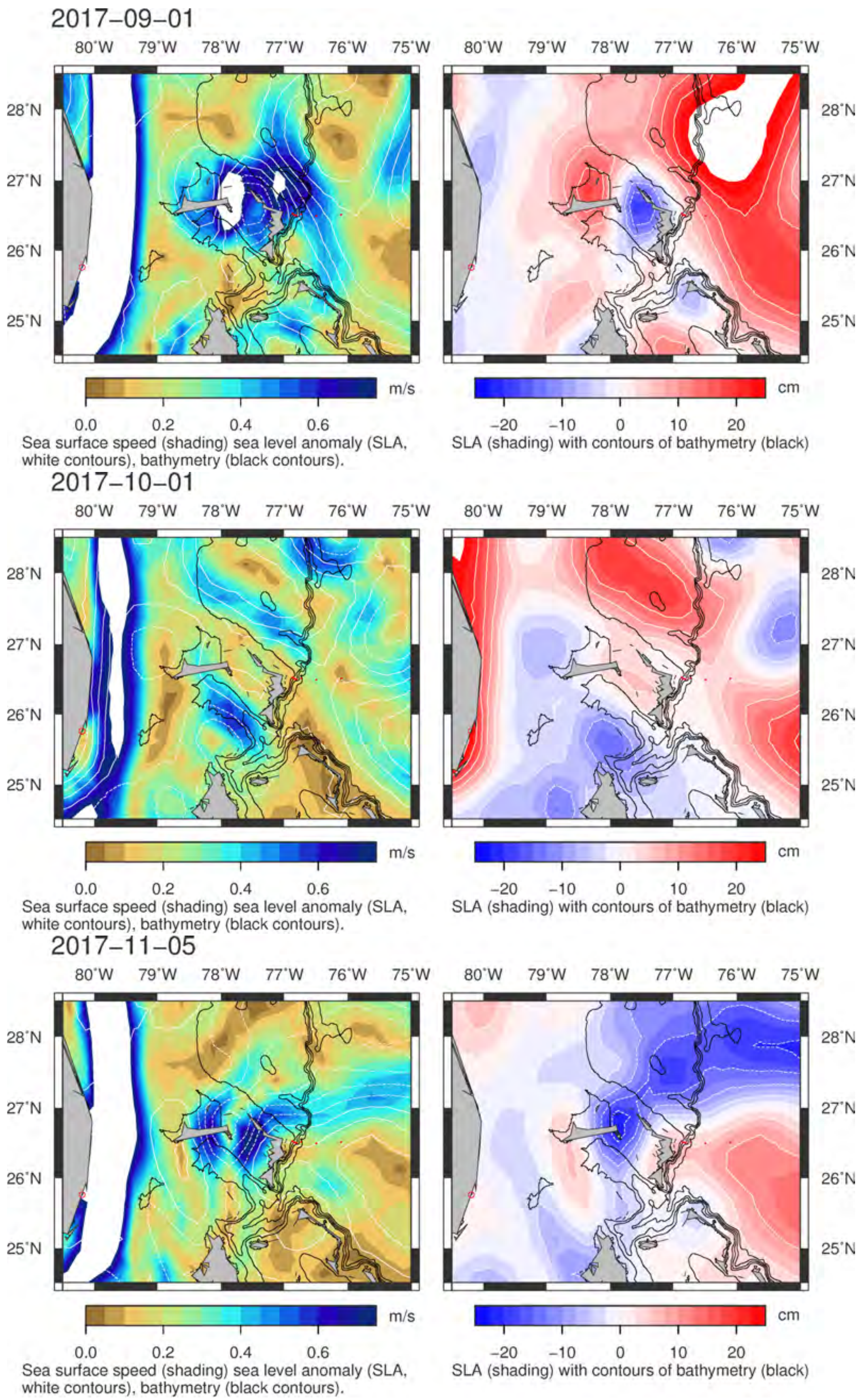

Figure 2: MSLA and UV from satellite altimetry.

7 VMP-2000 (Vertical Microstructure Profiler)

D. Gwyn Evans.

7.1 Overview

The tethered VMP-2000 vertical microstructure profiler manufactured by Rockland Scientific International (RSI) was used as the primary instrument on the WS17305 cruise. This instrument measures profiles of temperature and velocity microstructure on length scales of typically a few millimetres to tens of centimetres. From these profiles the rates of dissipaion of turbulent kinetic energy (ϵ) and temperature variance (χ) are estimated using a methodology based on Oakey [1982]; and finescale temperature, salinity and pressure with a pumped Seabird CTD mounted on the side of the instrument. The central goal of the cruise was to investigate the levels and processes involved in dissipating the anticyclone present during the cruise.

Instrument/sensor	Serial number	Notes
VMP	085	stations 1 and 3–9
T1	1166	
T1	1173	stations 4 through 9
T2	1167	
sh1	M400	
sh2	M987	
Pressure		
SBE temp	SN 5776	calibration 12 Sep 2017
SBE cond	SN 4169	calibration 22 Dec 2016
VMP	023	stations 2 and 10–16
T1	1168	
T2	1167	
sh1	M1039	
sh2	M1042	
Pressure		
SBE temp	SN 4869	calibration 12 Sep 2017
SBE cond	SN 4169	calibration 13 Oct 2016

Table 6: Serial numbers for the VMPs and sensors. See also the configuration files in §A.1–A.3.

A total of 112 microstructure profiles were collected during the WS17305 cruise (Fig. 3), between 01-Nov 21:09 and 09-Dec 12:00. During the cruise we utilised two VMP-2000s, SN085 (primary fish) and SN023 (secondary fish), each with a dedicated wire, hydraulic winch and line puller. The systems shared a power pack, loaned from Kurt Polzin (WHOI), that operated at the frequency of the *RV Walton Smith* ship power (60 Hz). The ship undertook a series of alongshore and offshore survey lines along the slope off of Grand Abaco, Bahamas. These sections alternated between VMP/ADCP transects and ADCP only transects. Two VMP/ADCP sections were cut short, sections 9 and 13. During cast 7 of section 9, SN085 was lost, the wire severed while the fish was at a pressure of approximately 185 dbar at an estimated location of 76.9159°W and 26.4734°N. Following section 9, SN023 was used for the duration of the cruise. During cast 3 of section 13, with full wire out, Billy and Paul noticed that the winch used for SN023 had begun to collapse. The section was completed as an ADCP only section while the fish was transferred onto the winch and line puller originally used for SN085.

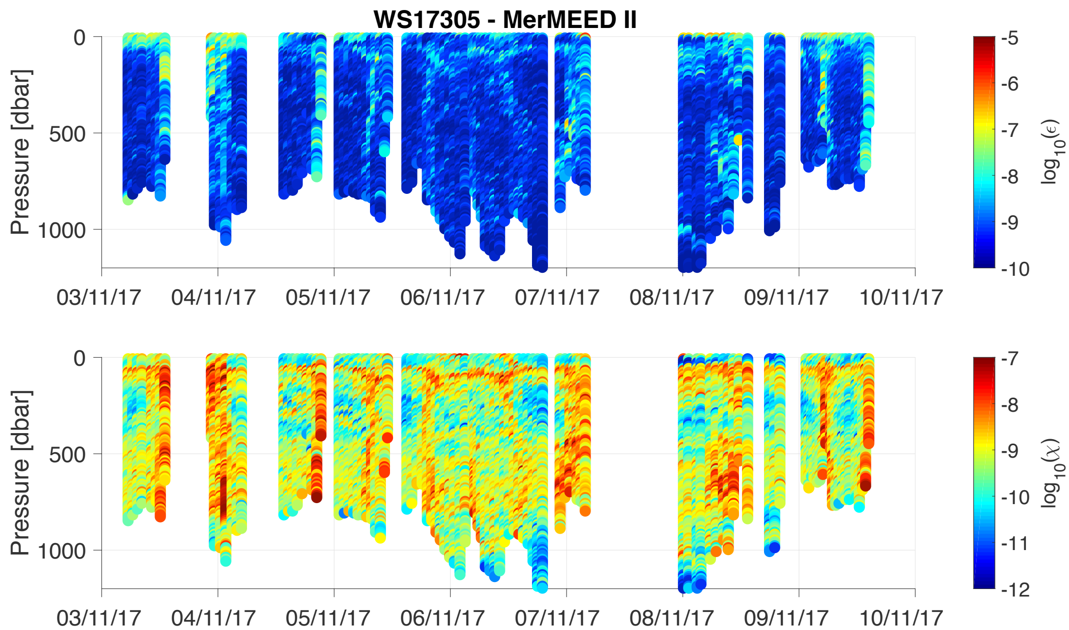

Figure 3: Profiles of turbulent dissipation (ϵ,top panel) and temperature variance (χ, bottom panel) collected during cruise WS17305.

The VMP and ADCP sections were chosen to resolve the processes responsible for the regions of high mixing near topography identified during WS16336. The VMP transects focused on the region between ~26.4°N and ~26.7°N. VMP sections 4 to 8 were completed across an escarpment at 26.5°N and into deeper water to the north. These parallel, 30km zonal sections were separated by between 2.5 and 7.5 km staying clear of the WBADCP and WB1 RAPID moorings. These moorings are instrumented with 75 kHz ADCPs, with the WB1 mooring additionally having 50 m spacing of thermistor/microCATs to resolve temporal variations in the vertical profile of temperature. VMP sections 8 and 12 were completed along-flow, running north-east to south-west, across the escarpment and into a cyclonic vortex created by steering of the flow by the shallow bathymetry of the escarpment. VMP profiles at station 11 were made for comparison with mixing estimates to be determined from Seaglider sg534. Finally, VMP sections 3 and 13-16 focused on a section of slope at ~26.4°N that ran parallel to the flow. These sections ran perpendicular to the slope.

7.2 VMP-2000 deployment, recovery and winch operation

The VMPs were stored on deck on stands, and strapped down with a ratchet strap. The slack wire was wound on the winch to remove the hazard of loose wire on the deck. For deployment, the VMP was attached to the winch on the A-frame to lift it over the back deck. Two people steadied the VMP while it was being raised to protect the delicate sensors. Once it was over the back, the wire was taken in on the VMP winch and the strop attaching the VMP to the A-frame was removed. The profiler was then lowered into the water and held at the surface until given the go-ahead by the person operating the recording computer. Once that message was received, the operator veered the winch and adjusted the speed of the winch and line puller to pay out wire at a sufficient rate so that the VMP was free falling (about 0.66 dbar/s for SN085 and 0.80 dbar/s for SN023). At a predetermined depth, judged based on previous casts and the surface currents/ship speed, the winch was halted and the VMP left to profile until the maximum pressure was achieved. In particularly strong currents, this was almost immediate. The time and position and maximum pressure were recorded, and then the winch hauled the profiler back to the surface. For the continuous sections (profiled in a to-yo manner), the profiler remained at the surface until the next cast was started. When recovering the profiler, the VMP winch was used to haul the profiler out of water where it could then be attached to the A-frame winch. The VMP winch then paid out, and the A-frame winch hauled in to transfer the weight to the A-frame. Two people steadied the VMP as it came back on board, and was again lowered into the stands and strapped down until the next station.

Figure 4: Back deck of the *RV Walton Smith* showing VMP winch/line puller setup.

7.3 Data acquisition and processing

Data acquisition and processing processing took place on two separate laptops. A Windows based laptop was used to run the ODAS-RT acquisition software supplied by RSI. With the VMP powered up, when opened ODAS-RT loads an existing configuration (.cfg) file, which unless the sensor configuration has changed, can be copied and renamed from the previous section/station. Once loaded, the configuration file should be edited within ODAS-RT to update the section/station number. The calibration routine should then be run, which is in the 'Calibrate' tab. Once successfully completed, the instrument can be connected from within the 'Real Time' tab ready for recording. Aboard the *RV Walton Smith*, particular care had to be taken to avoid tripping the circuit breakers in the wall mounted power sockets while using the handheld UK VHF radios. All processing scripts used on this cruise were adaptations of those used in previous VMP cruises by the UoS group. All processing steps and calculations remain the same as those described in previous cruise reports [Garabato, 2009, Meredith and Cunningham, 2011, Watson, 2011, Sallee, 2013], with the most recent cruise being the March 2017 DynOPO cruise. A summary of the processing steps is given in table 7.

7.4 Station/section description

See the summary table (Table 8) for an overview of section locations relative to the waypoints in Fig. 1. See the detailed tables for information on each cast (Table 9–13) which are transcribed from the logsheets (§C).

Section 1 (1 cast) A test dip of SN023 on day 2, in an deeper region during our passage South of Grand Abaco Bahamas. The cast was in 300 m of water and reached a maximum pressure of 150 dbar. The

Function	*Description*
`vmp_firstlook4`	Reads in the VMP datafile and produces two matlab files, one containing the raw un-calibraded VMP data, and the other containing the extracted downcast data with all calibrations supplied in the `setup.cfg` file applied (`_cdc.mat`). Also produces a series of diagnostic plots for the raw un-calibrated VMP data.
`vmp_process_seabird4`	Processes the VMP seabird data and applies various corrections. Output is saved as a separate matlab file (`_dCTD.mat` and `_uCTD.mat` for the down- and upcasts, respectively).
`vmp_process_micro4`	Processes the VMP microstructure shear and temperature. Microstructure temperature are calibrated by regressing against the processed VMP seabird temperature. Output is saved as a separate matlab file (`_micro.mat`).

