

# MSM15/1

Maria S. Merian cruise to the Black Sea -

Processing logs for

Navigation

Multibeam

Sediment echosounder

Navigation (usbl) for

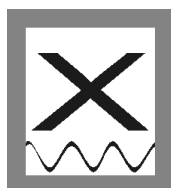
JAGO

MEDUSA

TV-MUC

provided **(2010)** by

Frederic Tardeck, FIELAX Gesellschaft für wissenschaftliche Datenverarbeitung mbH



by order of

Prof. Dr. Antje Boetius, Alfred Wegener Institute on behalf of the HYPOX project



## **MSM15-1 processing log** **Ship's navigation data**

### **a) Original data**

The original navigation data was extracted from the DSHIP data base on board of R/V "Maria S. Merian" in 1 second interval.

These data sets contain:

- GPS position from Seapath 200 INS
- Speed from Seapath 200 INS
- Heading from Seapath 200 INS
- Depth from deep water sounder (Simrad EA600)

### **b) Processing**

#### **I. Processing steps:**

1. Extraction of source data from DSHIP data base
2. Manual validation of erroneous positions by reviewing speed, time and distance jumps
3. Removing of invalid positions
4. Conversion of data to daily files of 1 and 10 second resolution

#### **II. Processed data:**

Result of the processing is the verified navigation in 1 second and in 10 second interval, held in ASCII table files (tab delimited) with the following format:

- Column 1: Latitude [decimal degree]
- Column 2: Longitude [decimal degree]
- Column 3: Date [Format: DD.MM.YYYY HH:MM:SS]
- Column 4: Flag
- Column 5: Speed [knots]
- Column 6: Heading [degree]
- Column 7: Depth [metres]

The flag string consists of four digits with the following meaning:

Digit 1:

- [0]: No position available
- [1]: Position based on sensor Seapath 200 INS
- [2]: Position based on sensor Leica DGPS

Digit 2:

- [0]: Position is not pitch corrected
- [1]: Position is pitch corrected

Digit 3:

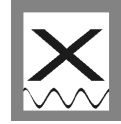
- [0]: Position is not roll corrected
- [1]: Position is roll corrected

Digit 4:

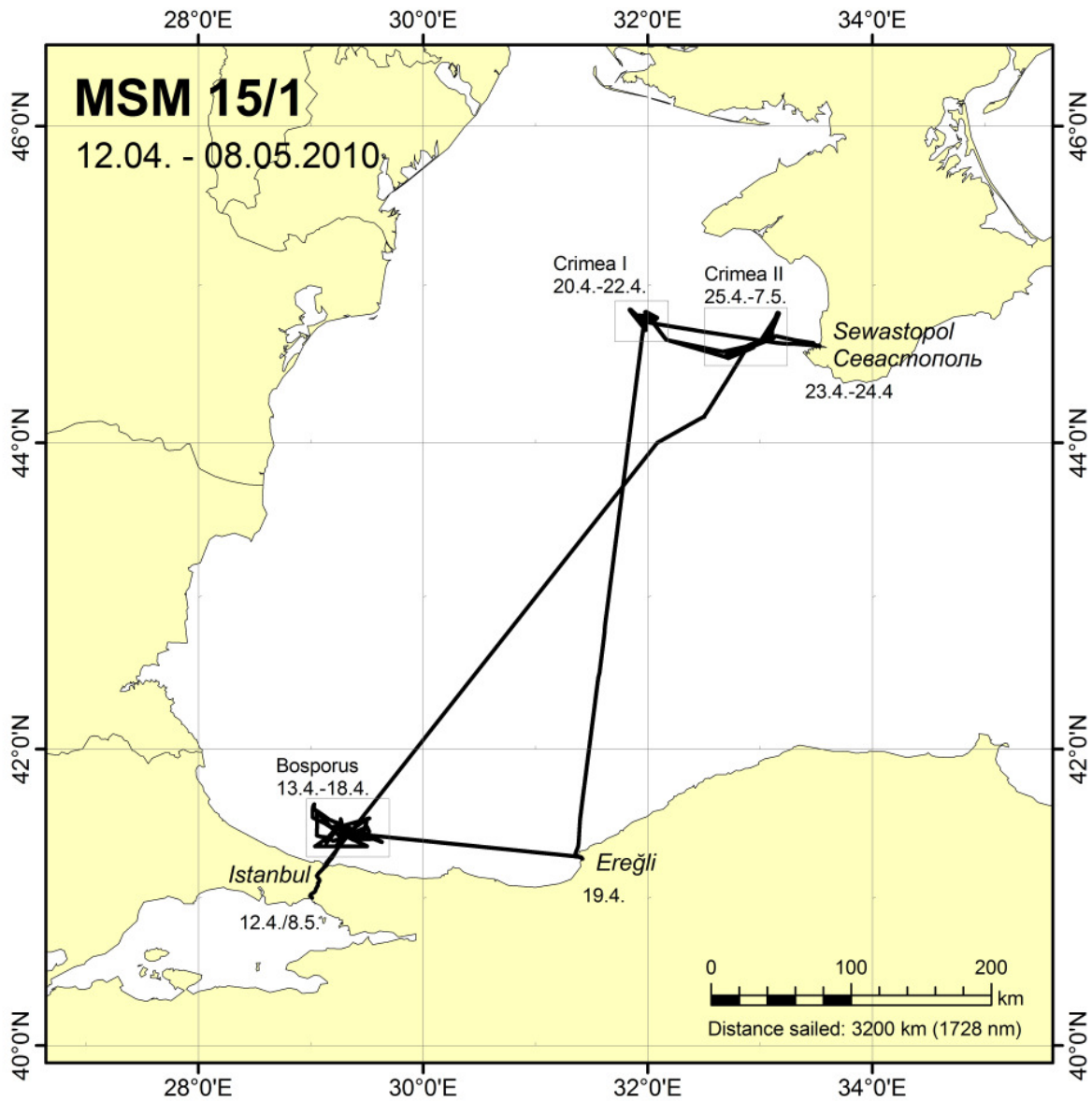
- [0]: Centering is based on heading from GPS data (less accurate)
- [1]: Centering is based on heading from Motion-Reference-Unit

#### **III. Statistic**

Data volume 1-second-interval data:	138 MB
First data set:	12.04.2010 00:00:00
Last data set:	08.05.2010 05:00:00
Total number of 1s positions after processing:	2332688
Number of positions missing (DSHIP error values)	112 (<0.0001%)



**c) Cruise plot**





## MSM 15/1 processing log Multibeam echosounder data (EM1002)

### a) Surveys

The following EM1002 surveys have been performed during this cruise. All surveys were run with a vessel speed of 5 knots. Atlas Parasound data has been recorded during most of the surveys, too.

