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Short Cruise Report

- RV Maria S. Merian, cruise MSM83 -

Las Palmas/Spain – St. John's/Canada

17 May – 15 June 2019

Chief Scientist: Dr. Dagmar Kieke

Captain: Björn Maaß

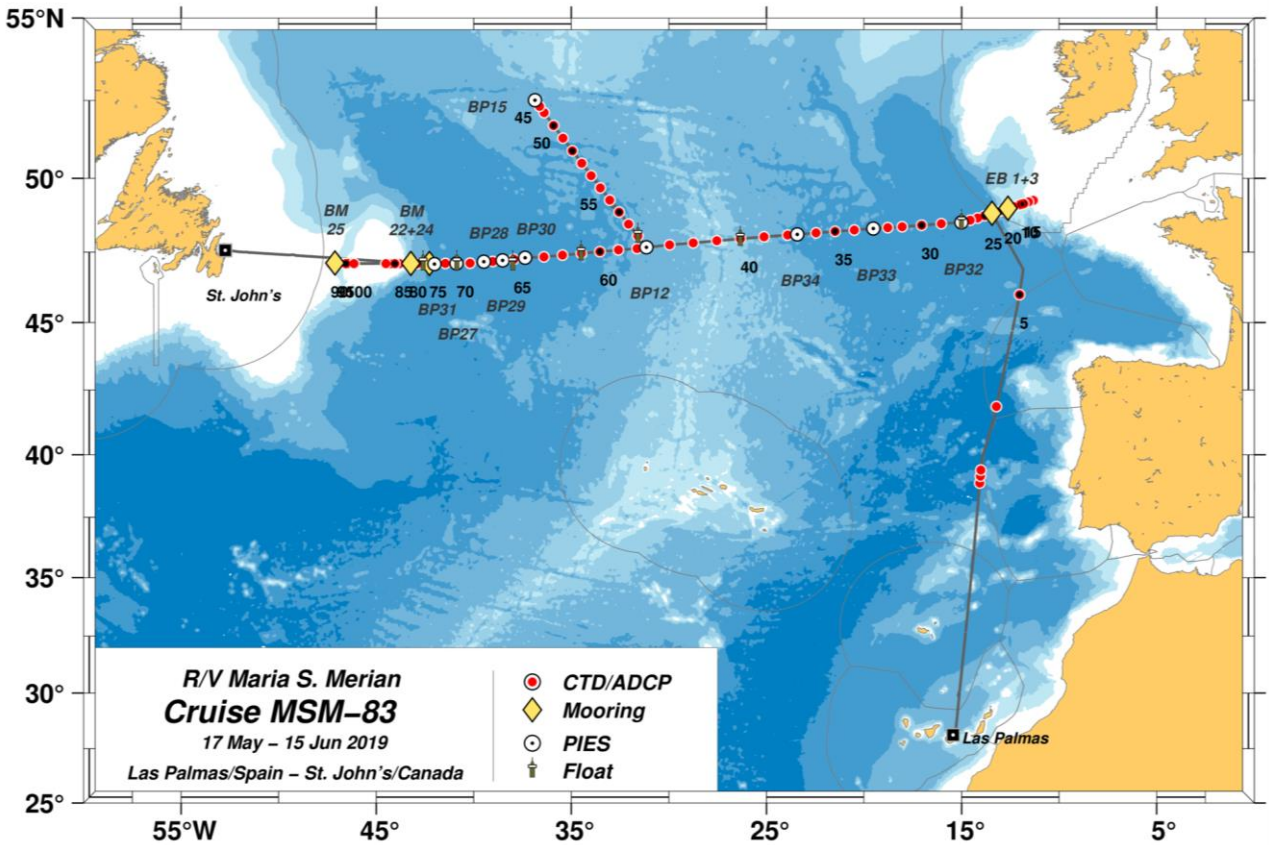

Figure 1. Track of RV MARIA S. MERIAN, cruise MSM83, and locations of hydrographic profiles (red dots denote profile numbers), deployed moorings (yellow diamonds), locations of inverted echo-sounders with pressure sensors (PIES, white dots), and Argo float deployments. Bathymetric contours are shown every 1000 m.