Table 7: Processing steps used for the VMP-2000 on cruise WS17305.

real time output of Seabird conductivity suggest either an issue with the sensor or a problem with the calibration information. It was later realised that the issue was due to the calibrations being applied to the incorrect portion of the sensor matrix in the config file.

Section 2 (1 cast) A test dip of SN085 on day 2, in the same region as section 2. A new section number was used so that the correct configuration file could be reloaded. The cast was in 300 m of water and reached a maximum pressure of 190 dbar when the cast was aborted because the VHF radio tripped the circuit breaker in the socket. Once recovered, the processed data was suitable except for the Seabird conductivity which gave values of salinity that were too low. The Seabird sensors had recently been calibrated at the NOC, but the provided calibration coefficients appeared to be an order of magnitude too low. The coefficients were swapped with a slightly older Seabird calibration, which gave acceptable values for salinity.

Section 3 (8/11 successful casts, 1,2 and 7) Zonal section running east to west along 26.2°N. Started in water deeper than 4000 m and moved to the shelf and a minimum depth of 923 m. The first cast was aborted when communication was lost to the VMP when the VHF radio tripped the circuit breaker. The cast 2 was aborted when it became apparent that the operator had double clicked 'Start Recording' / 'Stop Recording' at the beginning of the cast. The same problem occurred on cast 7. For the remaining casts the we made sure that the curser was moved clear of the stop/start button. Along this section, northeastward flow driven by the anticyclonic eddy is intensified at approximately 200 m. There was a notable reversal of this flow adjacent to the coast, generating positive potential vorticity (PV). There was also weaker northward flow in a layer at 100m, below the seasonal pycnocline. The strongest dissipation occurred through the whole water column adjacent to the shelf.

Section 4 (7/7 successful casts) A section running west to east on the southern side of the escarpment at 26.5°N. The section started in 425 m an reached a maximum depth of 3072 m at the eastern extent of the line. No cast 4 because the stop/start button was double clicked at the end of cast 5. The western most part of the section had very high levels of dissipation, related to a reversal of the flow. Following further ADCP and VMP transects in this region, it became clear that the shallow bathymetry was steering the flow, creating an cyclonic vortex. Throughout the rest of the section, mixing was relatively low except for a region of elevated dissipation in the region of strongest shear within the

Section	Cast	Time	Waypoint	Section	Cast	Time	Waypoint
S03	3	03-Nov-2017 05:34	4	S10	3	07-Nov-2017 07:22	31
	11	03-Nov-2017 13:45	5		3	07-Nov-2017 08:32	31
S04	1	03-Nov-2017 22:46	11	S11	1	08-Nov-2017 00:15	50
	8	04-Nov-2017 05:51	12		4	08-Nov-2017 05:00	39
S05	1	04-Nov-2017 13:44	9	S12	1	08-Nov-2017 05:49	39
	9	04-Nov-2017 21:43	10		8	08-Nov-2017 14:28	41
S06	1	05-Nov-2017 01:09	19	S13	1	08-Nov-2017 18:02	43
	12	05-Nov-2017 11:29	20		3	08-Nov-2017 21:39	44
S07	1	05-Nov-2017 15:08	23	S14	1	09-Nov-2017 01:34	46
	16	06-Nov-2017 03:58	24		8	09-Nov-2017 05:59	45
S08	1	06-Nov-2017 04:46	25	S15	1	09-Nov-2017 06:37	49
	17	06-Nov-2017 20:08	26		7	09-Nov-2017 11:05	51
S09	1	06-Nov-2017 22:47	30	S16	1	09-Nov-2017 11:53	55
	7	07-Nov-2017 04:30	31		5	09-Nov-2017 14:54	54

Table 8: Overview of VMP sections/stations and corresponding waypoints. Sections/station 1 and 3–9 were with the primary VMP. Sections/stations 2 and 10–16 were with the secondary VMP. Times were extracted from the datafiles. Two lines for each section/station represent the start and end time/cast/waypoint.

meridional flow. Still apparent was a layer of weaker meridional velocities at 100 m below the seasonal pycnocline.

Section 5 (9/9 successful casts) A section running east to west on the northern side of the escarpment at 26.5°N with the deepest cast performed in 4303 m depth and the shallowest in 425 m. All casts performed well, the only reported issue was a bad, presumably low fall rate on cast 6. Again, northeastward flow was intensified at approximately 200 m and a reversal of flow adjacent to the shelf, with a region of strong shear and positive PV. The highest dissipation was observed adjacent to the shelf.

Section 6 (12/12 successful casts) A section running along ∼26.6°N from offshore to onshore. One reported bad buffer in cast 10. Similar jet like structure to the previous sections with reversal adjacent to the shelf, and a stagnant layer near 100 m. The shear between these layers appear correspond to peaks in dissipation.

Section 7 (13/13 successful casts) A section running from east to west, from deep to shallow. The flow through this section was again characterised by the subsurface intensification of the northeastward flow at 200 m, which folds over a region of reversal adjacent to the shelf, generating positive PV. The dissipation profiles were highest in the region of strongest shear between the north and south flow.

Section 8 (17/17 successful casts) A section that ran from west to east, from shallow to deep, to the north of the escarpment at 26.5°N. The flow through this section was very similar to the previous section, except flow was possibly less intense. There were some relatively small peaks of dissipation in regions of higher vertical shear.

Section 9 (6/7 successful casts) A section that ran north-east to south-west over the escarpment. The VMP section was cut short when the VMP was lost, the line severed on recovery 500 m from the VMP (Fig. 5) when it was at a pressure of approximately 185 dbar. No explanation for what severed the line. Very interesting section science-wise. Again, the northeastward flow was intensified in the surface 200 m. There was clear steering of the flow before the escarpment and very high dissipation after the escarpment, suggestive of some mechanism of hydraulic control on the flow over the bump.

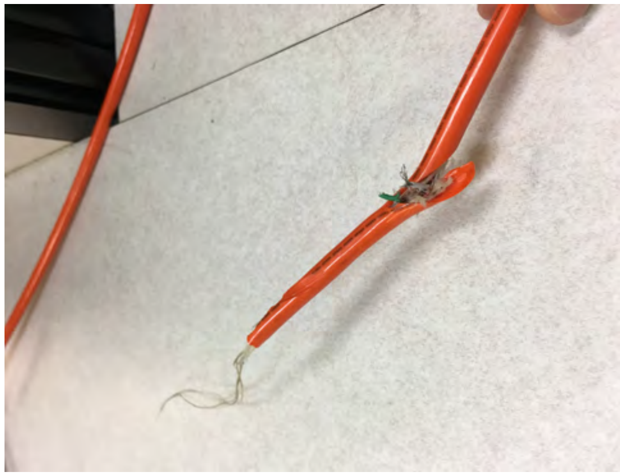

Figure 5: Photo of the end of the VMP cable.

Section 10 (1/1 successful casts) This was the first full cast with SN023, after the loss of SN085. Initially there was an issue with the cable puller so the cast had to be restarted from 50 m. While veering the winch, it became apparent the lay of the cable was very uneven as it had originally been hand wound and was affecting the fall rate. We therefore decided to pay out the wire fully so it did not affect future profiles. The fall rate of the profiler was notably higher, $\sim$0.8 dbar/s as opposed to 0.6 dbar/s.

Section 11 (4/4 successful casts) For this station we rendezvoused with Seaglider sg534 for a comparison with dissipation estimates to be made with the glider. The VMP appeared to be falling too fast for the VMP winch, so that frequently the winch would slow the VMP fall rate. Extra floatation was added before cast 3 to very little effect.

Section 12 (7/8 successful casts) This section followed a similar line to section 9, but to the east. The structure of the flow and dissipation was similar to section 9, but we appeared to be too far east (by a matter of kilometres) to observe the recirculation evident at the southern end of section 9. Prior to this cast the VMP handles were removed to reduce weight, and extra buoyancy was added (Fig. 6). It was also noticed that the lower pulley wheel on the line puller was seized, and once released, the winch was better able to keep up with the VMP. On cast 6 the VMP hit the seabed at a depth 150 m shallower that the depth estimated from the swath bathymetry. The section was continued to the end (cast 8). We were unable process cast 7 as the '.p' file header appeared to either missing or corrupted. The sensors appeared to give sensible values for cast 8. On recovery it was noted that there was a small amount of mud on the primary shear sensor (M1039), but the other sensors appeared to be ok.

Section 13 (3/3 successful casts) This section ran from east to west in a region near section 3 near a small bump in the topography, but was cut short when it was noted that the drum on the winch had begun to collapse due to the pressure exerted by the cable. It was decided to abandon further VMPs on this section and switch the profiler onto the winch and line puller that was used for SN085.

Section 14 (7/7 successful casts) This section ran east to west towards a small bump in the topography, near 26.4°N. This section was characterised by the same subsurface intensified flow at approximately 200 m, a thin layer of southward flow at 100 m and very high dissipation adjacent to the shelf. The primary shear sensor regularly produced some questionable peaks but seemed to improve toward the end of the section, so was not changed, relying on the secondary sensor.

Figure 6: Seaglider buoyancy was taped onto the secondary VMP to compensate for a too-fast fall rate.

Section 15 (7/7 successful casts) This section was in a similar location to section 14, but a 1/2 kilometers upstream of the flow. The section ran from west to east, and was stopped before we got the final waypoint as time was short and the dissipation profiles had become less interesting. The properties of the flow were very similar to those described in section 14. In section 15 however, dissipation was clearly elevated adjacent to the slope and slightly offshore of the slope in deeper water.

Section 16 (5/5 successful casts) The final VMP section of the cruise ran from east to west, offshore to onshore, slightly to the south of the section 14 and 15. Again the northeastward flow was intensified at 200 m. Unlike sections 14 and 15, the was a reversal in the flow adjacent to the shelf that seemed to drive high dissipation in the same region. During recovery it appear that VMP scraped the seabed which shallower quicker than expected. There was some scuffing on one of the bumpers and the guard was slightly bent.

Stn	Cast	Lat	Lon	Date/time	Depth	Max Pres	W/O	Operator	Notes
1	1	26°51.69′	78°25.48′	01-Nov 21:09	300 m	XXX dbar	XXXX m	DGE/AF	Test station SN023. SBE C not reading aborted at surface
2	1	26°51.69′	78°25.48′	01-Nov 21:45	300 m	190 dbar	XXXX m	DGE/AF	Test station SN085. Aborted 190 m, socket tripped
3	1	26°20.08′	76°44.96′	03-Nov 04:20	4362 m	XXX dbar	XXXX m	DGE/AF	Aborted comms failure
	2	26°20.16′	76°45.56′	03-Nov 04:42	4246 m	XXX dbar	XXXX m	DGE/AF	Aborted. Double clicked start/stop
	3	26°19.77′	76°46.07′	03-Nov 05:35	4107 m	851 dbar	1800 m	DGE/AF	1 of 2 thermistors looks dodgy
	4	26°20.00′	76°47.61′	03-Nov 06:31	3990 m	818 dbar	1800 m	DGE/AF	
	5	26°20.09′	76°49.20′	03-Nov 07:29	3943 m	791 dbar	1800 m	DGE/AF	
	6	26°20.14′	76°50.72′	03-Nov 08:26	3691 m	710 dbar	1800 m	DGE/AF	
	7	26°20.11′	76°52.39′	03-Nov 09:26	3476 m	726 dbar	1800 m	DGE/AF	No data recorded - user error at star, only spotted at the end
	8	26°19.80′	76°53.31′	03-Nov 10:26	3358 m	780 dbar	1800 m	DGE/AF	
	9	26°20.06′	76°54.62′	03-Nov 11:22	2844 m	751 dbar	1800 m	DGE/AF	
	10	26°20.28′	76°55.89′	03-Nov 12:13	1741 m	828 dbar	1800 m	DGE/AF	
	11	26°20.41′	76°57.04′	03-Nov 13:10	923 m	638 dbar	1600 m	DGE/AF	Double clicked start/stop at the beginning of cast. Renamed final file to continue numbering
4	1	26°28.14′	76°58.29′	03-Nov 22:46	425 m	425 dbar	840 m		
	2	26°27.97′	76°56.84′	03-Nov 23:23	1708 m	985 dbar	1800 m		
	4	26°28.12′	76°55.05′	04-Nov 00:38	2369 m	992 dbar	1800 m		Double clicked on start therefore no cast 3
	5	26°28.40′	76°53.28′	04-Nov 01:44	2547 m	992 1061	1800 m		
	6	26°28.30′	76°51.25′	04-Nov 03:03	2573 m	893 1061	1800 m		T2 suspect lower down
	7	26°28.22′	76°49.56′	04-Nov 04:03	2634 m	902 1061	1800 m		Bad buffer a 400 m
	8	26°28.20′	76°47.95′	04-Nov 04:58	3072 m	888 1061	1800 m		End of section

Table 9: Detailed information about each cast, section 1–4. Transcripted from §C VMP Logsheets.