Survey	Time (UTC)	Position Lat.	Position Long.	Depth [m]	Heading [deg]	Speed [kn]	Action
Area: Bosphorus							
MSM15/305-1	17.04.2010 09:44	41° 30.24' N	29° 16.45' E	326.9	214.7	0.2	start profile
<i>During TV-MUC</i>	17.04.2010 15:47	41° 22.27' N	29° 8.30' E	82.0	222.7	0.1	profile end
Area: Crimea I							
MSM15/345-1	20.04.2010 21:10	44° 47.37' N	31° 56.18' E	154.7	313.8	5	start profile
	21.04.2010 03:50	44° 43.43' N	31° 58.57' E	703.7	139.6	4.8	profile end
MSM15/357-1	21.04.2010 21:42	44° 48.62' N	31° 59.74' E	300.5	135.9	3.9	start profile
	22.04.2010 05:31	44° 48.01' N	32° 4.81' E	472.2	117.7	4.9	profile end
Area: Crimea II							
MSM15/369-1	24.04.2010 21:02	44° 34.01' N	32° 42.40' E	395.5	43	0.3	start profile
	25.04.2010 05:15	44° 37.31' N	32° 55.12' E	157.1	68.8	4.9	profile end
MSM15/376-1	26.04.2010 00:47	44° 36.87' N	32° 53.46' E	164.4	62.5	5.3	start profile
	26.04.2010 08:04	44° 35.83' N	32° 49.77' E	200.5	68.1	5.2	profile end
MSM15/391-1	27.04.2010 05:08	44° 36.78' N	32° 53.42' E	165.9	62	4	start profile
	27.04.2010 10:14	44° 35.85' N	32° 49.94' E	199.7	64	5.2	profile end
MSM15/417-1	29.04.2010 14:18	44° 36.81' N	32° 55.29' E	157.5	63.6	4.5	start profile
	30.04.2010 05:09	44° 32.60' N	32° 43.22' E	569	247.3	5.5	profile end
MSM15/441-1	01.05.2010 08:44	44° 40.53' N	33° 5.68' E	0	78.9	3	start profile
	01.05.2010 10:46	44° 49.49' N	33° 9.60' E	104.3	4.7	0.1	profile end
MSM15/445-1	01.05.2010 15:03	44° 48.90' N	33° 9.23' E	105	169.8	0	start profile
	01.05.2010 17:08	44° 38.69' N	33° 0.31' E	136.6	222.6	1.2	profile end
MSM15/461-1	02.05.2010 17:01	44° 39.29' N	33° 0.81' E	0	9.1	3.3	start profile
	02.05.2010 19:07	44° 49.56' N	33° 9.34' E	103.9	23.3	5	profile end
MSM15/475-1	03.05.2010 01:08	44° 49.42' N	33° 9.67' E	101.7	186.8	0.7	start profile
	03.05.2010 03:58	44° 49.44' N	33° 9.84' E	103.9	22.1	5	profile end
MSM15/483-1	03.05.2010 15:46	44° 49.62' N	33° 9.22' E	801.5	213.4	2.7	start profile
	03.05.2010 17:13	44° 49.42' N	33° 9.70' E	103.9	23.2	5.1	profile end
MSM15/485-1	04.05.2010 03:00	44° 49.49' N	33° 9.25' E	106.9	58.5	0.2	profile start
	04.05.2010 06:25	44° 39.31' N	33° 1.50' E	133.2	221.2	7	profile end
Infill survey	06.05.2010 15:44	44° 38.56' N	33° 0.07' E	136.9	184.5	0	start profile
	06.05.2010 18:00	44° 48.98' N	33° 9.18' E	104.7	21.2	5.2	profile end

### b) Original data

The original data was recorded by the Kongsberg software SIS. The time period of each raw data file is approx. 30 minutes. The data set contains 160 files (approx. 4 GB) in Kongsberg's .all format.

Data from the following sensors are included in the multibeam raw data:

Bathymetry data: Kongsberg EM1002

Position (GGA): Seapath MRU based on Leica DGPS

Heading: Seapath MRU

Speed (VTG): Seapath MRU based on Leica DGPS

Heave/Pitch/Roll: Seapath MRU

Sound velocity water column: Acquired from CTD casts (Seabird CTD)

Sound velocity at transducer: SVProbe sound velocity profiler and sound velocity sensor

Time (ZDA): Leica DGPS



### c) Processing

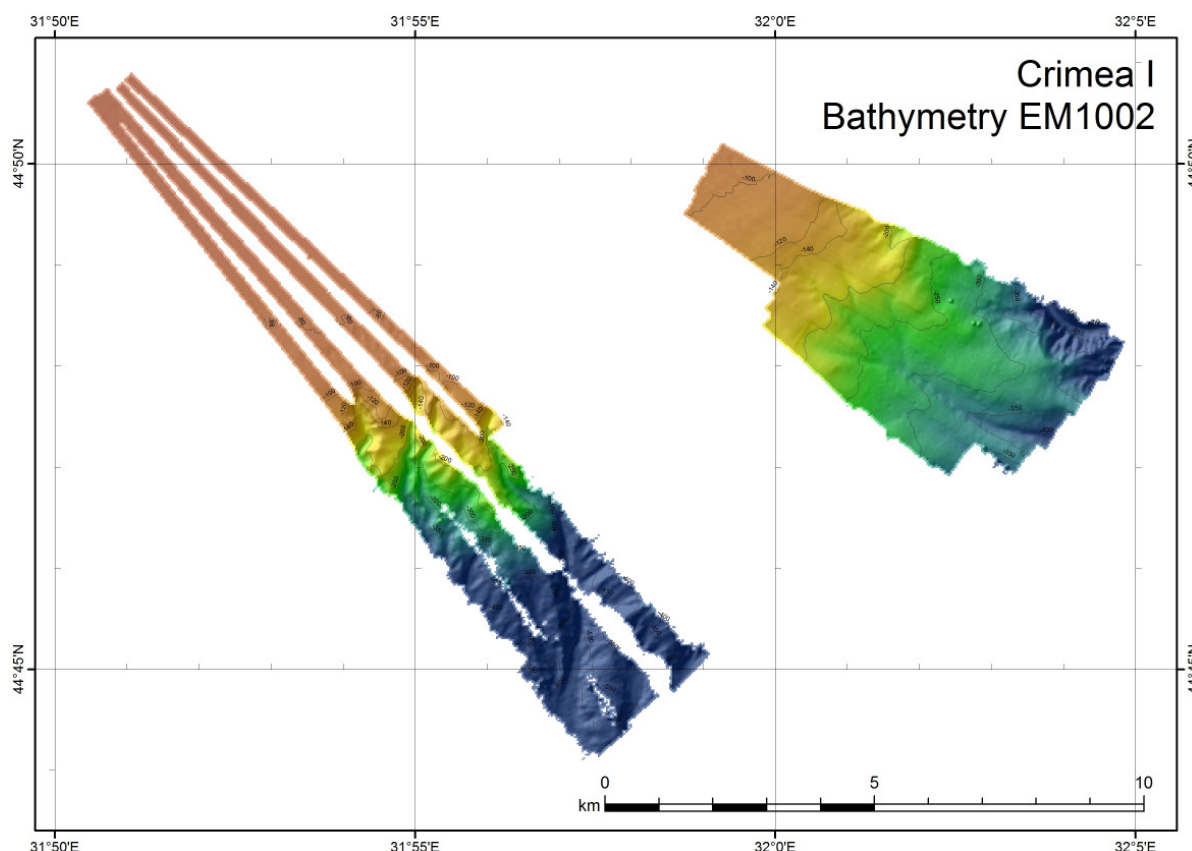
The post processing was done with Kongsberg Neptune on board Maria S. Merian. For the two processed survey areas Crimea I and Crimea II two separate Neptune projects were created and raw data from the survey lines has been imported accordingly. In the position editor ship turns and further outliers have been manually rejected from the navigation. Due to a systematic error of the EM1002 in the right outer swath 24 beams from the starboard side (beam numbers 88-111) have been rejected for all survey lines. Afterwards a grid of appropriate cell size has been calculated and noise and standard deviation filters have been applied. The resulting data has been exported to plaintext XYZ files.

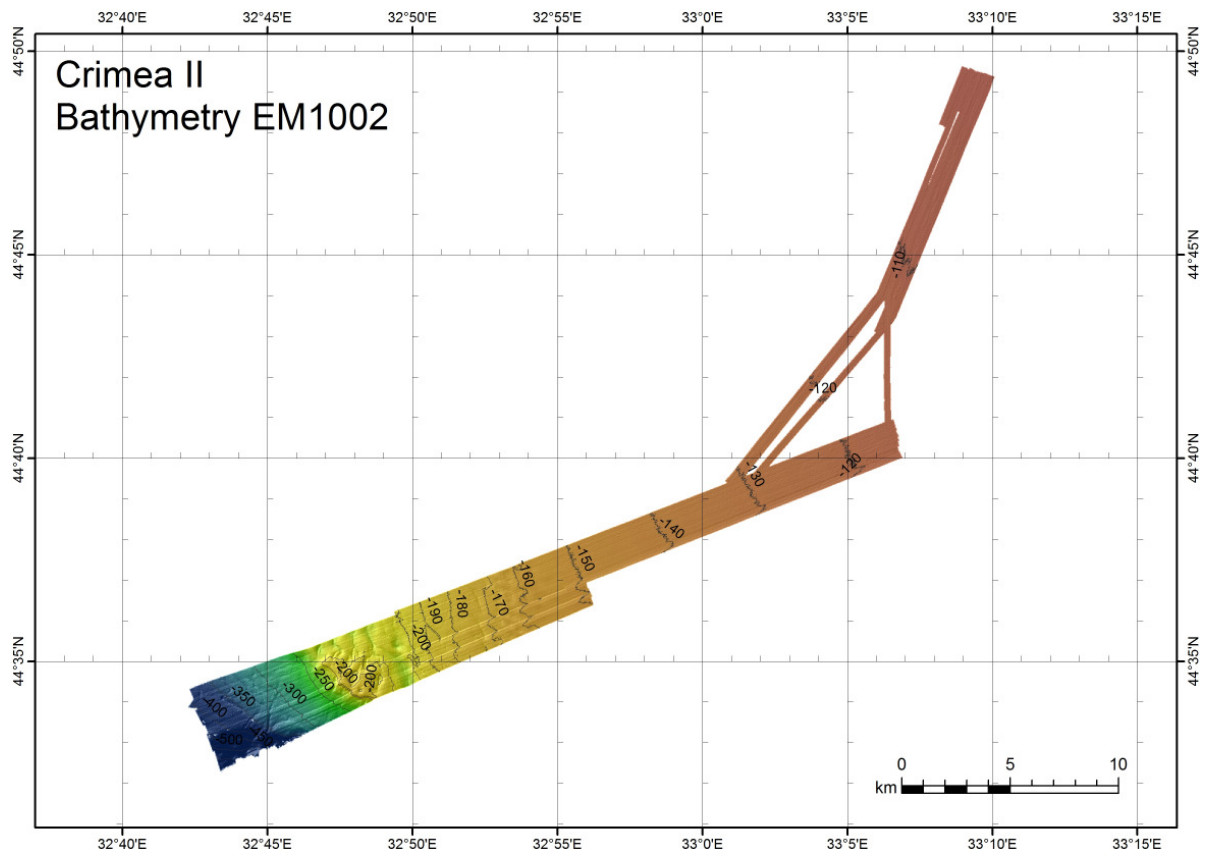
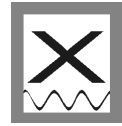
### d) File description