1. Objectives

Scientific measurements conducted during cruise *MSM83* focused on collecting physical-oceanographic data along the geographic latitude of ~47°/48°N as well as along a line located at the western flank of the Mid-Atlantic Ridge (MAR) stretching from ~47°/48°N to about 52°30'N.

Scientific tools comprised profiling of the entire water column using two lowered Acoustic Doppler Current Profilers (LADCP) and a Conductivity-Temperature-Depth-Oxygen (CTDO) unit, all attached to a carousel water sampler. Water sampling activities consisted of taking oxygen and salinity samples for the sake of conductivity-/oxygen-sensor calibration as well as taking samples for the onboard-analysis of anthropogenic trace gases (chlorofluorocarbon-12, CFC-12; sulphurhexafluoride, SF_6). Furthermore, water samples were taken for a home-based analysis of oceanic concentrations of the noble gas argon (^{39}Ar) and of tritium (^{3}H).

Hydrographic station work was complemented by the recovery and redeployment of deep-sea moorings located at the eastern and western continental margins of the North Atlantic (Goban Spur at the Irish shelf break; eastern flank of Flemish Cap; Flemish Pass). Several inverted echo-sounders carrying pressure sensors (PIES) were installed along 47°/48°N as well as near the western exit of the Charlie-Gibbs Fracture Zone at ~52°30'N. Respective station work was related to data retrieval via acoustic telemetry, recovery, and redeployment of the devices. The deep-sea moorings and the PIES form the oceanic long-term observatory *NOAC* ("North Atlantic Changes").

Two vessel-mounted ADCP (vmADCP) systems operated at 38 kHz and 75 kHz delivered velocity data of the upper water column. Further underway measurements focused on standard meteorological data and near-surface water temperatures and salinity.

Acquired measurements and data as well as recovery and redeployment of the moored instruments were carried out in order

- to observe and analyse transport fluctuations and short-term trends in the Deep Western Boundary Current and in Flemish Pass at 47°N,
- to measure the inflow of the North Atlantic Current (NAC) into the subpolar gyre at

47°N, its recirculation in the Newfoundland Basin (NBR), the net transport across the western part of the 47°N line, and the NAC transport from the western into the eastern basin between 47°N and 53°N,

- to analyse transport and transport fluctuations in the eastern part of the *NOAC* array, including a potential NAC flow between the subtropical and subpolar gyre, and study processes responsible for the observed variability of these flows,

- to measure the transport and its variability at the eastern boundary off Goban Spur,

- to calculate the fluxes of heat, freshwater, and anthropogenic carbon (using transient tracers) of various water masses across 47°/48°N.

2. Narrative of cruise *MSM83*

RV MARIA S. MERIAN left its berth in Las Palmas, Canary Islands, Spain, on May 17th, 2019, at 22:00 UTC. The scientific mission of cruise *MSM83* started on May 19th at 18:06 UTC, when continuous logging of underway data was switched on. Course was set towards the Irish shelf break at Goban Spur. While on transit towards north, a number of test stations were carried out in deep water during May 20th to May 22nd. These served to check the performance of the conductivity-temperature-depth-oxygen (CTDO) unit and the two Lowered Acoustic Doppler Current Profilers (LADCP) attached to the carousel water sampler. Furthermore, the functioning of acoustic releases at depth was verified as well as first calibration casts for moored sensors were carried out. Between May 23rd and May 26th, we conducted a high-resolution CTDO/LADCP section along the crest of Goban Spur and started tracer sampling and data analysis. We also recovered and subsequently redeployed the two deep-sea moorings *EB-1* and *EB-3* and performed acoustic telemetry on the bottom-mounted pressure-sensor-equipped inverted echo-sounder (PIES) *BP-32*. In the following, we headed across the West European Basin along 47°/48°N and continued the hydrographic sampling program as well as work on two additional PIES (*BP-33* and *BP-34*).