Stn	Cast	Lat	Lon	Date/time	Depth	Max Pres	W/O	Operator	Notes
5	1	26°32.91′	76°40.28′	04-Nov 13:41	4303 m	817 dbar	1800 m	DGE/ACNG	
	2	26°32.76′	76°41.56′	04-Nov 14:40	3882 m	803 dbar	1800 m	DGE/ACNG	
	3	26°32.75′	76°42.82′	04-Nov 15:33	3814 m	803 dbar	1800 m	DGE/ACNG	
	4	26°32.75′	76°44.20′	04-Nov 16:29	3785 m	767 dbar	1800 m	DGE/ACNG	
	5	26°32.64′	76°45.76′	04-Nov 17:30	XXXX m	710 dbar	1800 m	ACNG	
	6	26°32.52′	76°47.57′	04-Nov 18:30	3247 m	649 dbar	1800 m	ACNG	Sketchy fall rate
	7	26°32.59′	76°49.46′	04-Nov 19:30	1544 m	693 dbar	1800 m	ACNG/RH	
	8	26°32.66′	76°51.48′	04-Nov 20:32	781 m	727 dbar	1800 m	RH	ADCP suggests depth around 700 m
	9	26°32.59′	76°52.75′	04-Nov 21:24	425 m	406 dbar	720 m	RH	Double clicked on start/stop at start, file renamed to keep file sequence
6	1	26°35.62′	76°40.38′	05-Nov 01:11	3801 m	814 dbar	1800 m	AF	
	2	26°35.71′	76°42.24′	05-Nov 02:12	3092 m	808 dbar	1800 m	AF	
	3	26°35.68′	76°43.56′	05-Nov 03:09	2238 m	802 dbar	1800 m	AF	
	4	26°35.56′	76°44.88′	05-Nov 04:09	3030 m	813 dbar	1800 m	AF/DGE	
	5	26°35.49′	76°46.05′	05-Nov 05:03	3004 m	818 dbar	1800 m	AF/DGE	
	6	26°35.47′	76°47.35′	05-Nov 06:01	1606 m	818 dbar	1800 m	AF/DGE	
	7	26°35.51′	76°48.45′	05-Nov 06:50	1643 m	833 dbar	1800 m	AF/DGE	
	8	26°35.58′	76°49.80′	05-Nov 07:50	1689 m	830 dbar	1800 m	AF/DGE	
	9	26°35.61′	76°50.87′	05-Nov 08:40	1503 m	908 dbar	1800 m	AF/DGE	
	10	26°35.62′	76°52.14′	05-Nov 09:32	1278 m	944 dbar	1800 m	AF/DGE	
	11	26°35.61′	76°53.27′	05-Nov 10:30	708 m	601 dbar	1300 m	AF/DGE	
	12	26°35.56′	76°54.17′	05-Nov 11:08	460 m	420 dbar	802 m	EFW/DGE	
7	1	26°38.36′	76°40.28′	05-Nov 15:07	3989 m	790 dbar	1800 m	ACNG/DGE	
	2	26°38.48′	76°41.75′	05-Nov 16:07	3049 m	750 dbar	1800 m	ACNG/DGE	
	3	26°38.41′	76°43.49′	05-Nov 17:14	1744 m	703 dbar	1800 m	ACNG/RH	
	4	26°38.17′	76°45.44′	05-Nov 18:18	1578 m	688 dbar	1800 m	ACNG/RH	Start/stopped double clicked a few times at the surface, so casts 6 and 7 were skipped
	5	26°38.07′	76°46.91′	05-Nov 19:22	1590 m	840 dbar	1800 m	ACNG	
	8	26°38.09′	76°47.87′	05-Nov 20:17	1802 m	847 dbar	1800 m	ACNG	

Table 10: Detailed information about each cast, section 5–7. Transcripted from §C VMP Logsheets.

Stn	Cast	Lat	Lon	Date/time	Depth	Max Pres	W/O	Operator	Notes
7	9	26°38.14′	76°48.87′	05-Nov 21:08	1659 m	XXX dbar	1800 m	ACNG	
	10	26°38.28′	76°49.98′	05-Nov 22:03	1600 m	954 dbar	1800 m	ACNG/AF	
	11	26°38.41′	76°51.19′	05-Nov 22:58	1439 m	996 dbar	1800 m	ACNG/AF	
	13	26°38.45′	76°52.42′	05-Nov 23:59	1275 m	1040 dbar	1800 m	AF	
	14	26°38.37′	76°53.56′	06-Nov 00:56	1293 m	1019 dbar	1800 m	AF	
	15	26°38.38′	76°54.92′	06-Nov 02:06	1223 m	1127 dbar	1800 m	AF	
	16	26°38.47′	76°56.14′	06-Nov 03:10	1112 m	961 dbar	1503 m	AF	
8	1	26°39.82′	76°59.81′	06-Nov 04:47	573 m	423 dbar	612 m	AF	
	2	26°39.82′	76°59.35′	06-Nov 05:10	817 m	810 dbar	1241 m	DGE/AF	
	3	26°39.78′	76°58.76′	06-Nov 05:49	963 m	881 dbar	1267 m	DGE/AF	
	3	26°39.78′	76°58.76′	06-Nov 05:49	963 m	881 dbar	1267 m	DGE/AF	
	4	26°39.72′	76°58.09′	06-Nov 06:31	999 m	945 dbar	1373 m	DGE/AF	
	5	26°39.77′	76°57.30′	06-Nov 07:21	1157 m	1087 dbar	1583 m	DGE/AF	
	6	26°39.82′	76°56.39′	06-Nov 08:17	1257 m	1111 dbar	1674 m	DGE/AF	
	7	26°39.91′	76°55.35′	06-Nov 09:16	1395 m	1139 dbar	1800 m	DGE/AF	
	8	26°39.92′	76°54.21′	06-Nov 10:17	1550 m	1110 dbar	1800 m	DGE/AF	
	9	26°39.82′	76°52.89′	06-Nov 11:18	1826 m	1095 dbar	1800 m	DGE	
	10	26°39.93′	76°51.48′	06-Nov 12:15	1959 m	924 dbar	1800 m	ACNG	
	11	26°40.01′	76°49.90′	06-Nov 13:17	2597 m	895 dbar	1800 m	DGE/ACNG	
	12	26°40.05′	76°48.36′	06-Nov 14:15	3092 m	918 dbar	1800 m	DGE/ACNG	
	13	26°40.13′	76°46.73′	06-Nov 15:12	3153 m	939 dbar	1800 m	DGE/ACNG	
	14	26°40.07′	76°45.10′	06-Nov 16:10	2683 m	968 dbar	1800 m	DGE/ACNG	Spike on upcast at 800m
	15	26°40.01′	76°43.44′	06-Nov 17:12	3427 m	1067 dbar	1800 m	RH/ACNG	
	16	26°40.16′	76°41.95′	06-Nov 18:08	3878 m	1191 dbar	1800 m	RH/ACNG	
	17	26°40.44′	76°40.53′	06-Nov 19:07	4123 m	1213 dbar	1800 m	RH	
9	1	26°33.40′	76°49.35′	06-Nov 22:48	2084 m	888 dbar	1800 m	RH	
	2	26°32.86′	76°50.28′	06-Nov 23:46	1274 m	724 dbar	1800 m	AF	
	3	26°31.92′	76°51.21′	07-Nov 00:48	798 m	696 dbar	1700 m	AF	
	4	26°31.09′	76°51.95′	07-Nov 01:38	574 m	518 dbar	1238 m	AF	
	5	26°30.45′	76°52.53′	07-Nov 02:17	1010 m	743 dbar	1800 m	AF	
	6	26°29.72′	76°53.30′	07-Nov 03:05	1375 m	750 dbar	1800 m	AF	
	7	26°28.90′	76°54.34′	07-Nov 03:58	1964 m	805 dbar	1800 m	AF	Profiler lost at 185 dbar on recovery. Wire cut at 500 m from fish

Table 11: Detailed information about each cast, section 8–9. Transcripted from §C VMP Logsheets.

Stn	Cast	Lat	Lon	Date/time	Depth	Max Pres	W/O	Operator	Notes
10	3	26°28.65′	76°52.27′	07-Nov 07:22	2806 m	1165 dbar	1800 m	DGE/AF	Restarted cast from surface after getting to 50 m due to an issue with the cable puller. Spooled out all the cable as the lay was uneven and affecting fall rate.
11	1	26°36.39′	76°48.34′	08-Nov 00:15	1570 m	1470 dbar	max	AF	Fall rate high ~0.8 dbar/s
	2	26°33.09′	76°48.11′	08-Nov 01:20	1588 m	1472 dbar	max	AF	T1 looks spiky - spectra noisy and fall rate still high
	3	26°37.15′	76°47.03′	08-Nov 03:05	1737 m	1200 dbar	max	AF	Added extra flotation (glider flotation)
	4	26°37.06′	76°46.93′	08-Nov 03:53	1789 m	1175 dbar	max	AF	Fall rate still high >0.8
12	1	26°36.72′	76°49.49′	08-Nov 05:48	1525 m	1053 dbar	max	AF/DGE	Love handles removed
	2	26°35.42′	76°49.94′	08-Nov 07:00	1647 m	1007 dbar	max	AF/DGE	Love handles removed
	3	26°33.99′	76°50.36′	08-Nov 08:30	1498 m	1047 dbar	max	AF/DGE	2 bad buffers
	4	26°33.07′	76°50.75′	08-Nov 09:31	1207 m	1006 dbar	max	AF/DGE	
	5	26°32.09′	76°51.28′	08-Nov 10:34	931 m	823 dbar	max	AF/DGE	
	6	26°30.79′	76°51.92′	08-Nov 11:45	682 m	532 dbar	max	AF/DGE	Hit seabed, decided to continue with next profile and asses if sensors were still functioning
	7	26°29.95′	76°52.05′	08-Nov 12:27	1322 m	860 dbar	max	AF/DGE	Header in .p file corrupted, could not process
	8	26°28.69′	76°52.26′	08-Nov 13:30	2806 m	841 dbar	max	ACNG/DGE	File processed normally, data looks reasonable. Mud on sh1 (M1039) others were ok
13	1	26°27.26′	76°49.32′	08-Nov 18:03	3148 m	1007 dbar	max	ACNG/RH	
	2	26°26.80′	76°50.59′	08-Nov 19:05	3533 m	988 dbar	max	ACNG/RH	
	3	26°26.33′	76°51.90′	08-Nov 20:10	3444 m	985 dbar	max	ACNG/RH	While hauling the wonch drum began to collapse due to the pressure exerted by cable, cut section early to switch to the other winch

Table 12: Detailed information about each cast, section 10–13. Transcripted from §C VMP Logsheets.

Stn	Cast	Lat	Lon	Date/time	Depth	Max Pres	W/O	Operator	Notes
14	1	26°25.32′	76°49.22′	09-Nov 01:34	3091 m	641 dbar	max	ACNG/RH	Swapped winches, short cable ~1000 m only
	2	26°25.15′	76°49.86′	09-Nov 02:09	3889 m	681 dbar	max	ACNG/RH	Shear 1 a bit iffy
	3	26°25.07′	76°50.59′	09-Nov 02:42	3604 m	616 dbar	max	AF	
	4	26°24.97′	76°51.29′	09-Nov 03:11	3432 m	624 dbar	max	AF	Shear 1 a bit iffy
	5	26°24.87′	76°52.29′	09-Nov 03:53	2779 m	655 dbar	max	AF	Shear 2 iffy, shear 1 ok
	6	26°24.79′	76°53.10′	09-Nov 04:28	2093 m	640 dbar	max	AF	
	7	26°24.75′	76°53.98′	09-Nov 05:03	1422 m	608 dbar	max	DGE/AF	Shear 1 iffy, shear 2 ok
	8	26°24.67′	76°54.98′	09-Nov 05:38	861 m	455 dbar		DGE/AF	
15	1	26°23.94′	76°55.08′	09-Nov 06:37	585 m	485 dbar		DGE/AF	
	2	26°23.86′	76°54.65′	09-Nov 07:02	1121 m	771 dbar	max	DGE/AF	
	3	26°23.56′	76°54.09′	09-Nov 07:43	1528 m	772 dbar	max	DGE/AF	Shear 1 dodgy again
	4	26°23.28′	76°53.56′	09-Nov 08:23	2076 m	767 dbar	max	DGE/AF	Shear 1 dodgy
	5	26°22.95′	76°52.88′	09-Nov 09:05	2763 m	725 dbar	max	DGE/AF	Both shear sensors OK
	6	26°22.58′	76°52.23′	09-Nov 09:44	3214 m	725 dbar	max	DGE/AF	Both shear sensors OK
	7	26°22.16′	76°51.39′	09-Nov 10:31	3619 m	725 dbar	max	DGE/AF	Boring cast finished section early to save time
16	1	26°20.13′	76°53.12′	09-Nov 11:53	3350 m	731 dbar	max	DGE/ACNG	
	2	26°20.63′	76°53.97′	09-Nov 12:34	3093 m	774 dbar	max	DGE/ACNG	
	3	26°21.07′	76°54.88′	09-Nov 13:14	2590 m	695 dbar	max	DGE/ACNG	
	4	26°21.54′	76°55.79′	09-Nov 13:52	2007 m	666 dbar	max	DGE/ACNG	
	5	26°22.10′	76°56.81′	09-Nov 14:31	1032 m	449 dbar	1062	DGE/ACNG	Stopped early because of shoaling water depth, suspect VMP scraped seabed on recovery

Table 13: Detailed information about each cast, section 14–16. Transcripted from §C VMP Logsheets.

8 Seagliders

Rob Hall.