The multibeam survey data is available in the following data formats:

- Raw data files
  - o Kongsberg .all files stored survey-wise in tar-archives
  - o Example: *msm15-1\_305-1\_EM1002-all.tar*
- Processed XYZ files
  - o Plaintext XYZ files for each survey area containing all accepted depth soundings in the format: LATITUDE [deg] LONGITUDE [deg] DEPTH [m]
  - o Example: *msm15-1\_multibeam-em1002\_crimea2.xyz*
- Maps of survey areas
  - o JPG map of the survey area created with ArcGIS
  - o Example: *msm15-1\_multibeam-em1002\_crimea2.jpg*

### e) Maps







## MSM 15/1 processing log Sediment echosounder data (Atlas Parasound)

### a) Surveys

The following Atlas Parasound surveys have been performed during this cruise. All surveys were run with a vessel speed of 5 knots. EM1002 multibeam data has been recorded during all surveys, too.

Survey	Time (UTC)	Position Lat.	Position Long.	Depth [m]	Heading [deg]	Speed [kn]	Action
Area: Crimea I							
MSM15/345-1	20.04.2010 21:10	44° 47.37' N	31° 56.18' E	154.7	313.8	5	start profile
	21.04.2010 03:50	44° 43.43' N	31° 58.57' E	703.7	139.6	4.8	profile end
MSM15/357-1	21.04.2010 21:42	44° 48.62' N	31° 59.74' E	300.5	135.9	3.9	start profile
	22.04.2010 05:31	44° 48.01' N	32° 4.81' E	472.2	117.7	4.9	profile end
Area: Crimea II							
MSM15/369-1	24.04.2010 21:02	44° 34.01' N	32° 42.40' E	395.5	43	0.3	start profile
	25.04.2010 05:15	44° 37.31' N	32° 55.12' E	157.1	68.8	4.9	profile end
MSM15/376-1	26.04.2010 00:47	44° 36.87' N	32° 53.46' E	164.4	62.5	5.3	start profile
	26.04.2010 08:04	44° 35.83' N	32° 49.77' E	200.5	68.1	5.2	profile end
MSM15/391-1	27.04.2010 05:08	44° 36.78' N	32° 53.42' E	165.9	62	4	start profile
	27.04.2010 10:14	44° 35.85' N	32° 49.94' E	199.7	64	5.2	profile end
MSM15/417-1	29.04.2010 14:18	44° 36.81' N	32° 55.29' E	157.5	63.6	4.5	start profile
	30.04.2010 05:09	44° 32.60' N	32° 43.22' E	569	247.3	5.5	profile end
MSM15/445-1	01.05.2010 15:03	44° 48.90' N	33° 9.23' E	105	169.8	0	start profile
	01.05.2010 17:08	44° 38.69' N	33° 0.31' E	136.6	222.6	1.2	profile end
MSM15/461-1	02.05.2010 17:01	44° 39.29' N	33° 0.81' E	0	9.1	3.3	start profile
	02.05.2010 19:07	44° 49.56' N	33° 9.34' E	103.9	23.3	5	profile end
MSM15/475-1	03.05.2010 01:08	44° 49.42' N	33° 9.67' E	101.7	186.8	0.7	start profile
	03.05.2010 03:58	44° 49.44' N	33° 9.84' E	103.9	22.1	5	profile end
MSM15/483-1	03.05.2010 15:46	44° 49.62' N	33° 9.22' E	801.5	213.4	2.7	start profile
	03.05.2010 17:13	44° 49.42' N	33° 9.70' E	103.9	23.2	5.1	profile end
MSM15/485-1	04.05.2010 03:00	44° 49.49' N	33° 9.25' E	106.9	58.5	0.2	profile start
	04.05.2010 06:25	44° 39.31' N	33° 1.50' E	133.2	221.2	7	profile end
Infill survey	06.05.2010 15:44	44° 38.56' N	33° 0.07' E	136.9	184.5	0	start profile
	06.05.2010 18:00	44° 48.98' N	33° 9.18' E	104.7	21.2	5.2	profile end

### b) Original data

The following Atlas Parasound data types were recorded:

- PHF (primary high frequency, ~20 KHz) in ASD/PS3/SGY formats at a window range from seafloor to approx. 200 m above (for gas flare observation)
- SLF (secondary low frequency, ~4 KHz) for the sediment layer in ASD/PS3/SGY formats

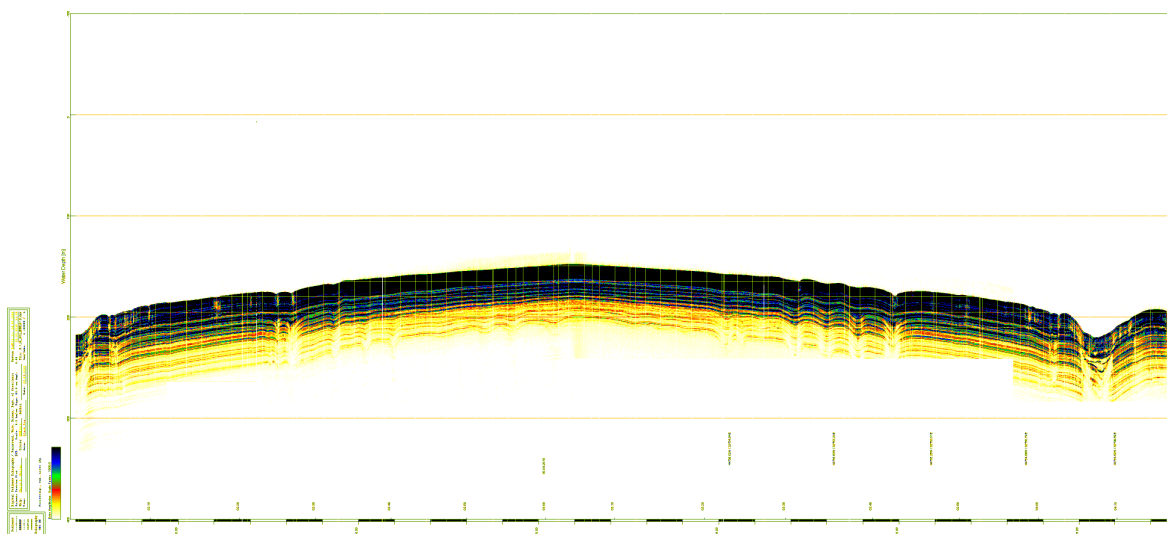
### c) Processing

The file headers of Atlas Parasound ASD- and PS3-files contain the original navigation recorded at expedition time. No further navigation processing was made.

The ASD, PS3 and SGY files are published as TAR archives each containing the data for one survey station.

### d) Data visualization with SeNT

SeNT (Se suite for Windows NT, from Universität Bremen, Hanno Keil) was used to create plots of the Parasound PS3 data. The data of each survey and each frequency (PHF, SLF) was plotted by distance (500 m per cm) and saved as PNG image file. See an example plot below.



**Figure 1: Exemplary plot of Atlas Parasound SLF data**





## **MSM15-1 processing log JAGO Navigation data**

### **a) Original data**

The original navigation data was extracted from the USBL-Positioning system via the DSHIP database on board of R/V "Maria S. Merian" in 1 second interval.