Having arrived at PIES-station *BP-12* on May 31st 2019, we changed to a northwestern course and headed north along the western flank of the Mid-Atlantic Ridge (MAR). On June 2nd we recovered PIES *BP-15* and carried out hydrographic measurements along the same line while heading back to the 47°/48°N section.

Between June 5th and June 11th, we followed a westward course towards Flemish Cap,

while performing hydrographic stations, work on the PIES *BP-27*, *BP-28*, *BP-30*, and *BP-31*, and recovering the moorings *BM-22* and *BM-24*. After transiting across Flemish Cap, field work continued in the Flemish Pass. There, we recovered mooring *BM-25* and carried out a last hydrographic section across the width of the passage.

Station work ended on June 12th/13th with two last CTD stations for instrument calibrations, followed by the redeployment of mooring *BM-22* east of Flemish Cap. On June 13th, field work was finished, and we headed west towards St. John's, Newfoundland.

Continuous logging of underway data was stopped on June 15th, 09:30 UTC, which marked the end of the scientific mission of cruise *MSM83* aboard *RV MARIA S. MERIAN*. The vessel arrived at the pilot station of St. John's and was finally towed at Pier 17 at around 10:00 UTC the same day.

In total, 104 hydrographic profiles were carried out during cruise *MSM83*. Five deep-sea moorings were recovered, and three were subsequently reinstalled again. We recovered four PIES and redeployed three again. Seven *Argo* floats of type *NKE ARVOR I* were deployed along 47°/48°N. All were programmed to drift at a parking depth of 1000 dbar and to cycle between 2000 dbar and the sea surface every ten days.

Acknowledgements

We would like to express our gratitude to the master of the vessel, Björn Maaß, and his entire crew for the assistance and great support granted to us during cruise *MSM83*. We greatly appreciated the very friendly working environment. The hospitality experienced onboard the vessel and the very professional and constructive cooperation between the different scientific teams and the ship's team is greatly acknowledged. We further thank Barbara Kozak and Wolfgang Böke at our home laboratory for assistance in the preparation of the cruise, the German Research Foundation (DFG), the DFG's Geschäftstelle des Gutachterpanels Forschungsschiffe (GPF), and the German Research Fleet Coordination Centre (Leitstelle Deutsche Forschungsschiffe) that provided the necessary ship time, funding, and support to pursue all scientific work.

Table 1. Participants of cruise MSM83.

	Name	Institute	Field of Activity
1.	Kieke, Dagmar, Dr.	IUPHB/MARUM	chief scientist, LADCP processing
2.	Bulsiewicz, Klaus	IUPHB	tracer sampling and analysis
3.	Deschepper, Inge	ULAVAL	CTDO/LADCP, data analysis
4.	Huhn, Oliver, Dr.	IUPHB/MARUM	tracer sampling and analysis
5.	Kastens, Malinn	UHB	oxygen analysis
6.	Kersting, Arne, Dr.	IUBHEID	argon sampling, CTDO/LADCP
7.	Köllner, Manuela	BSH	mooring preparation and analysis
8.	Krisztian, Lina	IUPHB/MARUM	CTDO/LADCP, data processing
9.	Leimann, Ilmar	IUPHB/MARUM	CTDO/LADCP, data processing
10.	Mirau, Bastian	IUPHB/MARUM	mooring preparation, technics
11.	Moritz, Martin	BSH	mooring analysis, vmADCP data processing
12.	Rohlfs, Nina	IUPHB/MARUM	tracer sampling and analysis
13.	Schneehorst, Anja	BSH	mooring preparation, technics, float deployments
14.	Steinfeldt, Reiner, Dr.	IUPHB/MARUM	CTDO data processing and calibration, data analysis, salinometry
15.	Stendardo, Ilaria, Dr.	IUPHB/MARUM	PIES preparation and data processing
16.	Stiehler, Jan	IUPHB/MARUM	CTDO/LADCP, vmADCP data processing
17.	Tao, Ran	UEA	CTDO/LADCP, data processing