Three iRobot/Kongsberg Seagliders where deployed during the cruise. Two were standard physics and biogeochemistry Seagliders from the NOC-MARS fleet. The third, from UEA, had a larger 'ogive' fairing and was equipped with a microstructure sensor system to measure microstructure shear and temperature, complimentary to the VMP-2000 dataset. Details of the sensor suite and variables measured by each glider are shown in Table 14.

	SG533	*SG534*	*SG641*
Manufacturer	iRobot	iRobot	Kongsberg
Owner	NOC-MARS	NOC-MARS	UEA
Fairing	Standard	Standard	Ogive
Sensors	Seabird CT sail Aanderaa dissolved oxygen optode WETLabs Eco Puck optical sensor	Seabird CT sail Aanderaa dissolved oxygen optode WETLabs Eco Puck optical sensor	Seabird CT sail
Loggers	-	-	Rockland Scientific MicroPODS - microstructure shear and temperature
Directly measured variables	Temperature Salinity Pressure Dissolved oxygen concentration Chlorophyll-a fluorescence Optical scatter for CDOM and 700 nm	Temperature Salinity Pressure Dissolved oxygen concentration Chlorophyll-a fluorescence Optical scatter for CDOM and 700 nm	Temperature Salinity Pressure Turbulent kinetic energy dissipation rate
Inferred variables	Dive-average horizontal current velocity Vertical current velocity	Dive-average horizontal current velocity Vertical current velocity	Dive-average horizontal current velocity Vertical current velocity

Table 14: Seaglider sensor configurations and measured variables.

8.1 Setup and selftests

'Selftests' were run on all three gliders from the upper deck of the ship during mobilisation. These diagnostic tests confirm the functioning of the glider's mechanical, sensor, GPS, and satellite communication systems. All three tested normally with the exception of Iridium communications; no connections to the glider 'basestations' (servers at NOC and UEA) were established until the cruise was underway. The exact cause of these communication problems is unknown but it was likely to be a combination of server upgrades and local satellite blackspots. Once underway all three gliders connected to their respective basestations and successfully uploaded the selftest data files. During selftests and satellite communication tests, the gliders were secured in their cradles at a 60 angle against the starboard gunnel (Figure 7).

Figure 7: Two of the three Seagliders during selftests.

A break in the antenna cable sheath of SG533 was discovered during its selftest (Fig. 8). Although it did not adversely affect GPS or satellite communication on deck, the break would allow seawater to ingress and likely cause both inaccurate GPS positions and limited or failed communications. A replacement antenna of the same length was fitted and care was taken over the antenna-to-pressure case connection: the O-ring in the antenna cable plug was lightly greased before fitting and the plug lightly torqued with a mole grip as per the instructions.

All three gliders had an auxiliary Argos tag, manufactured by Wildlife Acoustics, fitted to their antenna. These tags are completely separate to the gliders' GPS and satellite communication systems and are a failsafe in the event of glider failure. If a glider is at the surface for a prolonged period, the tag transmits its position through Argos satellite telemetry system approximately every 15 minutes. All three tags were turned on during mobilisation and accurate positions logged during transit.

8.2 Deployment

All three Seagliders were deployed on 2 November 2017. Deployment took place from the aft deck using the ship's A-frame. A deployment sling was used to avoid antenna damage and each glider was float tested before release. Deployment time and location for each glider is shown in Table 15. The two delicate microstructure probes on SG641 were not obviously damaged during the deployment procedure.

8.3 MARS gliders: SG533 and SG534

The mission plan for the NOC-MARS Seagliders, SG533 and SG534, was to map the fine-scale hydrography of the region for a 4-month period during and after the cruise. Contact was lost with SG533 on 6 November 2017, four days into the mission. Its last known location was 26°29.2′N, 76°56.6′W. The cause for the loss off communication is unknown. The glider was sounded for using a Benthos acoustic transponder on 7 November 2017. Multiple soundings were made using the correct interrogation frequency (13 kHz;

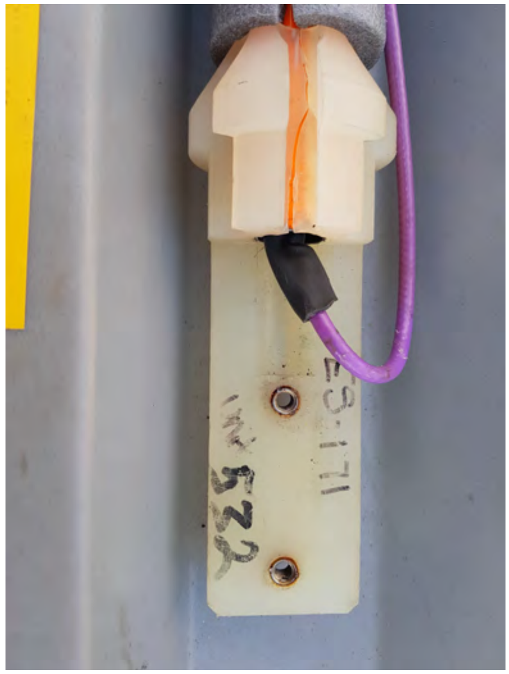

Figure 8: Broken antenna cable sheath on SG533.

	SG533	SG534	SG641
Deployment time	2 November 2017 14:10 GMT	2 November 2017 11:40 GMT	2 November 2017 14:45 GMT
Deployment location	25°54.34′N 77°1.1′W	25°55.76′N 76°59.7′W	25°53.49′N 77°1.6′W
Recovery time	-	-	3 November 2017 17:05 GMT
Recovery location			26°13.2′N 77°28.0′W

Table 15: Seaglider deployment and recover times and locations

confirmed with MARS) at and around the gliders last known location. No returns on the reply frequency (11.5 kHz) were received. SG534 successfully operated for the duration of the cruise.

8.4 UEA glider: SG641

The mission plan for the UEA Seaglider, SG641, was to make two along-current surveys of the experiment site measuring microstructure shear and temperature over a wide area. Predicted current speeds were faster than the glider is capable of travelling so the glider was to be recovered part way though cruise and re-deployed upstream. Unfortunately, the glider encountered technical difficulties during the first day of the mission, rebooting at depth four times during the first ten dives. The reboots appeared to be linked to the microstructure sensor system because when this system was switch off the reboots stopped occurring. As microstructure data collection was the primary objective of the mission an emergency recovery was scheduled. The glider completed a further ten shallow (<200 m) dives without rebooting while the ship transited to its location.

Figure 9: Paths of the NOC-MARS Seagliders (SG533: blue, SG534: purple).

Recovery took place along the starboard side of the ship using the starboard crane. A recovery loop was used to loop a rope around the glider's fairing, beneath the rudder. Although the glider sat unusually low in the water, recovery was straight forwards and the microstructure probes were not obviously damaged during the procedure. The recovery time and location for is shown in Table 15. After recovery, microstructure data was recovered form the microstructure data logger for the first five complete dives (1–4 and 6) and the descending profile of dive 7. Microstructure 'snippet' files were only successfully transmitted to the basestation for dives 1–3 and the ascending profile of dive 6.

8.5 Recommendations

The *RV Walton Smith* is a good vessel for the deployment and recovery of Seagliders. The twin-hull catamaran design means there is no hull beneath the centre of the A-frame and so glider deployments from the A-frame are relatively safe. The captain and crew are experienced in glider deployments and recoveries. There is plenty of space on the upper deck for storage of glider crates and a clear view of the sky for GPS and satellite communication tests. Unfortunately, the ship's satellite internet connection is slow and intermittent (directionally dependent) so should not be relied upon for glider piloting. A backup piloting team on land is highly recommended. As with all glider deployments, a suitable selection of spares (antenna, wings, rudder, screws, ballasting kit, etc.) and multiple deployment slings/recovery loops should be taken aboard.

Figure 10: Path of the UEA Seaglider (SG641).

9 Vessel Mounted ADCP

Eleanor Frajka-Williams.

The *RV Walton Smith* has two Acoustic Doppler Current Profilers (ADCP) installed; an RDI 600 kHz Workhorse (WH600) and an RDI 75 kHz Ocean Surveyor (OS75). The BB600 has a typical range of 10–20m in the best of conditions and was logged but not used. The OS75 can reach to 750 m in good weather in its deep-profiling ("narrowband") mode. The configuration of each instrument is given below.

ADCP was configured and run through the University of Hawaii Data Acquisition System (UHDAS), a suite of programs for ADCP data acquisition and automated processing. ADCP data was available to download in 5 minute averages in netcdf format during the cruise from an onboard webserver (`http://10.106.30.66`) accessible on the *RV Walton Smith* wireless network. The data were reprocessed in 1 minute averages by Alex Forryan following the cruise.

As for the previous cruise (WS16336 in Dec 2016), the default configuration (switching between narrowband and broadband) for the 75 kHz ADCP was switched to be narrowband (deeper reaching) only. During the WS17305 cruise, we made several ADCP transects in an ADCP-VMP lawnmower/radiator pattern east of Abaco. During initial transects, we tried experimenting with vessel speed, but found that a maximum of 5 kts resulted in reasonable data quality (no gaps) in the 5-minute averages. During more intensive transects, we reduced vessel speed to 3.5 kts (6.5 kph) resulting in an along-track resolution of about 540 m for the 5-minute averages. During VMP sections the speed was 1–2 kts (1.85–3.7 kph) resulting in an along-track resolution of 150–310 m.

trajectory	
uship	Ship meridional velocity
u	Meridional water velocity
vship	Ship zonal velocity
v	Zonal water velocity
tr_temp	ADCP transducer temperature.
pg	percentage good pings
pflag	Editing flags
lon	Longitude (degrees E)
lat	Latitude (degrees N)
heading	Ship heading
depth	Depth (m)
amp	Received signal strength

Table 16: Fields in the processed ADCP netcdf file.

ADCP transects are shown in Fig. 11.

Instrument Configuration

OS150 The instrument was configured to run in narrowband mode with 60 x 16 m bins and no bottom track. See Table 17 for command settings.

WH600 The instrument was configured to run in broadband mode with 40 x 2 m bins and no bottom track. See Table 17 for command settings.

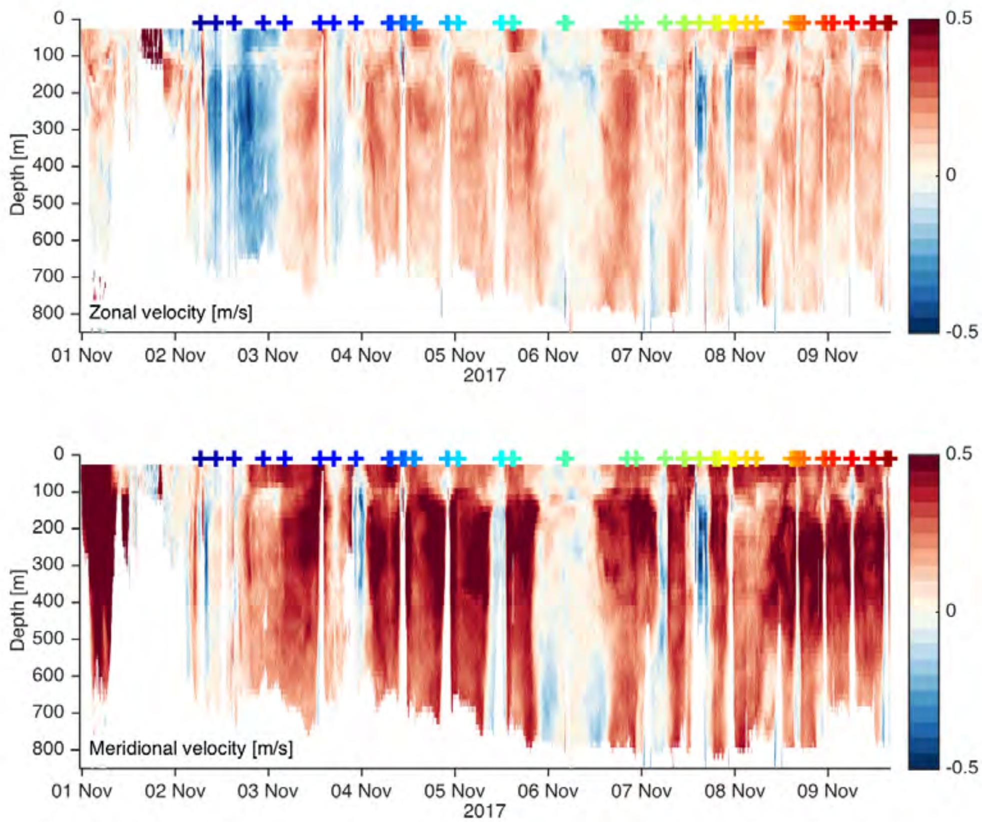

Figure 11: ADCP data (a) zonal velocities and (b) meridional velocities. Coloured + symbols indicate the waypoints.

OS75 RDI	*WH600 RDI*
NP1	WP1
NN60	WN40
NS1600	WS200
NF800	WF300
WP0	BP0
WN80	BX2000
WS800	WB0
WF800	WV550
BP0	TP00:00.80
BX1000	
TP00:01.80	
CX0,0	

Table 17: (left) OS75 RDI command settings used on cruise WS17305. (right) WH600 RDI command settings used on cruise WS17305.

10 Acknowledgements

We would like to thank the officers and crew of the *RV Walton Smith* for their expert and cheerful work in safely operating during VMP operations, and the Marine Operations department at University of Miami for their efficiency and enthusiasm in cruise preparations. The NMFD technicians were efficient, energetic, and expert in their operation of the VMP probes and winches, directly leading to the successful recovery of a high quality dataset.