These data sets contain:

- USBL position from Posidonia
- Timestamp
- Immersion

### **b) Processing**

#### **I. Processing steps:**

1. Extraction of source data from DSHIP data base
2. Manual validation of erroneous positions by reviewing speed, time and distance jumps
3. Removing of invalid positions
4. Interpolating missing data
5. Conversion of data to daily files of 1 and 10 second resolution

#### **II. Processed data:**

Result of the processing is the verified navigation in 1 second and in 10 second interval, held in ASCII table files (tab delimited) with the following format:

- Column 1: Latitude [decimal degree]
- Column 2: Longitude [decimal degree]
- Column 3: Date [Format: DD.MM.YYYY HH:MM:SS]
- Column 4: Immersion [metres]
- Column 5: Flag

The flag string consists of four digits with the following meaning:

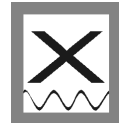
- Digit 1:
  - [0]: Position based on USBL sensor
  - [1]: Interpolated position

#### **III. Additional data**

Oxygen optode data was recorded during the dive. The data is saved as plain text, tab separated and readable with any text editor or excel. The raw optode data has been merged with JAGO navigation. It contains only data from the time JAGO was at the seafloor. The first 15 minutes at the seafloor are removed due to the optode's latency.

#### **IV. Statistic**

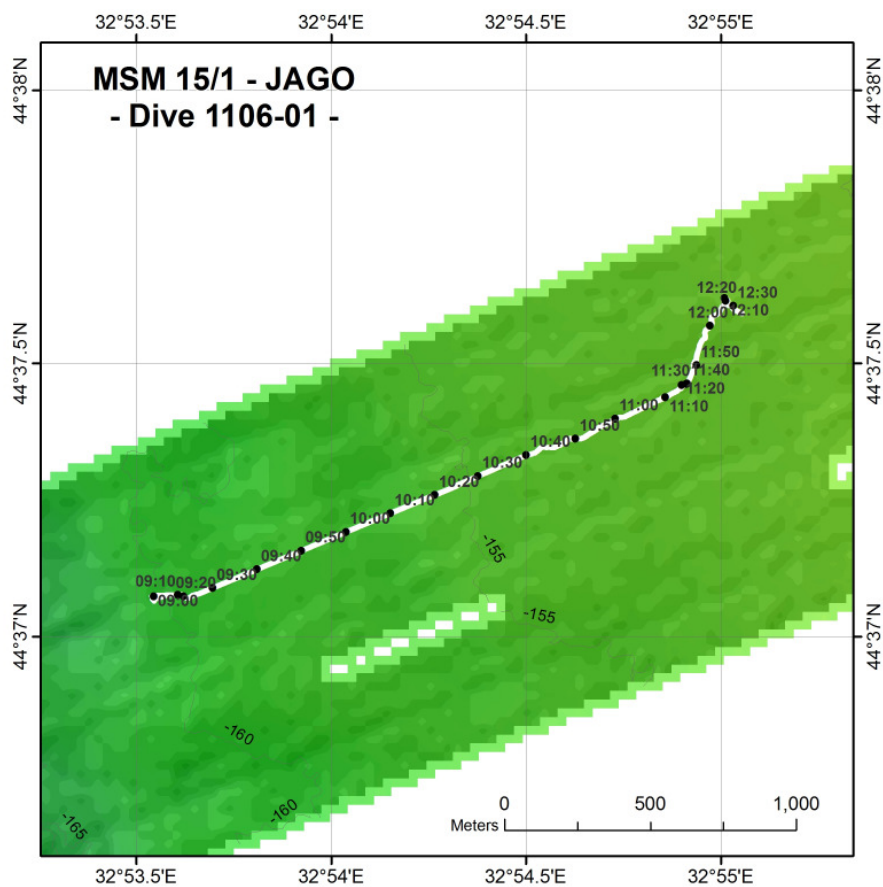
Station Number	Dive Number	Starttime	Endtime	Number of 1 s Positions	Interpolated Positions [%]
MSM15/372-1	1106	25.04.2010 08:53:29	25.04.2010 12:36:18	13369	91.794
MSM15/374-1	1107	25.04.2010 17:41:23	25.04.2010 19:59:19	8276	88.606
MSM15/394-1	1108	27.04.2010 13:37:51	27.04.2010 16:53:33	11742	84.517
MSM15/398-1	1109	28.04.2010 05:38:23	28.04.2010 07:08:08	5385	96.230
MSM15/405-1	1110	28.04.2010 14:28:28	28.04.2010 17:44:10	11742	83.512
MSM15/412-1	1111	29.04.2010 05:35:31	29.04.2010 07:57:00	8489	82.884
MSM15/416-1	1112	29.04.2010 11:37:14	29.04.2010 12:53:54	8460	92.283
MSM15/440-1	1113	01.05.2010 06:35:03	01.05.2010 08:09:51	5689	83.386

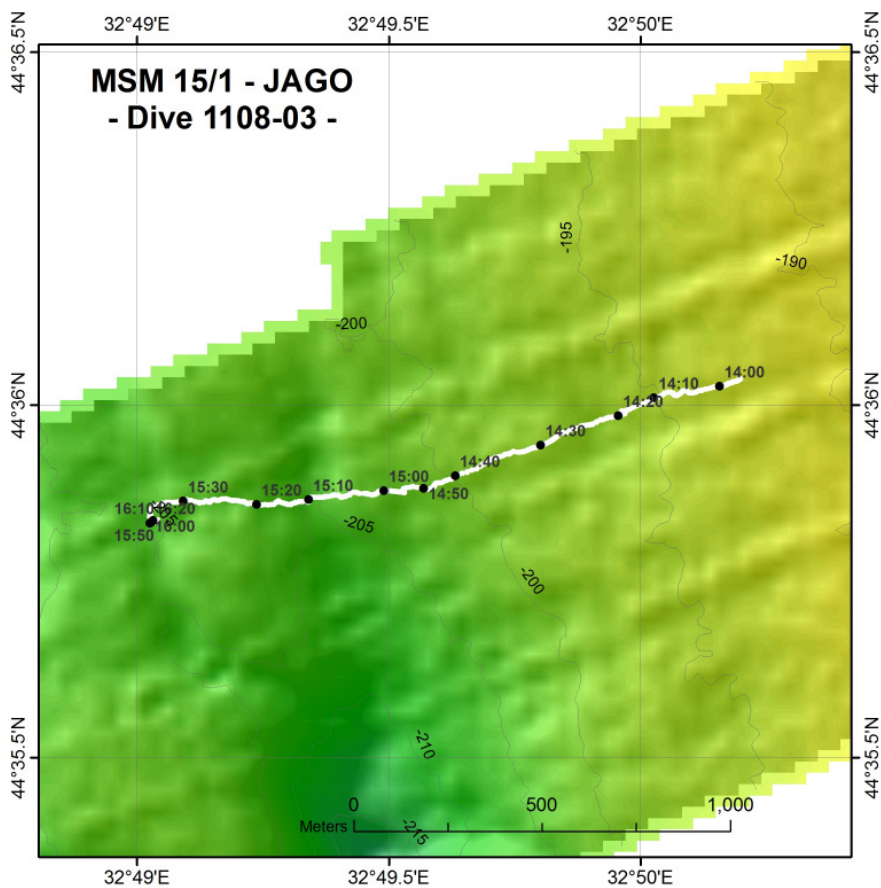
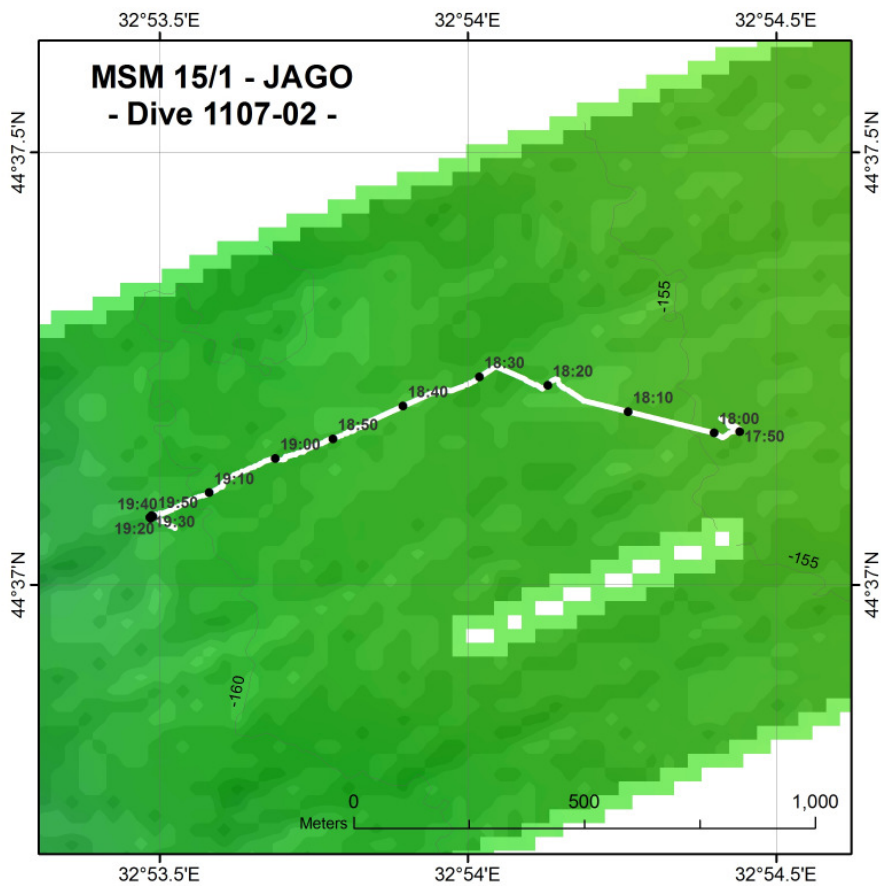
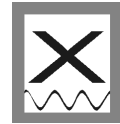