BSH	Federal Maritime and Hydrographic Agency, Hamburg, Germany
IUPHB	University of Bremen, Institute of Environmental Physics, Bremen, Germany
IUPHEID	University of Heidelberg, Institute of Environmental Physics, Heidelberg, Germany
MARUM	University of Bremen, Center for Marine Environmental Sciences, Bremen, Germany
UEA	University of Alberta, Edmonton, Alberta, Canada
UHB	University of Bremen, Faculty 2, Biology/Chemistry, Bremen, Germany
ULAVAL	Université Laval, Québec, Québec, Canada

Table 2. Argo float deployments during cruise *MSM83*.

MSM83-Station	Float s/n	WMO ID	Latitude	Longitude	Deployment Date/Time	CTD #
28-1	AI260019DE017	7900523	48°31.056'N	15°00.389'W	26 May 2019 17:37:24	28
41-1	AI260019DE013	7900524	47°57.498'N	26°20.329'W	30 May 2019 16:40:31	40
58-1	AI260019DE012	7900525	48°03.205'N	31°35.086'W	05 Jun 2019 02:10:49	57
62-1	AI260019DE015	7900526	47°27.308'N	34°29.638'W	06 Jun 2019 00:43:30	61
71-1	AI260019DE011	7900527	47°06.101'N	40°53.040'W	08 Jun 2019 11:08:33	70
78-1	AI260019DE009	7900528	47°05.307'N	42°35.354'W	10 Jun 2019 10:16:24	76
66-1	AI260019DE016	7900529	47°15.077'N	37°56.750'W	07 Jun 2019 03:33:19	65

All times are given as UTC. All deployed floats are of type *NKE ARVOR I* and carry conductivity, temperature, and pressure sensors. The parking depth is 1000 dbar, the cycling period is 10 days.

Table 3. Deep-Sea moorings recovered and deployed during cruise *MSM83*.

MSM83-Station	Mooring ID	Latitude	Longitude	Depth [m]	Recovery Date/Time	Deployment Date/Time	CTD Profile
7-2	EB-1/3	49°00.03'N	12°37.14'W	1534	23 May 2019 14:24 – 15:39	–	7
22-2	EB-1/4	49°00.03'N	12°37.02'W	1553	---	25 May 2019 07:14 – 08:56	7
6-2	EB-3/3	48°49.98'N	13°25.98'W	4453	23 May 2019 06:14 – 09:44	–	6
18-1	EB-3/4	48°49.98'N	13°26.03'W	4454	---	24 May 2019 12:33 – 15:44	6
75-1	BM-22/9	47°06.19'N	43°13.37'W	3048	09 Jun 2019 14:15 – 16:28	–	74
106-1	BM-22/10	47°06.19'N	43°13.37'W	3048	---	13 Jun 2019 10:12 – 12:42	103,104
74-2	BM-24/6	47°06.21'N	42°16.47'W	4008	09 Jun 2019 08:02 – 10:33	--	73
90-1	BM-25/6	47°07.11'N	47°06.38'W	1003	11 Jun 2019 19:32 – 20:11	–	88

All times are given as UTC. The top buoy of all deployed moorings was equipped with radio beacons, flags, flashers, and *Iridium* or *Argos* beacons.

Table 4. Activities related to inverted echo-sounders with pressure sensors (PIES).