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A. M. Hogg, W. K. Dewar, P. Berloff, and M. L. Ward. Kelvin wave hydraulic control induced by interactions between vortices and topography. *Journal of Fluid Mechanics*, 687:194–208, 2011. doi: 10,1017/jfm.2011.344.

A VMP config file

A.1 Serial number 085, station 2–3

```
; VMP-2000 setup file for MerMeed part two 01-November-2017
; Not original instrument calibrations
; Calibration Certificate 12-09-2017
rate=512
prefix=WS17305_S03_
disk=
recsize=1
man_com_rate=4
profile=vertical
no-fast=6
no-slow=2

; fast channels 512/s
; slow channels 64/s
[matrix]
num_rows=8
row01= 255 0 1 2 5 7 8 9
row02= 32 40 1 2 5 7 8 9
row03= 41 42 1 2 5 7 8 9
row04= 4 6 1 2 5 7 8 9
row05= 10 11 1 2 5 7 8 9
row06= 12 0 1 2 5 7 8 9
row07= 16 17 1 2 5 7 8 9
row08= 18 19 1 2 5 7 8 9

[identification]
instrument=VMP-2000
sn=085
operator=BP/PP

[channel]
id=0
type=gnd
name=Gnd
coef0=0

[channel]
id=1
type=accel
name=Ax
coef0=0
coef1=1
display=false
```

```
[channel]
id=2
type=accel
name=Ay
coef0=0
coef1=1
display=false

[channel]
id=4
type=therm
name=T1
adc_fs=4.096
adc_bits=16
a=-13
b=0.99882
G=6
E_B=0.68209
SN=T1166
beta=3143.55
T_0=289.301
units=[C]

[channel]
id=5
type=therm
name=T1_dT1
adc_fs=4.096
adc_bits=16
a=-13
b=0.99882
G=6
E_B=0.68209
beta=3143.55
T_0=289.301
diff_gain=0.93
display=false

[channel]
id=6
type=therm
name=T2
SN=T1167
adc_fs=4.096
adc_bits=16
a=-15
b=0.99831
G=6
```

```
E_B=0.68201
beta=3143.55
T_0=289.301
units=[C]

[channel]
id=7
type=therm
name=T2_dT2
adc_fs=4.096
adc_bits=16
a=-15
b=0.99831
G=6
E_B=0.68201
beta=3143.55
T_0=289.301
diff_gain=0.94
display=false

[channel]
id=8
type=shear
name=sh1
diff_gain=0.96
SN=M400
sens=0.0663
adc_fs=4.096
adc_bits=16
display=false

[channel]
id=9
type=shear
name=sh2
diff_gain=0.96
SN=M987
sens=0.0737
adc_fs=4.096
adc_bits=16
display=false

; pressure
; calibration 14-06-2013
[channel]
id=10
type=poly
name=P
```

```
coef0=7.28
coef1=0.12671
coef2=5.114e-8
units=[dBar]

; differentiated pressure
; calibration 14-06-2013
[channel]
id=11
type=poly
name=P_dP
coef0=7.05
coef1=0.12668
coef2=5.214e-8
diff_gain=20.17
display=false

[channel]
id=12
type=poly
name=PV
coef0=4.094
coef1=1.25e-4
units=[V]

; SBE temperature SN 5776
; calibration 12-9-2017
[channel]
id_even=16
id_odd=17
name=SBT1
type=sbt
coef0=4.38569557e-3
coef1=6.37279584e-4
coef2=2.02308458e-5
coef3=1.31235297e-6
coef4=1000
coef5=24e6
coef6=128
SN=5776
date=2017-09-12
units=[C]

; SBE cond SN 4169
; calibration 22-December-2016
[channel]
id_even=18
id_odd=19
```

```
name=SBC1
type=sbc
coef0=-9.86465696e0
coef1=0
coef2=1.39899978e0
coef3=-4.56383990e-004
coef4=9.35304743e-005
coef5=24e6
coef6=128
SN=4169
date=
units=[mS/cm]

[channel]
id=32
type=voltage
name=V_Bat
G=0.1
adc_fs=4.096
adc_bits=16
units=[V]

[channel]
id=40
type=inclxy
name=Incl_Y
coef0=0
coef1=0.025
units=[o]

[channel]
id=41
type=inclxy
name=Incl_X
coef0=0
coef1=0.025
units=[o]

[channel]
id=42
type=inclt
name=Incl_T
coef0=624
coef1=-0.47
units=[C]
```

A.2 Serial number 085, station 4–9

```
; VMP-2000 setup file for MerMeed part two 01-November-2017
; Not original instrument calibrations
; Calibration Certificate 12-09-2017
rate=512
prefix=WS17305_S05_
disk=
recsize=1
man_com_rate=4
profile=vertical
no-fast=6
no-slow=2

; fast channels 512/s
; slow channels 64/s
[matrix]
num_rows=8
row01= 255 0 1 2 5 7 8 9
row02= 32 40 1 2 5 7 8 9
row03= 41 42 1 2 5 7 8 9
row04= 4 6 1 2 5 7 8 9
row05= 10 11 1 2 5 7 8 9
row06= 12 0 1 2 5 7 8 9
row07= 16 17 1 2 5 7 8 9
row08= 18 19 1 2 5 7 8 9

[identification]
instrument=VMP-2000
sn=085
operator=BP/PP

[channel]
id=0
type=gnd
name=Gnd
coef0=0

[channel]
id=1
type=accel
name=Ax
coef0=0
coef1=1
display=false

[channel]
id=2
```

```
type=accel
name=Ay
coef0=0
coef1=1
display=false

[channel]
id=4
type=therm
name=T1
adc_fs=4.096
adc_bits=16
a=-13
b=0.99882
G=6
E_B=0.68209
SN=T1173
beta=3143.55
T_0=289.301
units=[C]

[channel]
id=5
type=therm
name=T1_dT1
adc_fs=4.096
adc_bits=16
a=-13
b=0.99882
G=6
E_B=0.68209
beta=3143.55
T_0=289.301
diff_gain=0.93
display=false

[channel]
id=6
type=therm
name=T2
SN=T1167
adc_fs=4.096
adc_bits=16
a=-15
b=0.99831
G=6
E_B=0.68201
beta=3143.55
```

```
T_0=289.301
units=[C]

[channel]
id=7
type=therm
name=T2_dT2
adc_fs=4.096
adc_bits=16
a=-15
b=0.99831
G=6
E_B=0.68201
beta=3143.55
T_0=289.301
diff_gain=0.94
display=false

[channel]
id=8
type=shear
name=sh1
diff_gain=0.96
SN=M400
sens=0.0663
adc_fs=4.096
adc_bits=16
display=false

[channel]
id=9
type=shear
name=sh2
diff_gain=0.96
SN=M987
sens=0.0737
adc_fs=4.096
adc_bits=16
display=false

; pressure
; calibration 14-06-2013
[channel]
id=10
type=poly
name=P
coef0=7.28
coef1=0.12671
```

```
coef2=5.114e-8
units=[dBar]

; differentiated pressure
; calibration 14-06-2013
[channel]
id=11
type=poly
name=P_dP
coef0=7.05
coef1=0.12668
coef2=5.214e-8
diff_gain=20.17
display=false

[channel]
id=12
type=poly
name=PV
coef0=4.094
coef1=1.25e-4
units=[V]

; SBE temperature SN 5776
; calibration 12-9-2017
[channel]
id_even=16
id_odd=17
name=SBT1
type=sbt
coef0=4.38569557e-3
coef1=6.37279584e-4
coef2=2.02308458e-5
coef3=1.31235297e-6
coef4=1000
coef5=24e6
coef6=128
SN=5776
date=2017-09-12
units=[C]

; SBE cond SN 4169
; calibration 22-December-2016
[channel]
id_even=18
id_odd=19
name=SBC1
type=sbc
```

```
coef0=-9.86465696e0
coef1=0
coef2=1.39899978e0
coef3=-4.56383990e-004
coef4=9.35304743e-005
coef5=24e6
coef6=128
SN=4169
date=
units=[mS/cm]

[channel]
id=32
type=voltage
name=V_Bat
G=0.1
adc_fs=4.096
adc_bits=16
units=[V]

[channel]
id=40
type=inclxy
name=Incl_Y
coef0=0
coef1=0.025
units=[o]

[channel]
id=41
type=inclxy
name=Incl_X
coef0=0
coef1=0.025
units=[o]

[channel]
id=42
type=inclt
name=Incl_T
coef0=624
coef1=-0.47
units=[C]
```