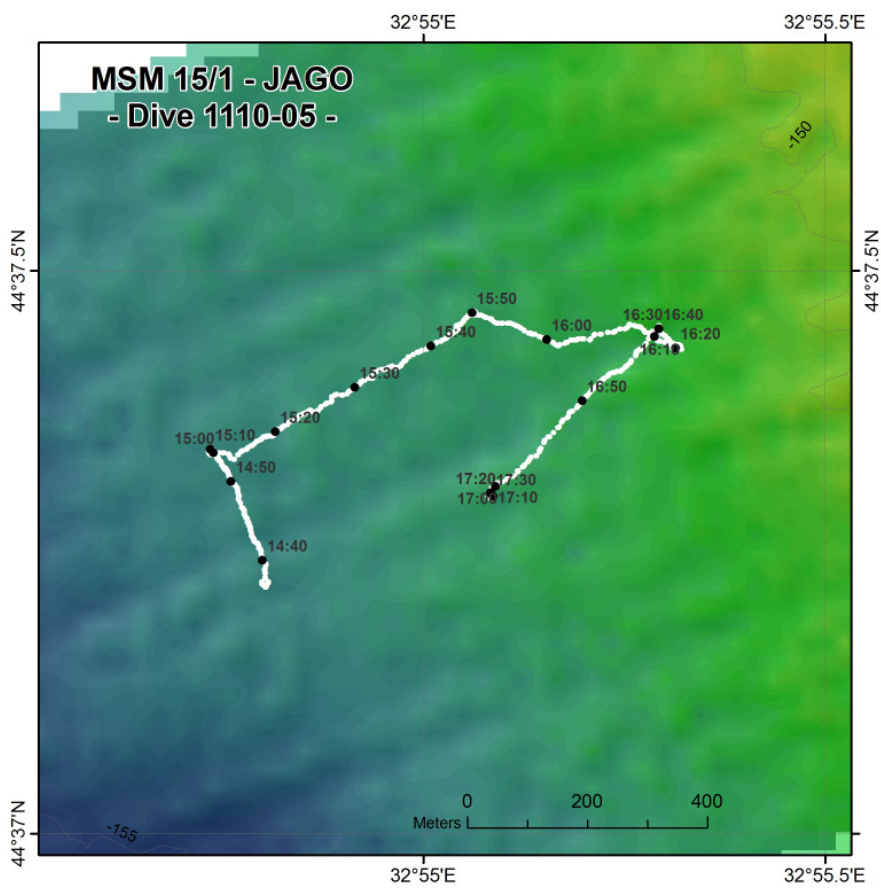
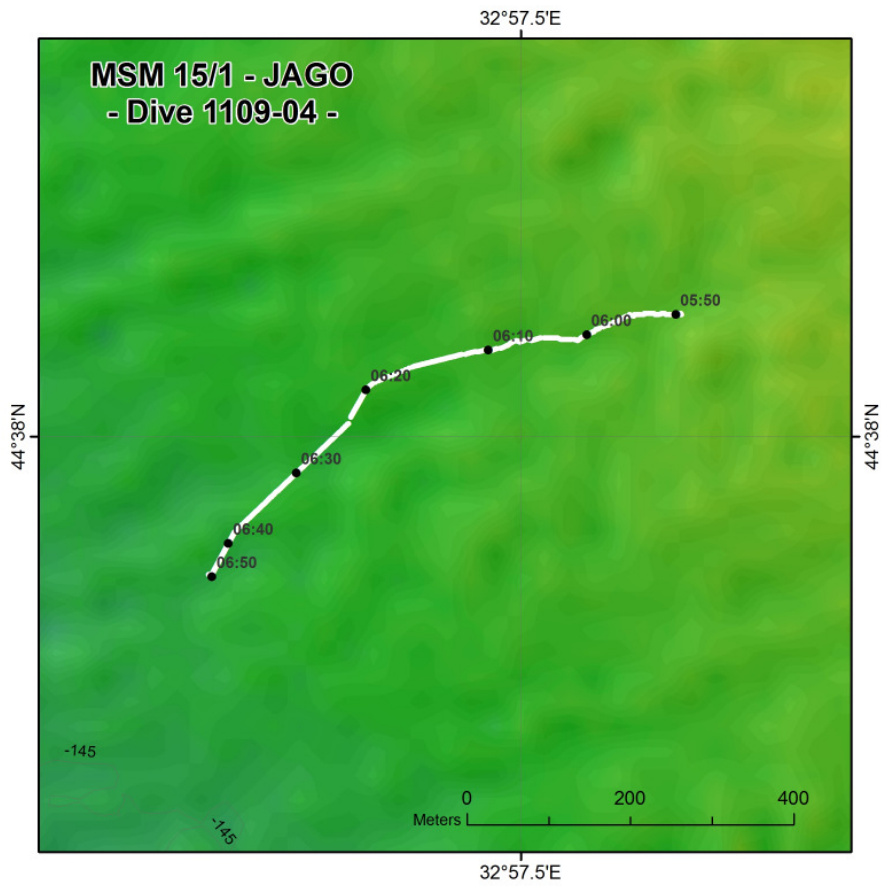
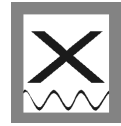
MSM15/444-1	1114	01.05.2010 12:19:00	01.05.2010 14:40:00	6393	99.965*
MSM15/456-1	1115	02.05.2010 08:39:29	02.05.2010 10:01:52	8779	91.341
MSM15/460-1	1116	02.05.2010 14:36:16	02.05.2010 16:22:49	8387	90.380
MSM15/477-1	1117	03.05.2010 06:02:47	03.05.2010 08:29:06	6927	91.719
MSM15/482-1	1118	03.05.2010 12:23:07	03.05.2010 14:42:54	6968	90.974
MSM15/486-1	1119	04.05.2010 07:04:17	04.05.2010 08:59:44	5418	90.920
MSM15/492-1	1120	04.05.2010 13:13:28	04.05.2010 15:09:36	6716	90.672
MSM15/507-1	1121	05.05.2010 06:19:23	05.05.2010 07:49:41	7108	90.901
MSM15/512-1	1122	05.05.2010 12:46:57	05.05.2010 14:38:53	6049	91.498
MSM15/527-1	1123	06.05.2010 05:54:43	06.05.2010 07:53:11	8460	91.784
MSM15/529-1	1124	06.05.2010 09:56:39	06.05.2010 11:37:28	4943	91.833