MSM83 Station	PIES ID	s/n	Latitude	Longitude	Depth [m]	Deployment Date/Time	Telemetry Date/Time	Recovery Date/Time	CTD #
28-2	BP 32/3	075	48°31.09'N	15°00.10'W	4784	–	26 May 2019 14:21 – 17:23	–	28
33-1	BP 33/2	363	48°18.66'N	19°31.30'W	4553	–	27 May 2019 23:11 – 28 May 2019 01:30	28 May 2019 01:41 – 03:16	33
33-2	BP 33/3	240	48°18.66'N	19°31.29'W	4553	28 Jun 2019 03:42 – 06:02	–	–	33
37-1	BP 34/2	188	48°06.69'N	23°25.16'W	4484	–	29 May 2019 08:00-10:12	–	38
39-2	BP 34/2	188	48°06.69'N	23°25.16'W	4484	–	–	29 May 2019 21:06 – 22:41	38
39-3	BP 34/3	362	48°06.69'N	23°25.15'W	4484	29 May 2019 23:08 – 30 May 2019 00:55	–	–	38
45-2	BP 12/6	271	47°39.79'N	31°08.66'W	4094	–	31 May 2019 22:06 – 01 Jun 2019 01:34	–	44
49-2	BP 15/4	201	52°30.53'N	36°51.93'W	3387	–	02 Jun 2019 19:06 – 22:05	02 Jun 2019 22:35 – 23:42	48
65-2	BP 30/2	235	47°18.06'N	37°21.70'W	4539	–	06 Jun 2019 19:24 – 22:43	–	64
69-1	BP 28/4	272	47°10.21'N	39°28.70'W	4605	–	07 Jun 2019 14:52 – 17:46	–	68
71-2	BP 27/4	302	47°06.11'N	40°53.04'W	4499	–	08 Jun 2019 08:07 – 10:56	–	70
73-2	BP 31/3	303	47°05.17'N	42°00.77'W	4246	–	08 Jun 2019 telemetry not possible	–	72
76-1	BP 31/3	303	47°05.17'N	42°00.77'W	4246	–	–	09 Jun 2019 23:25 – 10 Jun 2019 01:20 recovery not possible	72
76-2	BP 31/4	201	47°05.90'N	42°01.02'W	4222	10 Jun 2019 01:30 – 02:48	–	–	72

All times are given as UTC. All instruments were equipped with flags, radio senders, and flashers.

Table 5. List of CTDO/lowered ADCP/water sampling stations carried out during cruise *MSM83*

MSM83 Station	Profile	Date	Time [UTC]	Latitude	Longitude	Water Depth [m]	Profile Depth [m]	SF_6 CFC	^{39}Ar	^{3}H	Bottle Oxygen	LADCP	Comment
1-1	1	2019/05/20	08:09	38°52.57'N	14°03.75'W	5372	4990	-	-	-	x	x	calibration stops for *Seaguard* devices
2-1	2	2019/05/20	13:22	39°8.93'N	14°01.86'W	3641	3732	-	-	-	x	x	test of acoustic releases 40 m above bottom
3-1	3	2019/05/20	17:11	39°23.49'N	14°00.31'W	4395	3445	-	-	-	x	x	calibration stops for *MicroCAT*, *Aquadopp*, *NKE* and *RBR* devices
4-1	4	2019/05/21	08:09	41°52.13'N	13°12.49'W	5338	3494	-	-	-	x	x	calibration stops for *Aquadopp* devices
5-1	5	2019/05/22	06:52	46°00.03'N	12°01.75'W	4815	4805	x	x	x	x	x	test of acoustic releases 30 m above bottom
6-1	6	2019/05/23	02:16	48°49.00'N	13°25.47'W	4442	4428	x	-	-	x	x	
7-1	7	2019/05/23	11:15	48°59.87'N	12°35.56'W	1534	1522	x	-	-	x	x	
8-1	8	2019/05/23	16:44	49°01.57'N	12°26.49'W	1282	1262	-	-	-	-	x	
9-1	9	2019/05/23	18:47	49°04.75'N	12°11.67'W	1019	1006	x	-	-	x	x	
10-1	10	2019/05/23	20:41	49°07.78'N	11°56.58'W	858	845	-	-	-	-	x	
11-1	11	2019/05/23	22:30	49°11.02'N	11°41.77'W	797	780	x	-	-	x	x	
12-1	12	2019/05/24	00:14	49°14.16'N	11°26.73'W	470	452	x	-	-	x	x	test of radio and *Argos* beacon
13-1	13	2019/05/24	01:21	49°15.70'N	11°19.30'W	283	267	x	-	-	x	x	
14-1	14	2019/05/24	02:45	49°12.59'N	11°34.18'W	630	614	-	-	-	-	x	
15-1	15	2019/05/24	04:20	49°09.42'N	11°49.09'W	800	787	x	-	-	x	x	