A.3 Serial number 023, station 10–16

```
; Standard configuration setup.cfg file for a downward profiling VMP.
```

```
; Change the vehicle type in the [instrument_info] section to rvmp for an
; uprising profiler.
; Created by RSI, 2015-12-17
; Modified by Dave Cronkrite, 2016-09-19,new setupfile for NOC
;
; Any line that starts with a semicolon, ";", is a comment and is ignored by
; software. Likewise, everything to the right of a semicolon is ignored.
; Use this feature to leave notes and to indicate that you have made changes
; to this file. Indicate the date (YYYY-MM-DD), your name and a brief
; description of your changes.

; The first section is the [root] section. It determines the data
; acquisition parameters. It does not need to be declared explicitly.

rate        = 512            ; the sampling rate of "fast" channels
prefix      = WS17305_S13_   ; the base name of your data files. A 3-digit file num
  ; appended to this base name. The limit is 8 characters
                             ; total for internally recording instruments.
disk        =                ; the directory for the data files. It must exist. The
  ; should be /data for internally recording instruments. For
  ; real-time instruments it is best to leave this blank, so
  ; that it defaults to the local directory.
recsize     = 1      ; the size of a record in seconds
man_com_rate= 4      ; the communication rate for real-time VMPs. This value must
                     ; match the jumper settings of the RSTRANS in your VMP.
                     ; It is not needed for internally recording instruments.
no-fast     = 8      ; number of fast "columns" in the address matrix (see below).
no-slow     = 2      ; number of slow "columns" in the address matrix.

; -----------------
; This section presents the address [matrix] of your instrument and
; automaticaly ends the [root] section above. The first columns are "slow"
; channels as defined by the "no-slow" parameter in the [root] section.
; The remiander are "fast" columns ("no-fast").
[matrix]
num_rows=8
row01   = 255 0 1 2 3 5 7 8 9 12
row02   = 4 6 1 2 3 5 7 8 9 12
row03   = 10 11 1 2 3 5 7 8 9 12
row04   = 14 15 1 2 3 5 7 8 9 12
row05   = 0 0 1 2 3 5 7 8 9 12
row06   = 0 0 1 2 3 5 7 8 9 12
row07   = 16 17 1 2 3 5 7 8 9 12
row08   = 18 19 1 2 3 5 7 8 9 12
; --------------------
;This section identifies your instrument. Only the vehicle is important.
[instrument_info]
vehicle = vmp-2000 ; downward profiling. Use either vmp or rvmp but not both.
```

```
;vehicle= rvmp     ; upward profiling
model   = vmp-2000 ; The actual model. Used for trouble shooting.
sn      = 023      ; The serial numnber of the instrument. For trouble shooting

; --------------------
; The next section is optional and can be expanded. Do not use the parameter "id =
[cruise_info]
operator    = BP/PP
project     = MerMeed part 2
ship        = RV W/S
leg         =

; --------------------
; Next come the [channel] sections. These are used to convert your data
;  into physical units, and to save them into a mat-file.
;  They also determine the name given to various signals
;  in your data file. Please, stick to the convention of
;  RSI because data visualization using the RSI Matlab Library of functions
;  assumes particular names. However, data will be converted into physical
;  units regardless of the name of the channels. If you change the names,
;  then data visualization and further processing is your responsibility.
;  A list of typical channel addresses (id) and their names and functions
;  is at the end of this file.

; Each channel section consists of a part that is unique to your instrument.
;  It does not need to be changed. The second part is dependent on your
;  sensors (shear probes, FP07 thermistors, etc.) and must be updated
;  whenever you change a probe.
;
; The record average value is display for some channels with a real-time
;  instrument. Display can be forced or suppressed using
;  display = true, or display = false. Internally recording instruments
;  have no display. The units used for display can be specified with
;  units = [unit_symbols]. Keep it short for best display.

; The ground reference channel.
[channel]
; instrument dependent parameters
id      = 0   ; the channel address, 0 to 254.  Listed in the [matrix] section.
name    = Gnd ; the name it will have in the mat-file.
type    = gnd ; the algorithm used to convert raw data into physical units.
;coef0   = 0   ; the coefficients required for conversion. None in this case.

; --------------
; The piezo-vibration sensors
[channel]
; instrument dependent parameters
id      = 1
```

```
name    = Ax
type    = accel
coef0   = 3150
coef1   = 15653
display = true ; Pertinent only to real-time telemetering VMPs.

[channel]
; instrument dependent parameters
id      = 2
name    = Ay
type    = accel
coef0   = 4045
coef1   = 18533
display = true

[channel]
; instrument dependent parameters
id      = 3
name    = Az
type    = accel
coef0   = 2423.5
coef1   = 19154
display = false

; -----------------
; The thermistor channels
; without pre-emphasis
[channel]
; instrument dependent parameters
id          = 4
name        = T1
type        = therm
adc_fs      = 5.000
adc_bits    = 16
a           = -35
b           = 0.99879
G           = 11
E_B         = 0.68209
; sensor dependent parameters
SN          = T1168
beta      = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
cal_date    =
units       = [C]

; with pre-emphasis
[channel]
```

```
; instrument dependent parameter
id          = 5
name        = T1_dT1
type        = therm
adc_fs      = 5.000
adc_bits    = 16
a           = -35
b           = 0.99879
G           = 11
E_B         = 0.68209
beta      = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
diff_gain   = 0.995
display=false

; without pre-emphasis
[channel]
; instrument dependent parameters
id          = 6
name        = T2
type        = therm
adc_fs      = 5.000
adc_bits    = 16
a           =-15
b           = 0.99885
G           = 11
E_B         = 0.68201
; sensor dependent parameters
SN          = T1167
beta      = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
cal_date    =
units       = [C]

; with pre-emphasis
[channel]
; instrument dependent parameters
id          = 7
name        = T2_dT2
type        = therm
adc_fs      = 5.000
adc_bits    = 16
a           =-15
b           = 0.99885
G           = 11
E_B         = 0.68201
```

```
beta      = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
diff_gain   = 0.995
display=false

; -----------------
; The shear probe channels
[channel]
; instrument dependent parameters
id          = 8
name        = sh1
type        = shear
adc_fs      = 5.000
adc_bits    = 16
diff_gain   = 1.01
; sensor dependent parameters
sens        = 0.0716
SN          = M1039
cal_date    = 08-08-2017

[channel]
; instrument dependent parameters
id          = 9
name        = sh2
type        = shear
adc_fs      = 5.000
adc_bits    = 16
diff_gain   = 1.02
; sensor dependent parameters
sens        = 0.0777
SN          = M1042
cal_date    = 08-08-2017

; -----------------
; The pressure transducder
; without pre-emphasis
[channel]
; instrument dependent parameters
id          = 10
name        = P
type        = poly
; sensor dependent parameters
coef0       = 6.52
coef1       = 0.10649
coef2       = -6.435e-9
cal_date    =
units       = [dBar]
```

```
display=true

; with pre-emphasis
[channel]
; instrument dependent parameters
id          = 11
name        = P_dP
type        = poly
diff_gain   = 20.3

[channel]
id          = 12
type        = ucond
name        = C1_blank
a           = -0.7869
b           = 196.9
diff_gain   = 0.995
adc_fs      = 5.000
adc_bits    = 16
units       = [mS / cm]
display     = false
; Sensor dependent cell-constant in units of metres.
K           = 1.03e-3
SN          =

[channel]
id      = 14
name    = Chlorophyll
type    = poly
sign    = unsigned
coef0   = -4.58552e0
coef1   = 6.564e-3
units   = [ppb]
SN      = 2
display = false

[channel]
id      = 15
name    = Turbidity
type    = poly
sign    = unsigned
coef0   = -2.670057e0
coef1   = 3.638e-3
coef2   = 0
coef3   = 0
units   = [FTU]
SN      = 2
display = false
```

```
; -----------------
; Sea-Bird SBE3 thermometer. Remove, if you are using a JAC CT, and
;  remember to update the [matrix] section.
[channel]
; instrument dependent parameters
;id           = 16, 17    ; A two-channel signal. Separate channels with a "," and/c
id_even      = 16
id_odd       = 17
name         = SBT1
type         = sbt
coef5        = 24e6       ; reference clock
coef6        = 128        ; periods
; sensor dependent parameters
coef0        = 4.33172014e-3
coef1        = 6.36238494e-4
coef2        = 2.05415014e-5
coef3        = 1.66852309e-6
coef4        = 1000
SN           = 4869
cal_date     = 2017-09-12 ; date of calibration
units        = [C]
display      = true

; Sea-Bird SBE4 conductivity cell. Remove, if you are using a JAC CT, and
;  remember to update the [matrix] section.
[channel]
; instrument dependent parameters
;id           = 18, 19
id_even      = 18
id_odd       = 19
name         = SBC1
type         = sbc
coef5        = 24e6
coef6        = 128
; sensor dependent parameters
coef0        = -1.07837921e1
coef1        = 0
coef2        = 1.66255830
coef3        = -3.33094922e-3
coef4        = 3.66229645e-4
SN           = 3389
cal_date     = 13 October 2016 ; date of calibration
units        = [mS/cm]
display      = true

; -----------------
```

```
; The Sea-Bird  SBE43F oxygen sensor
[channel]
;id       = 48,49
;name     = O2_43F
;type     = o2_43f
;coef0    = -8.677e-2
;coef1    = 2.7697e-4
;coef2    = 24e6      ; reference frequency
;coef3    = 128       ; number of cycles for estimate
;SN       = 0122
;cal_date = 2007-09-28
;display  = false

; ------------------
; This is a list of typical channels (addresses) and their signals
; Only some of these channels will be in any particular instrument
;  id    Name    - rate - Description
; -------------------------------------------------------------------
;  0     Gnd     - slow - Reference ground
;  1     Ax      - fast - horizontal acceleration in the direction of the pressure
;  2     Ay      - fast - horizontal acceleration orthogonal to the direction of th
;  3     Az      - fast - vertical acceleration, positive up
;  4     T1      - slow - Temperature from Thermistor 1 without pre-emphasis
;  5     T1_dT1  - fast - Temperature from Thermistor 1 with pre-emphasis
;  6     T2      - slow - Temperature from Thermistor 2 without pre-emphasis
;  7     T2_dT2  - fast - Temperature from Thermistor 2 with pre-emphasis
;  8     sh1     - fast - velocity derivative from shear probe 1
;  9     sh2     - fast - velocity derivative from shear probe 2
; 10     P       - slow - pressure signal without pre-emphasis
; 11     P_dP    - slow - pressure signal with pre-emphasis
; 12     C1_dC1  - fast - micro-conductivity with pre-emphasis
; 14     Chlorophyll - fast - JAC fluorometer
; 15     Turbidity   - fast - JAC backscatter sensor
; 16, 17 SBT     - slow - The even and odd addresses of the Sea-Bird SBE3 thermomet
; 18, 19 SBC     - slow - The even and odd addresses of the Sea-Bird SBE4 conductiv
; 48, 49 O2_43F  - slow - The even and odd addresses of the Sea-Bird SBE43F oxygen
; 255    sp_char - slow - special Character that always returns 32752D or 7FF0H and
;                         is used to test the integrity of communication.

; End of setup configuration file.
```

B Event Log

WS17305 Event Log

#	Date/time (g - gmt, L - local)	Latitude (NORTH) POS MV	Longitude (WEST)	Event (activity, data features, downtime station/section numbers)
1	31 Oct ____			Set sail
2	____	25.727°	79.320°	Arrive @ ~~South~~ Bimini
3	1 Nov 12:17l	25.722°	79.313°	Clear in/out
4	1 Nov 14:15l			Leave Bimini
5	1 Nov 20:02	25°51.648	78°25.515	Stop for VMP test dip
6	1 Nov 2120	25°51.798	78°25.463	VMP #2 in water → Station #1 Cast #1
7	1 Nov 2133	25°51.840	78°25.418	VMP #2 out water Problem with C-sensor.
8	1/11/17 2148	25°51.938	78°25.426	VMP #1 in water → Station #2 Cast #1
9	1/11/17 2203	25°52.015	78°25.397	VMP #1 out water Systems working - radio tripped socket
10	1/11/17 2209			Underway to WP1
11	2/11/17 0740	25.840	77.180	Arrive at WP1 → WP2 for ADCP survey.
12	2/11/17 1019	25 56.023	76 59.517	Arrived at WP2 → Prep for glider deployment.
13	2/11/17 1142	25°55.5	76°59.9	sg534 in water staying within visual range.
14	1310			sg534 dived
15	1322	25.8404	77.1804	Reposition
16	1400			Ready to deploy 533
17	1411	25.839	77.187	Glider in
18	1420	25.839	77.187	Glider sg533 dive
19	1446	25.8389	77.1865	sg641 in water
20	1455			sg641 dive
21	1550	25.839	77.187	depart for WP3 (ADCP)

1 east - no internet west - no TV

WS17305 Event Log

#	Date/time (g - gmt, ~~l - local~~)	Latitude	Longitude	Event (activity, data features, downtime station/section numbers)
22	2 Nov17 1600g	25.817	77.044	Slow to 6-6.5kts for ADCP
23	2 Nov17 1610g			Slow to 5.5 kts (into wind, rocky)
24	2 Nov 21845			Reach WP3 +
~~2~~				Head to WP4
25	2 Nov17 0419	26° 20.141	76° 45.173	Arrive @ WP4 → WP5 doing VMPs
26	2/11/17 0433	26° 20.187	76° 45.520	Lost coms with VMP Bringing to surface to restart cast
27	3/11/17 1355	26 19.77	76° 57.51	Finish VMP. → WP6* glider
28	3/11/17 1703	26.22	77° 28	Glider sg641 recovered
~~29~~				→ WP 11 for VMP
29	3/11/17 22:35	26.470	76.990	WP11 start VMP sxn
30	4/11/17 0551g.	26 28.261	76 46.272	Finish VMP section → WP12 → WP13 → WP14 ADCP
31	4/11/17 1050g			WP15, head to WP16 ADCP
32	4/11/17 13:41	26° 32.91'	76° 40.28'	Start VMP 9-10
33	4/11/17 2150	26° 32.	76° 54	End VMP. Go to WP 17
34	4/11 2210	26° 34.18	76° 54.85'	ADCP sxn WP17 → 18
35	5/11 0044			end ADCP WP18
36	5/11 0058			start VMP WP19
37	5/11 1135	26° 35.82	76° 54.74	end VMP WP20
38	5/11 1202	26° 36.95	76° 55.47	start ADCP WP21
39	5/11 1445	26° 37.04	76° 39.93	end ADCP WP22
40	1507			start VMP WP23

WS17305 Event Log

#	Date/time (g - gmt, L - local)	Latitude	Longitude	Event (activity, data features, downtime station/section numbers)
41	6/11 03:59	26° 38.55	76° 57.10	end VMP WP24, S07
42	6/11 04:47	26° 39.815	76° 59.812	Start VMP S08 (WP25)
43	6/11 2020	26° 40.20	76° 39.39	end VMP - Start ADCP
44	6/11 2236	26° 33.68	76° 48.91	start VMP WP 30
45	7/11 00:28			Sounded for glider 533
46	7/11 04:30			Lost comms w/ VMP - line went slack and when recovered, VMP gone.
47	7/11 0600			end WP31 → WP36
48	7/11 06:55	26° 28.49	76° 52.37	VMP test
49	7/11 0850			Finish VMP test → WP 33
50	/			
51	1506			sounding glider × 2 freq 13 kHz 11.5 kHz
52	7/11 1512	26° 29.076	76° 56.326	sounding glider × 1 freq 13 kHz
53	7/11 1528	26° 29.232	76° 56.558	" last known × 2 freq 13 kHz
			1533	response on 10.5 19639 m 23551 m
54	1537			ADCP backon
55				WP 35 → 37 → 38 → 15
56	7/11 2301	26° 31.21	76° 54.85	WP 15 → 34 transit
57	8/11 0000	26° 36.33	76° 48.39	VMP @ WP 50 (S11)
58	0141			SG534 calls in
59	3:00	26° 37.20	76° 41.05	GKPS for 2×VMP
60	05:15	26° 37.03	76° 46.85	Steam for WP 30
61	0548	26° 36.72	76° 49.49	Start VMP section 12

1

62	8/11	0935	26°27.38	76°52.79	End VMP @ WP40
~~63~~					~~VMP drum breaking~~ buckling
					~~Start VMP~~
63					ADCP 40→41
64					ADCP 42-43 VMP
65		18:[illegible]			VMP 43→44 (513)
66	8/11	2032			VMP drum buckling
67	8/11	22:08			Swith TO ADCP
68	8/11	0605	26° 24.44	76° 55.61	End VMP @ WP 45 → WP 49 for next VMP sec
69	8/11	1138			End VMP section (to WP51) early → WP55 for VMP → WP54.
70		1604			after ADCP end of cruie

cable photo
cruise map

C VMP logsheets

MERMEED VMP 2000 LOG # 1

St. No.	Date (jday)		Latitude N	Longitude W	Time (GMT)	Water Depth	Max. Press.	File	Notes
01	01/11 2017	start	25 51.694	78 25.4792	21:09	300	/	TEST FILES 001-001 -002 -003	Test dip sn023 Setup- 011117 SBC not reading aborted at surface.
		max							
		end							
02	0/11 2017	start	25 51.644	78 25.4792	21:45	300	190	WS17305_S02_001	Test dip sn085 Setup - 011117 aborted 190m scalar tripped
		max							
		end							
03	03/11 2017	start	26 20.083	76 44957	04:20:36	4362m (swath)		WS17305_S03_001	Start of first section Aborted → coms fail
		max							
		end							
	03/11 2017	start	26 20.1582	76 45.559	04:42	4246m (swath)		WS17305_S03_002	Restarting first section. Stopped recording partway through dive → 'user error'
		max							
		end	26 19.804	76 46.059	05:30				
	3/11 2017	start	26 19.77	76 46.07	05:35	4107	851	WS17305_S03.003	3rd time lucky... max pressure = 851 1 of 2 thermisters look dodgy.
		max	26 19.89	76 46.78	05:58				
		end	26 20.00	76 47.53	06:27				