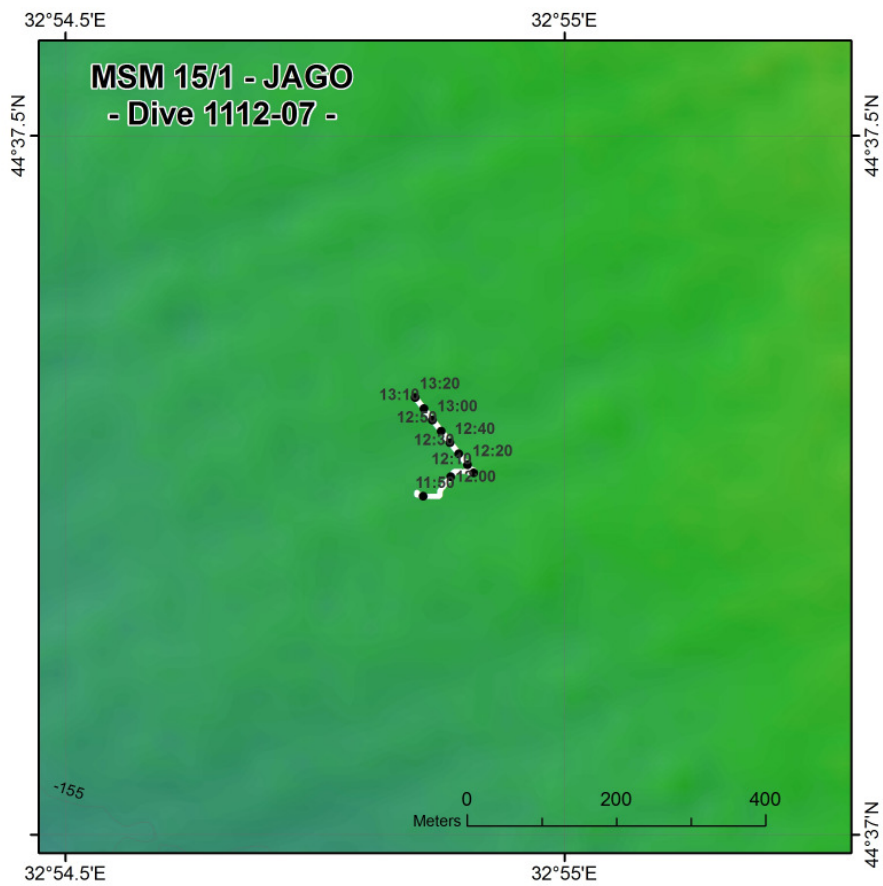
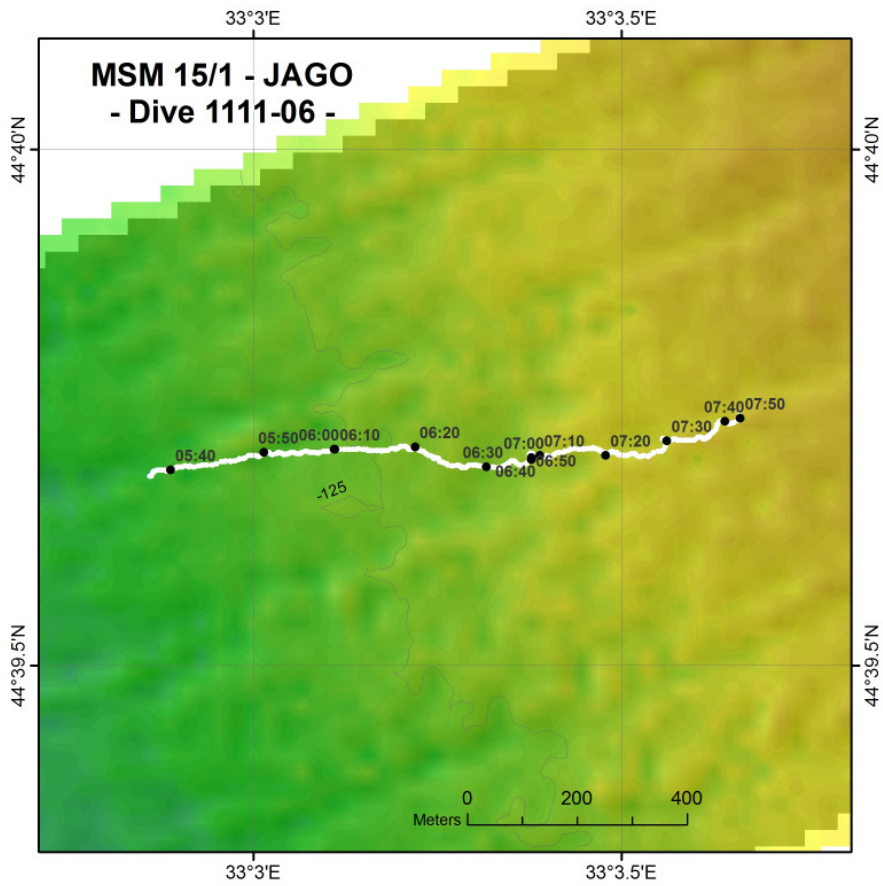
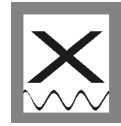
\* No USBL data was available for this dive. Submerging and recovering positions were taken as begin/end points – data in between has been interpolated

### c) Dive maps

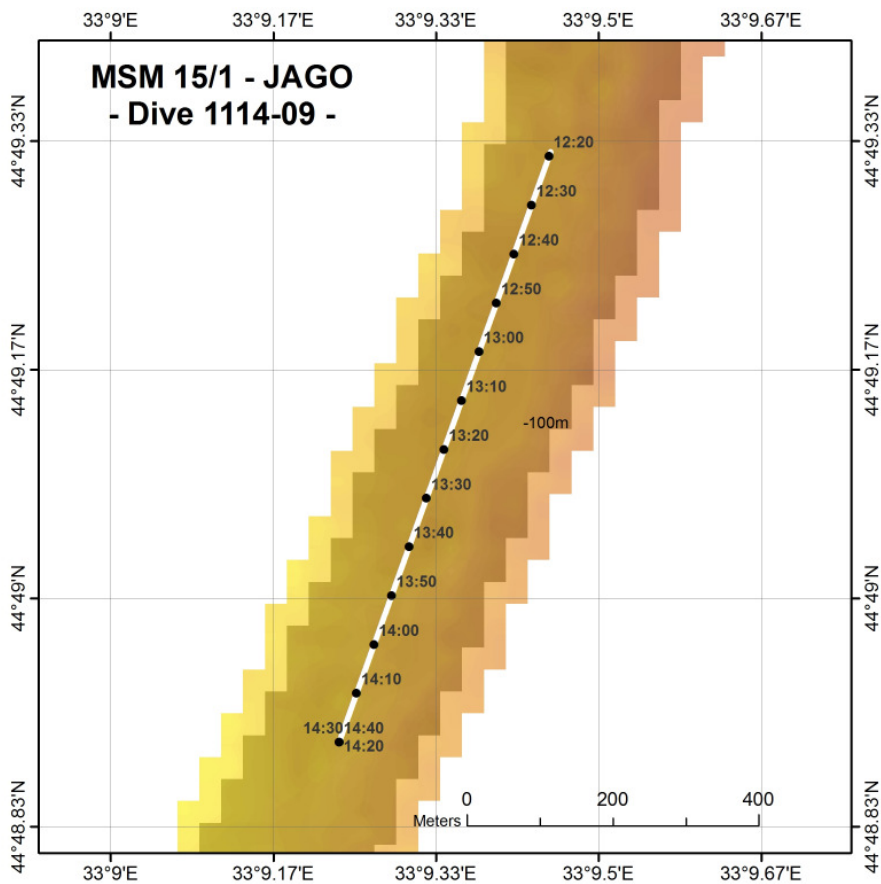
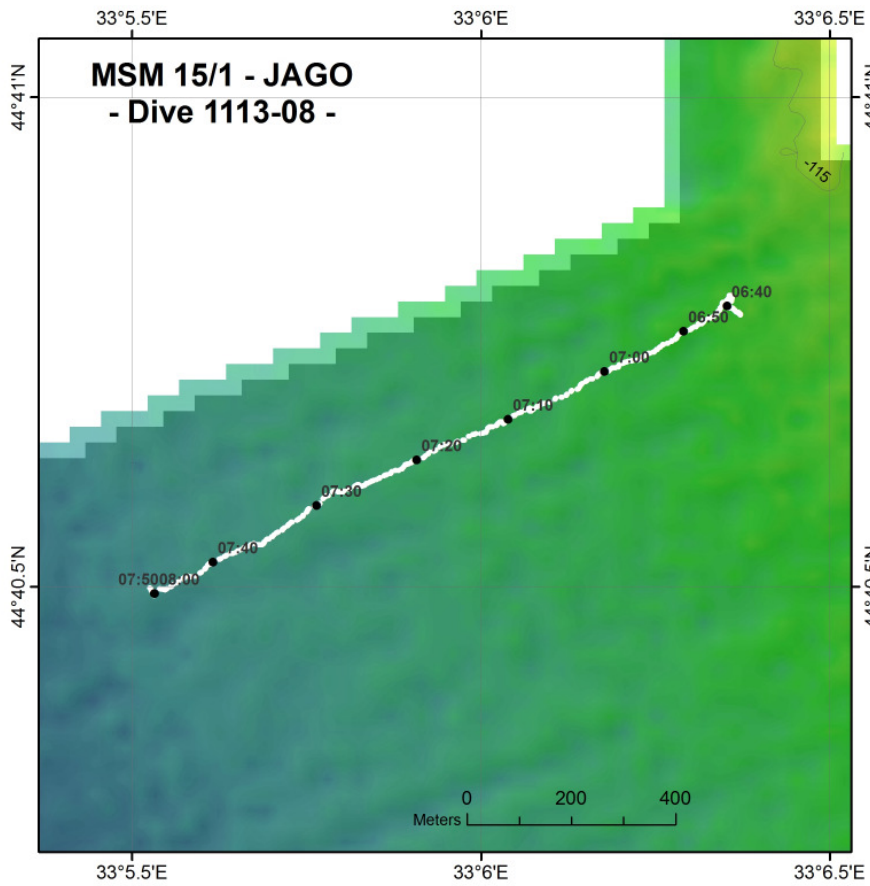
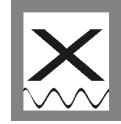