16-1	16	2019/05/24	06:08	49°06.26'N	12°04.03'W	925	907	-	-	-	-	x	
17-1	17	2019/05/24	07:50	49°03.10'N	12°19.07'W	1138	1123	x	-	-	x	x	
18-2	18	2019/05/24	16:56	48°49.96'N	13°24.44'W	4320	4279	-	-	-	x	x	calibration stops for *MicroCAT* devices, test of radio and flasher beacons
19-1	19	2019/05/24	21:26	48°53.76'N	13°03.79'W	3630	3610	x	x	x	x	x	
20-1	20	2019/05/25	00:39	48°56.86'N	12°48.76'W	2090	2075	x	-	-	x	x	test of radio and *Iridium* beacons
21-1	21	2019/05/25	02:37	48°58.42'N	12°41.25'W	1772	1758	-	-	-	-	x	
22-1	22	2019/05/25	04:21	49°00.02'N	12°37.07'W	1543	1530	-	-	-	-	x	
23-1	23	2019/05/25	10:35	48°55.54'N	12°56.99'W	2620	2602	-	-	-	-	x	
24-1	24	2019/05/25	13:20	48°51.68'N	13°13.84'W	3752	3735	x	-	-	x	x	
25-1	25	2019/05/25	17:44	48°44.98'N	13°48.43'W	4534	4520	x	-	-	x	x	
26-1	26	2019/05/26	00:06	48°40.22'N	14°10.89'W	4544	4529	-	-	-	x	x	
27-1	27	2019/05/26	04:43	48°35.49'N	14°33.20'W	4699	4684	x	-	-	x	x	
28-1	28	2019/05/26	10:15	48°31.12'N	15°00.19'W	4810	4796	x	-	-	x	x	
29-1	29	2019/05/26	21:07	48°28.58'N	16°01.86'W	4838	4822	x	-	-	x	x	
30-1	30	2019/05/27	03:23	48°25.34'N	17°02.35'W	4171	4154	x	-	-	x	x	
31-1	31	2019/05/27	12:07	48°22.10'N	18°02.78'W	4509	4489	x	-	-	x	x	
32-1	32	2019/05/27	17:30	48°20.50'N	18°46.86'W	4351	4337	x	-	-	x	x	
33-1	33	2019/05/28	06:10	48°18.72'N	19°31.24'W	4566	4551	x	-	-	x	x	
34-1	34	2019/05/28	12:15	48°15.76'N	20°29.92'W	4180	4163	x	-	-	x	x	