MERMEED VMP 2000 LOG # 2

St. No.	Date (jday)		Latitude N	Longitude W	Time (GMT)	Water Depth	Max. Press.	File	Notes
03	3/11 2017	start	26 20.003	76 47 602	06:31	3990m swath	818	WS17305_S03_004	
		max	26 20.053	76 48.268	06 53				
		end	26 20.091	76 49.100	0726				
3/5	3/11 2017	start	26 20.094	76 49.195	0729	3943m swath	791	WS17305_S03_005	
		max	26 20.102	76 49.792	0750				
		end	26 20.139	76 50.467	08:23				
3/6	3/11 2017	start	26 20.138	76 50.719	0826	3691 swath	710	WS17305_S03_006	
		max	26 20.122	76 51.371	0848				
		end	26 20.107	76 52.293	09:23				
3/7		start	26 20.106	76 52.387	09:26	3476 swath	726	WS17305_S03_007	No data recorded – user error at start. Spotted at end ∴ no data.
		max	26 20.094	76 53.00	0947				
		end	26 19.823	76 53.226	1022				
3/8	3/11 2017	start	26 19.80	76 53.31	1026	3358 swath	780	WS17305_S03_008	
		max	26 19.91	76 53.90	1050				
		end	26 20.05	76 54.55	1120				

MERMEED VMP 2000 LOG # 3

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Water Depth	Max. Press.	File	Notes	operat. + wire out
3/9	3/11 2017	start	26 20.06	76 54.62	1122	2844	751	WS17305_S03_009.p		DGE 1800m
		max	26 20.16	76 55.20	1142					
		end	26 20.28	76 55.86	1211					
3/10	3/11 2017	start	26 20.28	76 55.89	1213	1741	828	WS17305_S03_010.p		
		max	26 20.37	76 56.38	1235					
		end	26 20.42	76 56.91	1303					
3/11	3/11 2017	start	26 20.41	76 57.04	1310	923	638	WS17305_S03 -011.p	Double clicked start/stop → Restarted cast, created cast 12 file will rename after cast.	DGE 1600m
		max	26 20.16	76 57.28	1327					
		end	26° 19.89'	76° 57.44	13:46					
4/1	3/11 17	start	26 28.138	76 58.294	22:46	~~306~~ 400	425	WS17305_S04 -001	no swath. eye ball off map. (wire at 840m) all sensors good –	
		max			22:58					
		end			23:19					
4	3/11/17	start	26 27.969	76 56.835	23:23	1708 (swath)	985	WS17305_S04 -002		1780wire
		max			23:50					
		end			00:34					

MERMEED VMP 2000 LOG # 4

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Water Depth	Max. Press.	File	Notes
04	04/11 2017	start	26 28.1214	76 55.05218	00:38	2369	992	WS17305-04-03	-04 → double click on slipping
		max			01:05				
		end			01:42				
04	04/11 2017	start	26 28.3987	76 53.2752	01:44	2547	1061	WS17305-04-05	← NB
		max			02:13				
		end			02:57				
04	04/11 2017	start	26 28.299	76 51.251	03:03	2573	893	WS17305-04-06	T2 suspect lower down.
		max			03:27				
		end	26 28.224	76 49.639	04:00				
04	04/11 2017	start	26 28.221	76 49.563	0403	2634	902	WS17305-04-07	BB @ 400m
		max	?		0428				
		end	26 28.200	76 48.013	0455				
04/8	04/11 2017	start	26 28.202	76 47.948	0458	3072	888	WS17305-S04-08	Recovered
		max			0522				
		end	26 28.261	76 46.272	0551				

MERMEED VMP 2000 LOG # 5

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
05/01	04/11 2017	start	26° 32.91'N 76° 40.28'W	→	13:41	Albuts DGE	4303	817	1800	WS17305_ 505_ 001.p	
		max	26 32.791	76 40.786	14:07						
		end	26 ~~41.481~~ 32.76	76 41.484	1437						
05/02		start	26 32.760	76 41.555	1440	DGE	3882	803	1800	WS17305_ 505_ 002.p	
		max	26 32.730	76 42.104	1502						
		end	26 32.751	76 42.785	1531						
05/03		start	26 32.752	76 42.820	1533	DGE	3814	803	1800	WS17305_ 505_ 003.p	Y-axis ~~accelerometer very noisy, but spectra look OK~~ Axis had changed scale.
		max	26 32.75	76 43.374	1555						
		end	26 32.75	76 44.136	1627						
05/04		start	26 32.75	76 44.20	1629	DGE	3785	767	1800	WS17305_ 505_ 004.p	
		max	26 32.73	76 44.79	1652						
		end	26 32.65	76 45.69	17:26						
05/05		start	26 32.64	76 45.76	17:30	Albeto		710	1800	WS17305_ 505_ 005 p	
		max	26 32.58	76 46.38	1750						
		end	26 32.52	76 47.45	18:26						

MERMEED VMP 2000 LOG # 6

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
05 — 06	04/11	start	26 32.52	76 47.57	18:30	ACWG	3247	649	1800	WS17305_ 505_ 006.p	sketchy fall rate
		max	26 32.53	76 48.24	18:51						
		end	26 32.59 [illegible]	76 49.40	19:27						
05 — 07	4/11	start	26 32.59	76 49.46	19.30	ACWG / Rob	1544	693	1800 [illegible]	WS17305_ 505- 007.p	20
		max	26 32.65	76 50.13	19.50						
		end	26 32.66	76 51.32	20.27						
05 / 08	4/11	start	26 32.66	76 51.48	20:32	Rob	781	727 [illegible]	1800	WS17305_ 505- 008.p	ADCP suggests depth around 700m 30
		max	26 32.64	76 52.09	20:53						
		end	26 32.60	76 52.71	21:22						
05 / 09	4/11	start	26 32.59	76 52.75	21:24	Rob	425	406	720	WS17305_ 505- 010.p	WS17305_505_09.p is a mistake (double click) ADCP suggests depth around 450m 30
		max	26 32.58	76 53.05	21:36					NB → RENAMED TO 009	
		end	26°32.57	76°53.24	2144						
		start									
		max									
		end									

MERMEED VMP 2000 LOG # 7

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
06/1	05/11 2017	start	26 35.623	76 40.378	01:11	AF	3801	814	max	WS17305_S06 -001	All sensors look good.
		max			01:32						
		end			02:08						
06/2	05/11 2017	start	26 35.211	76 42.240	02:12	AF	3092	808	max	WS17305-S06 -002	
		max			02:35						
		end			03:07						
06/3	05/11 2017	start	26 35.6785	76 43.555	03:09	AF	2238	802		WS17305_S06 -003	
		max			03:33						
		end	26 35.563	76 44.842	0408						
06/4	05/11 2017	start	26 35.56	76 44.88	0409	AF/DGE	3030	813		WS17305-S06 -004	
		max	26 35.526	76 45.399	0432						
		end	26 35.493	76 45.997	0501						
06/5		start	26 35.491	76 46.052	0503	AF/DGE	3004	818			
		max	26 35.471	76 46.570	0525						
		end	26 35.472	76 47.298	0559						

MERMEED VMP 2000 LOG # 8

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
06 / 06	05/11 2017	start	26 35.473	76 47.347	06:01	AF DGE	1606	818		WS17305_S06 -06	
		max	26 35.47	76 47.850	0622						
		end	26 35.51	76 48.41	0648						
06 / 07	05/11 2017	start	26 35.51	76 48.45	0650	AF / DGE	1643	833		WS17305_S06 -07	
		max	26 35.55	76 49.01	0713						
		end	26 35.58	76 49.75	0747						
06 / 08	05/11 2017	start	26 35.58	76 49.80	0750	AF / DGE	1689	830		WS17305_S06 _08	
		max	26 35.58	76 50.34	0814						
		end	26 35.61	76. 50.84	0840						
06 / 09	05/11 2017	start	26 35.61	76 50.87	0840	AF / DGE	1503	908		WS17305_S06 -09	
		max	26 35.60	76 51.43	0905						
		end	26 35.62	76 52.10	0937						
06 / 10	05/11 2017	start	26 35.62	76 52.14	0939		1278	944		WS17305_S06 _10	BB @ ~120 m
		max	26 35.61	76 52.76	1005						
		end	26 35.61	76 53.25	1029						

MERMEED VMP 2000 LOG # 9

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
06/11	5/11 2017	start	26 35.61	76 53.27	1030	DGF / AF	708	601	TGT 1100m ACT ~1300m		
		max	26 35.59	76 53.66	1046						
		end	26 35.57	76 54.10	1105						
06/12		start	26 35.56	76 54.17	1108	DGF / FFW	460	420	~~750m~~ 802		
		max	26 35.53	76 54.49	1120						
		end	26 35.52	76 54.71	1129						
07/1	5/11 2017	start	26 38.36	7640.28	15:07	ACNG / DGF	3989	790		WS17305_507_001.p	
		max	26 38.39	76 40.81	1529						
		end	26 38.43	76 41.66	1604						
07/2	5/11 2017	start	26 38.48	76 41.75	1607	ACNG / DGF	3049	750		WS17305_507_002.p	
		max	26 38.44	76 42.31	1628						
		end	26° 38.42	76° 43.33	1708						
07/3	5/11 2017	start	26°38.41	76°43.49	17:14	RH ACNG	1744	703	1800	WS17305_507_003.p	
		max	26° 38.78	76° 44.05	17:33						
		end			18:15						

MERMEED VMP 2000 LOG # (10)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
07/4	5/11 2017	start	26°38.17	76°45.44	18:18	RH acng	1578	688	Full	WS17305_ 507_006.p rename 4	_005.p and _006.p are at the surface
		max	26°38.12	76°45.00	18:38						
		end	26°38.07	76°46.87	19:20						
07/5	5/11 2017	start	26°38.07	76°46.91	19:22	acng	1590	840	full	WS17305_ 507_007.p rename 5	
		max	26°38.08	76°47.34	19:45						
		end	26°38.09	76°47.82	20:14						
07/6	5/11 2017	start	26°38.09	76°47.87	20:17	acng	1802	847	full	WS17305_ 507_008.p	
		max	26°38.10	76°48.28	20:36						
		end	26°38.13	76°48.82	21:05						
07/7	5/11 2017	start	26°38.14	76°48.87	21:08	acng	1659		full	WS17305_ 507_009.p	
		max	26°38.21	76°49.39	21:32						
		end	26°38.28	76°49.94	22:01						
07/8	5/11 2017	start	26 38.282	76 49.979	22:03	acng AF	1600	954		WS17305_ 507_010.p	
		max	26 38.35	76 50.57	22:29						
		end	26 38.41	76 51.15	22:56						

665
22

MERMEED VMP 2000 LOG # 11

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
7/9	5/11 2017	start	26 38.414	76 51.193	22 58	AF acg	1439	996	full	WS17305_S07 -011	
		max	26 38.416	76 51.799	23:26						
		end			23:55						
7/10	5/11 2017	start	26 38.451	76 52.419	23:59	AF	1275	1040	max	WS17305-S07 _013 ← NB	(day changed)
		max			00:27						
		end			00:56						
7/11	6/11 2017	start	26 38.374	76 53.556	00:56	AF	1293	1019	max	WS17305_S07 -014	
		max			01:25						
		end			02:05						
7/12	6/11 2017	start	26 38.376	76 54.917	02:06	AF	1223	1127	max	WS17305_S07 -015	
		max			02:36						
		end			03:08						
7/13	6/11 2017	start	26 38.473	76 56.140	03:10	AF	1112	961	1503	WS17305-S07 _016	
		max	26 38.55	76 57.10							
		end	↓	↓	03:59						

MERMEED VMP 2000 LOG # (12)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
8/1	6/11 2017	start	26 39.815	76 59.812	04:47	AF	573	423	612	WS17305-S08 -001	3838 3226 612
		max			05:00						
		end	26 39.82	76 59.36	0509						
8	6/11 12	start	26 39.82	76 59.35	0510	DGE / AF	817	810	1241	WS17305-S08 -002	750 stop
		max			05						
		end	26 39.78	76 58.76	0548						
8	6/11 12	start	26 39.78	76 58.76	0549	DGE / AF	963	881	1267	WS17305-S08 -003	
		max	26 39.73	76 58.36	0613						
		end	26 39.72	76 58.10	0630						
8	6/11 17	start	26 39.72	76 58.09	0631	AF / DGE	999	945	1373	WS17305-S08 -004	
		max	26 39.74	76 57.66	0647						
		end	26 39.722	76 57.303	07:20						
8	6/11 17	start	26 39.772	76 57.303	07:21	AF DGE	1157	1087	1583	WS17305-S08 -005	
		max	26 39.79	76 56.79	07:50						
		end	26 39.82	76 56.40	08:16						