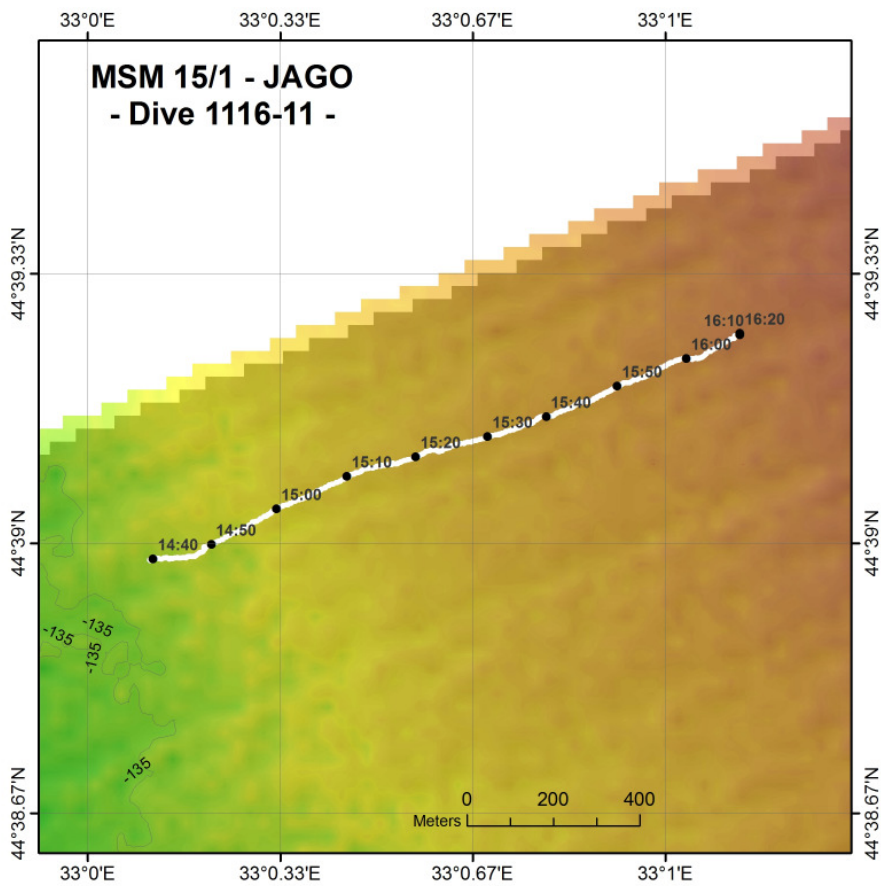
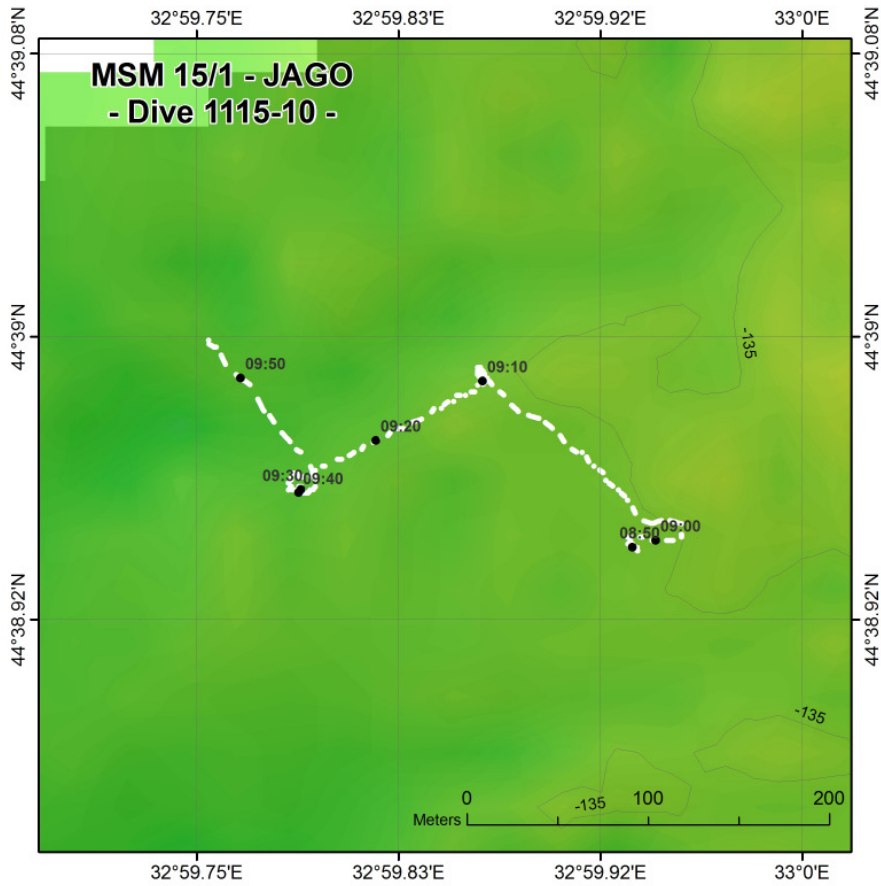
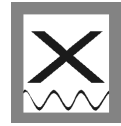