35-1	35	2019/05/28	18:14	48°12.75'N	21°28.54'W	4453	4438	x	-	-	x	x	
36-1	36	2019/05/29	00:24	48°09.73'N	22°27.17'W	4253	4225	x	-	-	x	x	
38-1	37	2019/05/29	12:48	48°05.15'N	23°54.89'W	4089	4075	x	-	-	x	x	
39-1	38	2019/05/29	17:07	48°06.78'N	23°25.06'W	4503	4481	x	-	-	x	x	
40-1	39	2019/05/30	07:46	48°01.67'N	25°07.47'W	3885	3859	x	-	-	x	x	
41-1	40	2019/05/30	14:56	47°57.52'N	26°20.03'W	3015	3014	x	-	-	x	x	
42-1	41	2019/05/30	22:33	47°53.34'N	27°32.60'W	3443	3287	x	-	-	x	x	
43-1	42	2019/05/31	06:04	47°49.18'N	28°45.19'W	2999	2692	-	-	-	-	x	profile aborted during downcast @2730 dbar due to electronic failure
44-1	43	2019/05/31	12:54	47°45.03'N	29°57.75'W	3487	3464	x	-	-	x	x	
45-1	44	2019/05/31	19:21	47°39.80'N	31°08.61'W	4095	4068	x	-	-	x	x	
46-1	45	2019/06/02	04:00	51°42.47'N	35°54.40'W	3448	3413	x	-	-	x	x	
47-1	46	2019/06/02	08:35	52°06.79'N	36°23.13'W	3352	3323	x	-	-	x	x	
48-1	47	2019/06/02	12:52	52°18.85'N	36°37.69'W	3714	287	-	-	-	-	x	profile aborted during downcast @300 dbar due to electronic failure
49-1	48	2019/06/02	15:56	52°30.07'N	36°51.64'W	3429	3394	x	x	x	x	x	calibration stops for *Seaguard* devices
50-1	49	2019/06/03	06:57	51°18.14'N	35°25.56'W	3719	3686	x	-	-	x	x	
51-1	50	2019/06/03	11:54	50°53.70'N	34°56.63'W	3565	3496	x	-	-	x	x	test of acoustic releases 30 m above bottom
52-1	51	2019/06/03	16:53	50°29.42'N	34°28.04'W	4060	4035	x	-	-	x	x	calibration stops for *MicroCAT*, *Aquadopp* and *NKE* devices
53-1	52	2019/06/03	22:25	50°05.03'N	33°59.11'W	4258	4228	x	-	-	x	x	

54-1	53	2019/06/04	03:15	49°40.70'N	33°30.41'W	4023	3981	x	-	-	x	x	
55-1	54	2019/06/04	08:18	49°16.41'N	33°01.61'W	3819	3791	x	-	-	x	x	
56-1	55	2019/06/04	13:35	48°51.99'N	32°32.70'W	3820	3816	x	-	-	x	x	
57-1	56	2019/06/04	18:37	48°27.72'N	32°03.95'W	4205	4196	-	-	-	x	x	
58-1	57	2019/06/04	23:49	48°03.34'N	31°35.03'W	3928	3924	x	-	-	x	x	
59-1	58	2019/06/05	04:30	47°37.46'N	31°37.47'W	3748	3747	x	-	-	x	x	
60-1	59	2019/06/05	10:31	47°34.48'N	32°34.61'W	3955	3954	x	-	-	x	x	
61-1	60	2019/06/05	16:29	47°30.83'N	33°32.12'W	4090	4087	x	-	-	x	x	
62-1	61	2019/06/05	22:07	47°27.27'N	34°29.47'W	4403	4395	x	-	-	x	x	
63-1	62	2019/06/06	04:04	47°23.66'N	35°26.92'W	4309	4300	x	-	-	x	x	
64-1	63	2019/06/06	10:15	47°20.04'N	36°24.30'W	4235	4229	x	-	-	x	x	
65-1	64	2019/06/06	15:56	47°17.97'N	37°20.95'W	4547	4541	x	x	x	x	x	
66-1	65	2019/06/07	00:50	47°15.07'N	37°56.61'W	4588	4587	-	-	-	x	x	
67-1	66	2019/06/07	05:40	47°12.49'N	38°31.07'W	4614	4607	x	-	-	x	x	
68-1	67	2019/06/07	10:09	47°10.27'N	39°01.20'W	4588	4580	x	-	-	x	x	
69-2	68	2019/06/07	18:11	47°10.66'N	39°28.47'W	4580	4577	x	-	-	x	x	
70-1	69	2019/06/07	23:27	47°06.59'N	40°11.29'W	4565	4554	x	-	-	x	x	
71-1	70	2019/06/08	04:23	47°06.57'N	40°52.65'W	4740	4478	x	-	-	x	x	
72-1	71	2019/06/08	13:13	47°06.32'N	41°26.99'W	4341	4338	x	-	-	x	x	