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- ~~2455~~ 2238

MERMEED VMP 2000 LOG # (13)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
8/6	6/11/2017	start	26 39.824	76 56.394	8:17	DGE AF	1257	1111	1674	WS17305_S08_006	
		max	26 39.85	76 55.85	8:46						
		end	26 39.91	76 55.37	0915						
8/7	6/11/2017	start	26 39.71	76 55.55	0916	DGE AF	1395	1139	1800	WS17305_S08_007.p	
		max	26 39.94	76 54.76	0946						
		end	26 39.92	76 54.23	1018						
8/8	6/11/2017	start	26 39.92	76 54.21	1017	DGE AF	1550	1110	1800	WS17305_S08_008.p	
		max	26 39.86	76 53.59	1048						
		end	26 39.81	76 52.94	11:16						
8/9	6/11 2017	start	26 39.82	76 52.89	11 18	DGE	1826	1095	1800	WS17305_S08_009.p	
		max	26 39.87	76 52.24	1144						
		end	26 39.92	76 51.55	12:12						
8/10	"	start	26 39.93	76 51.48	12:15	ACNG	1959	924		WS17305_S08_010.p	
		max	26 39.96	76 50.82	1240						
		end	26 40.01	76 49.96	1315						

3838 − 1750 = 2088
2164

MERMEED VMP 2000 LOG # (14)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
8/11	6/11/2017	start	26 40.01	76 49.90	1317	DGE ACNG	2597	895	1800	S08-011.p	
		max									
		end	26 40.05	76 48.40	1413						
8/12	6/11 2017	start	26 40.05	76 48.36	1415	DGE ACNG	3092	918	1800	S08 -012.p	
		max	26 40.09	76 47.61	1439						
		end	26 46.80	76 ~~46~~.80	1510						
8/13	6/11 2017	start	26 40.13	76 46.73	1512	DGE ACNG	3153	939		S08 -013.p	
		max	26 40.11	76 46.01	~~939~~ 1537						
		end	26 40.07	76 45.18	1607						
8/14	6/11 2017	start	26 40.07	76 45.10	1610	DGE ACNG	2683	968	full	WS17305_S08-014.p	Spike in upcast at ~800m?
		max	26 39.99	76 44.36	16:36						
		end	26 40.00	76 43.51	17:09						
8/15	6/11 2017	start	26 40.01	76 43.44	17:12	ACNG RH	3427	1067	full	WS17305_S08-015.p	
		max									
		end	26 40.15	76 42.00	18:06						

MERMEED VMP 2000 LOG # 15

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
8/16	6/11 2017	start	26 40.16	76 41.98	18:08	acny	3878	1191	Max	WS17305_ S08_016.p	
		max	26° 40.30	76° 41.17	18:39						
		end	26° 40.44	76 40.55	19:06						
8/17 [illegible]	6/11 2017	start	26° 40.44	76° 40.53	19:07	RH	4123	1213	Max	WS17305_ S08_017.p	
		max	26° 40.45	76° 39.82	19:39						
		end	26° 40.51	76° 39.17	20:09						
9/1	6/11 22 47	start	26° 33.40	76°49.35	22:48	RH	2084 [illegible]	888	Max	WS17305_ S09_001.p	All sensors good
		max	26° 33.26	76° 49.77	23:12						
		end			23 43						
9/2	6/11 17	start	26 32.859	76 50.283	23 46	AF	1274	724	max	WS17305_ S09_002.p	WB date change
		max			00:08						
		end			00:44						
9/3	7/11 17	start	26 31.920	76 51.214	00:48	AP	798	696	max -100	WS17305 S09-003.p	
		max			01:08						
		end			01:36						

590

775

MERMEED VMP 2000 LOG # (16)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
9/4	7/11 17	start	26 31.085	76 51.947	01:38	AP	574	518	1238	WS17305-04 -004.p	
		max			01:53						
		end			02:14						
9/5	7/11 17	start	26 30.454	76 52.526	02:17	AP	1010	743	max	WS17305-04 -005.p	
		max	[illegible]		02:37						
		end			03:04						
9/6	7/11 17	start	26 29.719	76 53.296	03:05	AF	1375	750	max	WS17305-S09 -006.p	
		max			03:26						
		end			03:55						
9/7	7/11 17	start	26 28.902	76 54.340	03:58	AF	1964	805	max	WS17305-S09 -007.p	• Profiler lost at ~ ~~300~~ 185m depth. on recovery • wire cut approx 500m from profiler
		max			04:20						
		end									
		start									
		max									
		end									

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MERMEED VMP 2000 LOG # 17

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
10	7/11	start	26 28.65	76 52.27	~~0723~~ 0733	AF — DGE — EFW	2806	1165		WS17305_S10_003.p	Restarted cast from surface after getting to ~50 m due to issue with the cable puller. Continued with full cast - cable was poorly scrolled and was affecting fall speed — so decided to spool all out in anticipation of using it for future profiles.
	17	max			~~0832~~						
		end	26 30.52	76 50.13	0832						
		start									
		max									
		end									
11	8/11	start	26 36.387	76 48.344	00:15	AR	1570	1470	max	WS173005-S11-001.p	Fall rate high ≈ 0.8 db/s
	17	max			00:44						
		end			01:18						
11	8/11	start	26 32.086	76 48.115	01:20	AR	1588	1472	max	WS173005-S11-002.p	T1 looks spiky - spectra noisy. Fall rate still high
	17	max			01:50						
		end			02:39						
11	8/11	start	26 37.152	76 47.0284	03:05	AR	1737	1200	1000m	WS173005 S-11-003.p	added ~ 100g extra flotation (glider ballast). [1000m + fall max]
	17	max			03:28						
		end			03:51						

MERMEED VMP 2000 LOG # (18)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
11	8/11 17	start	26 37.059	76 46.926	03:53	MP	1789	~1175		WS17300S_ S11-004	[to 1000db + run max] Fall rate still > 0.8
		max	26 37.03	76 46.89	04:18						
		end			05:01						
12/1	8/11 17	start	26 36.72	76 49.49	0548	DGF/AF	1525	1053	max	WS17305_ S12-001	Lowehandels removed —
		max			06:12						
		end	26 35.51	76 49.91	0654						
12/2	8/11 17	start	26 35.42	76 49.94	0700	DGF/AF	1647	1007	max	WS17305_ S12-002	
		max	26 34.97	76 50.08	0724						
		end	26 34.30	76 50.29	0802						
12/3	8/11 17	start	26 33.99	76 50.36	0830	DGF/AF	1498	1047	max	WS17305 S12-003	BB x 2
		max	26 33.61	76 50.50	0855						
		end	26 33.11	76 50.73	0928						
12/4	8/11 2017	start	26 33.07	76 50.75	0931	DGF/AF	1201	1006	max	WS17305 S12-004	
		max	26 32.69	76 50.93	0953						
		end	26 32.15	76 51.23	1030						

MERMEED VMP 2000 LOG # (19)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
12/5	8/11 2017	start	26 32.09	76 51.28	1034	DGE/AF	931	823		WS17305_ S12- 005	
		max	26 31.66	76 51.52	1058						
		end	26 30.89	76 51.89	1140						
12/6	8/11 2017	start	26 30.79	76 51.92	1145	DGE/AF	~~628~~ 682	532		WS17305_ S12_ 006	TGT = 630 Hit sea bed. Decided to continue with next profile and assess if sensors were still functioning.
		max	26 30.44	76 52.01	1201						
		end	26 30.00	76 52.05	1224						
12/7	8/11 2017	start	26 29.95	76 52.05	1227	DGE/AF	1322	860	full	WS17305_ S12_ 007	→ Header in file corrupted → could not process.
		max			1250						
		end	26 28.89	76 52.18	1321						
12/8	8/11 2017	start	26 28.69	76 52.26	1330	DGE/ACNG	2806	841	full	WS17305_ S12_ 008	File fine processed normally → data looks reasonable. Some mud on sh1 (M1039) others were ok.
		max	26 28 28	76 52 42	13:51						
		end	26 27.54	76 52.72	14:29						
13/1	8/11 2012	start	26 27.26	76 49.32	18:03	ACNG/RdS	3148	1007	full	WS17305_ S13_ 001	
		max	26 27 10	76 49 80	18:24						
		end	26 26.83	76 50.52	19:02						

MERMEED VMP 2000 LOG # (20)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
13/2	8/11 2012	start	26 26.80	76 50.59	19:05	ACNG Rob	3533	[illegible] 988	full	WS17305_ S13_002	
		max	26 26.59	76 51.04	19:27						
		end			[illegible]						
13/3	8/11 2017	start	26°26.33	76°51.90	20:10	ACNG Rob	3444	985	full	WS17305_ S13_003	While hauling, the winch drum began to collapse due to pressure exerted by cable. Short-term fix with tape. Need to change drums after all, so section with skirt.
		max	26 26.16	76 52.34	20:32						
		end	26°26.32	76°53.30	21:40						
		start									
		max									
		end									
		start									
		max									
		end									
		start									
		max									
		end									

MERMEED VMP 2000 LOG # (21)

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
14	9/11 2017	start	26 25.315	76 49.223	01:34	AP	3091	641	max	WS17305-S014-001.p	Swapped winches — Short cable ~1000m only
		max			01:48						
		end			02:06						
14	9/11 2017	start	26 25.146	76 49.859	02:09	AP	3889	681	max	WS17305-S014-002.p	Sh1 a bit iffy
		max			02:23						
		end			02:39						
14	9/11 2017	start	26 25.071	76 50.585	02:42	AP	3604	616	max	WS17305-S014-003.p	
		max			02:55						
		end			03:10						
14	9/11 2017	start	26 24.968	76 51.288	03:11	AP	3432	624	max	WS17305-S014-004.p	Sh1 still iffy
		max			03:24						
		end			03:48						
14	9/11 2017	start	26 24.874	76 52.286	03:53	AP	2779	655	max	WS17305-S014-005.p	Sh2 ~~sh1~~ iffy (Sh1 ok on this cast) replace on next Sh1 recovery
		max			04:07						
		end			04:25						

MERMEED VMP 2000 LOG # 22

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
14	9/11 2017	start	26 24.785	7653.099	04:28	AP	2093	640	max	WS173005 -S14-006	
		max			04:41						
		end	26 24.75	76 53.91	05:00						
14 — 7	9/11 2017	start	26 24.75	76 53.98	05:03	AF / DGE	1422	608	max	WS17305_ S14_ 007.p	Sh1 still iffy — Sh2 looks ok
		max	26 24.73	76 54.40	0517						
		end	26 24.68	76 54.91	0536						
14 — 8	9/11 2017	start	26 24.67	76 54.98	0538	AF / DGE	861 (ADCP = ~600m)	455		WS17305_ S14_ 008.p	
		max	26 24.58	76 55.28	0549						
		end			06:00						
15 — 1	9/11 2017	start	26 23.937	76 55.884	06:37	AF	585	485		WS17305_ S15_ 001.p	
		max	26 23.90	76 54.85	0649						
		end	26 23.87	76 54.67	0700						
15 — 2	9/11 2017	start	26 23.859	76 54.649	0702	AF / DGE	1121	771	max	WS17305— S15-002.p	
		max	26 23.73	76 54.40	0718						
		end	26 23.58	76 54.13	0740						

MERMEED VMP 2000 LOG # 23

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
15/3	9/11 2017	start	26 23.56	76 54.09	0743	DGF/AF	1528	772		WS17305_S15_003.p	Shl dodgy again
		max	26 23.43	76 53.87	0800						
		end	26 23.291	76 53.586	08:20						
15/4	9/11 2017	start	26 23.28	76 53.56	0823	DGF/AF	2076	767		WS17305_S15_004.p	shl dodgy
		max	26 23.14	76 53.29	0839						
		end	26 22.97	76 52.92	0902						
15/5	9/11 2017	start	26 22.95	76 52.88	0905	DGF/AF	2763	725		WS17305_S15_005.p	both sh ok
		max	26 22.78	76 52.60	0921						
		end	26 22.60	76 52.27	0941						
15/6	9/11 2017	start	26 22.58	76 52.23	0944	DGF/AF	~~3214~~ 3214	725		WS17305_S15_006.p	Both Shear Probes A-OK!
		max	26 22.41	76 51.91	1000						
		end	26 22.19	76 51.46	1027						
15/7	9/11 2017	start	26 22.16	76 51.39	1031	DGF/AF	3619				Boring casts finished section early to save time.
		max	26 22.02	76 51.09	10:47						
		end	26 21.88	76 50.78	1106						

MERMEED VMP 2000 LOG # 24

St. No.	Date (jday)		Latitude	Longitude	Time (GMT)	Operator	Water Depth	Max Press	Wire Out	File	Notes
16/1	9/11 2017	start	26 20.13	76 53.12	1153	DGE ACWG	3350	731	full	WS17305_ S16_ 001.p	
		max	26 20.32	76 53.46	1209						
		end	26 20.58	76 53.88	12:29						
16/2	9/11 2017	start	26 20.63	76 53.97	12:34	ACWG DGE	3093	774	full	WS17305_ S16_ 002.p	
		max	26 20.74	76 54.26	12:50						
		end	26 21.01	76 54.78	13:09						
3	9/11 2017	start	26 21.07	76 54.88	13:14	"	2590	695	full	S16_ 003.p	
		max	26 21.75	76 55.25	13:29						
		end	26 21.50	76 55.71	13:49						
16/4	9/11 2017	start	26 21.54	76 55.79	13:52	"	2007	666	full	S16_ 004.p	
		max	26 21.73	76 56.18	14:06						
		end			14:29						
4	9/14 2017	start	26 22.102	76 56.867	14:31	AF ACWG	1032	449	[illegible] 1062	WS17305- S16-005.p	Wind stopped before running half of cast bc. of approaching bottom
		max									
		end	26 22.47	76 57.34	14:54						

*scraped seabed