73-1	72	2019/06/08	18:30	47°05.89'N	41°59.88'W	4236	4218	x	-	-	x	x	
74-1	73	2019/06/08	23:56	47°06.04'N	42°13.42'W	4074	4050	x	-	-	x	x	
75-2	74	2019/06/09	16:48	47°06.15'N	43°13.10'W	3059	3040	x	-	-	x	x	
77-1	75	2019/06/10	04:13	47°06.22'N	42°16.45'W	4013	3986	-	-	-	x	x	
78-1	76	2019/06/10	08:01	47°06.04'N	42°35.41'W	3680	3659	x	-	-	x	x	
79-1	77	2019/06/10	11:41	47°06.02'N	42°53.60'W	3467	3439	x	-	-	x	x	test of radio, flasher, and *Iridium* beacons
80-1	78	2019/06/10	14:50	47°06.12'N	43°07.12'W	3514	3501	x	x	x	x	x	
81-1	79	2019/06/10	17:38	47°06.20'N	43°13.36'W	3049	3023	-	-	-	-	x	
82-1	80	2019/06/10	19:57	47°06.06'N	43°17.78'W	2677	2565	x	-	-	x	x	
83-1	81	2019/06/10	21:57	47°05.95'N	43°19.94'W	1960	1943	x	-	-	x	x	
84-1	82	2019/06/10	23:42	47°06.04'N	43°25.22'W	1292	1263	x	-	-	x	x	
85-1	83	2019/06/11	01:42	47°05.99'N	43°38.35'W	775	755	-	-	-	x	x	
86-1	84	2019/06/11	03:09	47°05.99'N	43°47.43'W	595	573	x	-	-	x	x	
87-1	85	2019/06/11	05:00	47°06.06'N	44°02.50'W	364	343	x	-	-	x	x	
88-1	86	2019/06/11	06:55	47°05.59'N	44°17.88'W	252	232	-	-	-	-	x	
89-1	87	2019/06/11	08:26	47°06.02'N	44°29.97'W	165	146	-	-	-	-	x	
90-2	88	2019/06/11	20:22	47°07.09'N	47°06.37'W	1013	979	-	-	-	x	x	
91-1	89	2019/06/11	22:18	47°05.62'N	47°22.81'W	243	223	-	-	-	-	x	
92-1	90	2019/06/11	22:56	47°05.78'N	47°19.36'W	313	293	x	-	-	x	x	

93-1	91	2019/06/11	23:41	47°05.91'N	47°15.81'W	483	461	-	-	-	-	x	
94-1	92	2019/06/12	00:26	47°06.00'N	47°12.48'W	739	720	x	-	-	x	x	
95-1	93	2019/06/12	01:21	47°05.93'N	47°09.28'W	890	866	-	-	-	-	x	
96-1	94	2019/06/12	02:26	47°05.90'N	47°05.84'W	1034	1006	x	-	-	x	x	
97-1	95	2019/06/12	03:39	47°06.06'N	47°00.53'W	1134	1114	-	-	-	-	x	
98-1	96	2019/06/12	05:12	47°06.01'N	46°51.24'W	1178	1156	x	-	-	x	x	
99-1	97	2019/06/12	06:42	47°06.00'N	46°42.44'W	1148	1124	-	-	-	-	x	
100-1	98	2019/06/12	07:47	47°06.05'N	46°39.95'W	1107	1079	x	-	-	x	x	
101-1	99	2019/06/12	08:56	47°06.08'N	46°36.61'W	820	791	-	-	-	-	x	
102-1	100	2019/06/12	09:52	47°06.06'N	46°33.20'W	502	475	x	-	-	x	x	
103-1	101	2019/06/12	10:56	47°06.13'N	46°24.17'W	363	343	x	-	-	x	x	
104-1	102	2019/06/12	12:20	47°06.07'N	46°08.35'W	336	321	-	-	-	-	x	
105-1	103	2019/06/12	22:07	47°06.19'N	43°13.32'W	3032	3026	-	-	-	-	x	calibration stops for *MicroCAT* and *Aquadopp* devices
105-2	104	2019/06/13	01:11	47°05.96'N	43°12.76'W	3052	3066	-	-	-	-	x	calibration stops for *MicroCAT* and *Aquadopp* devices