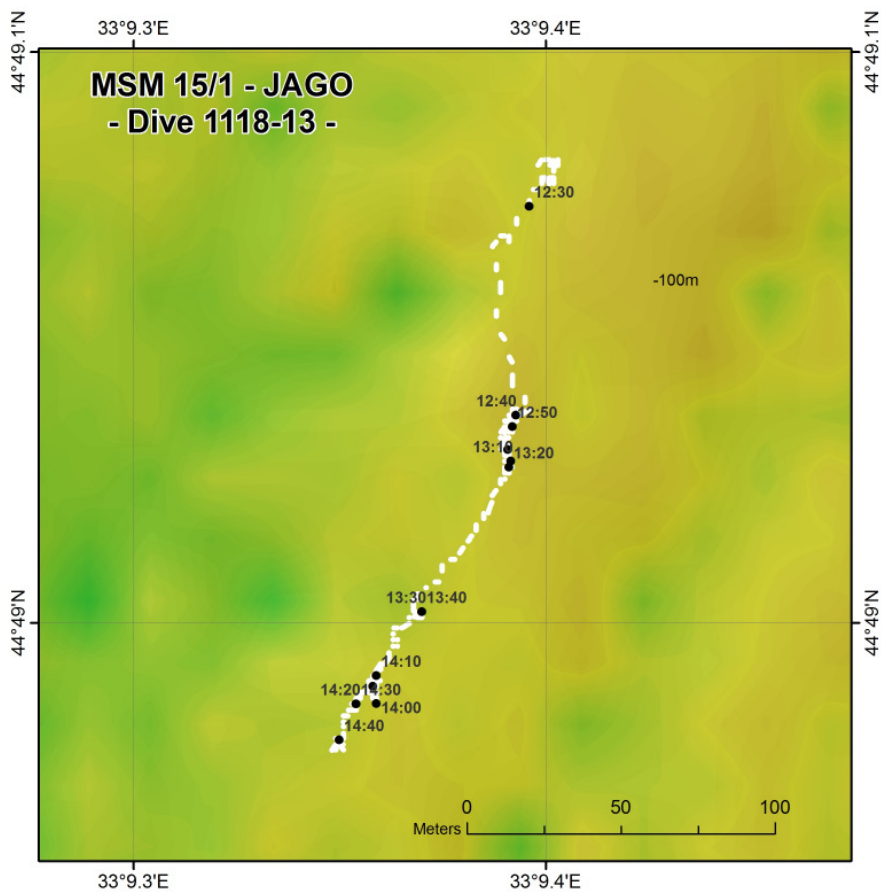
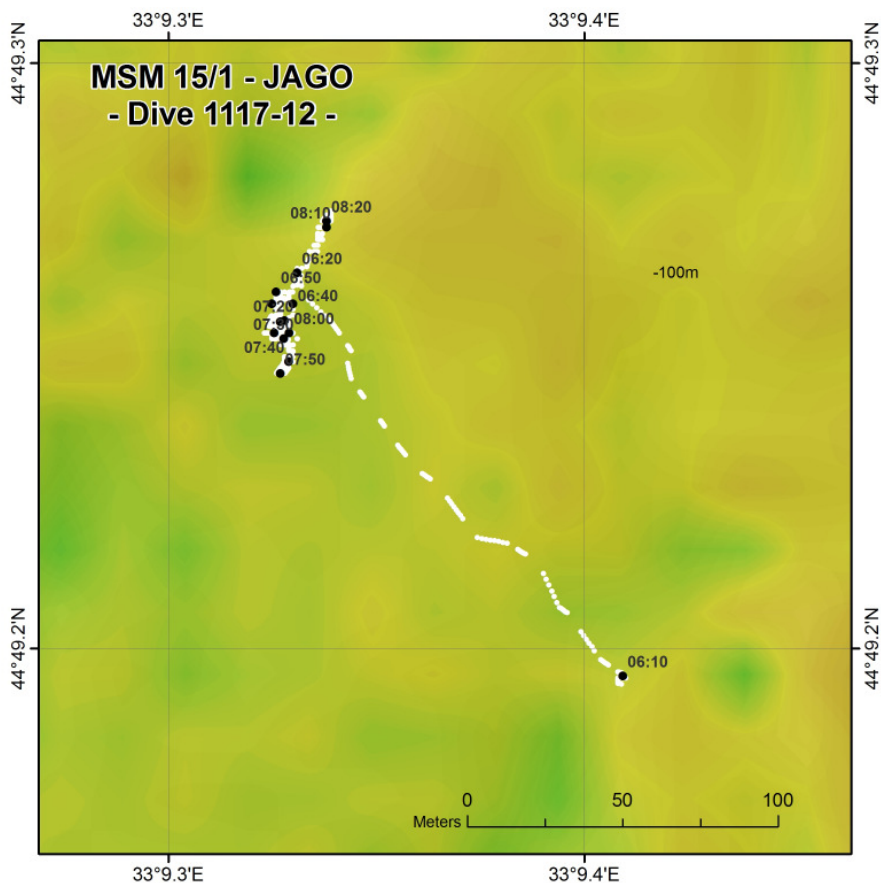




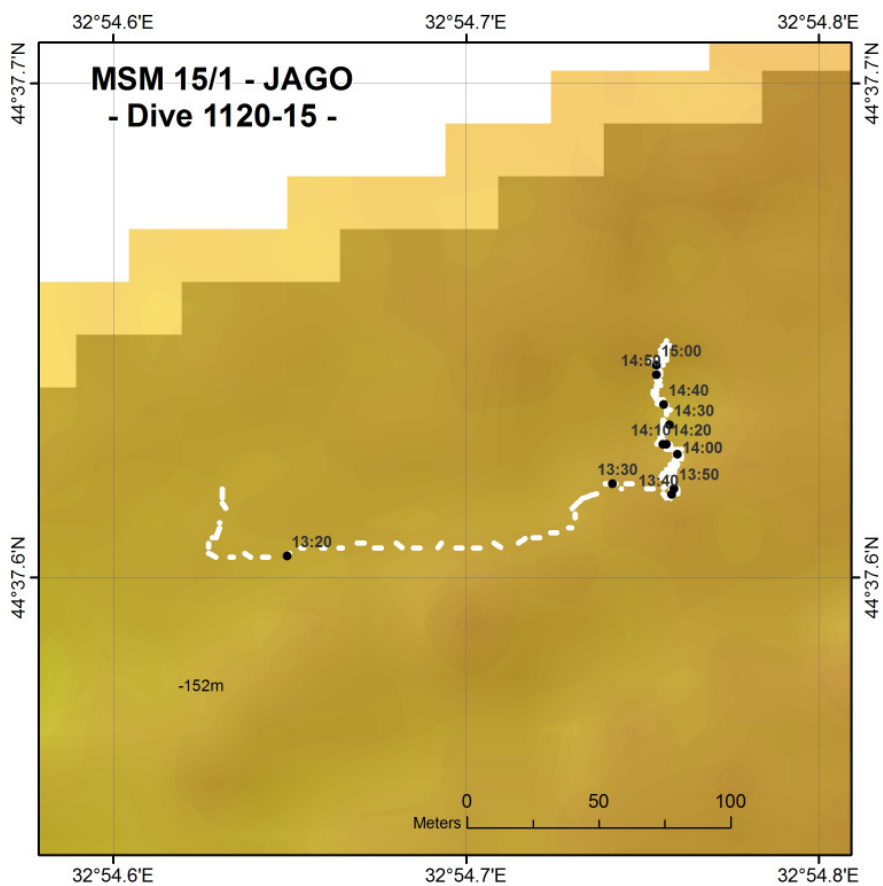
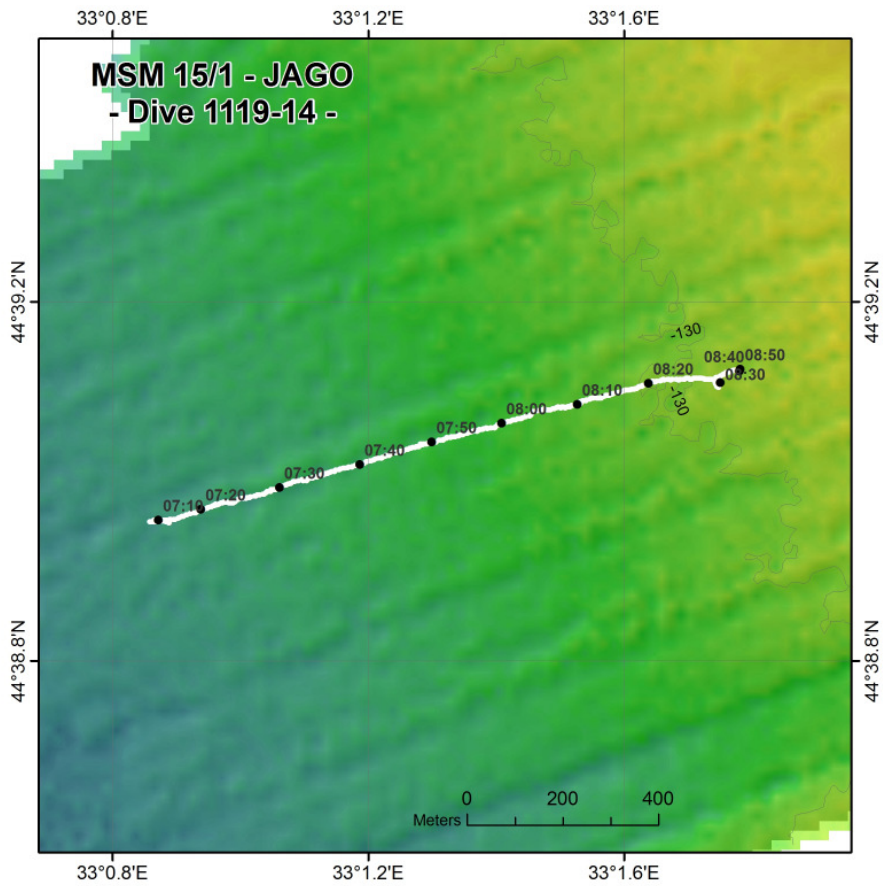
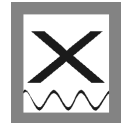


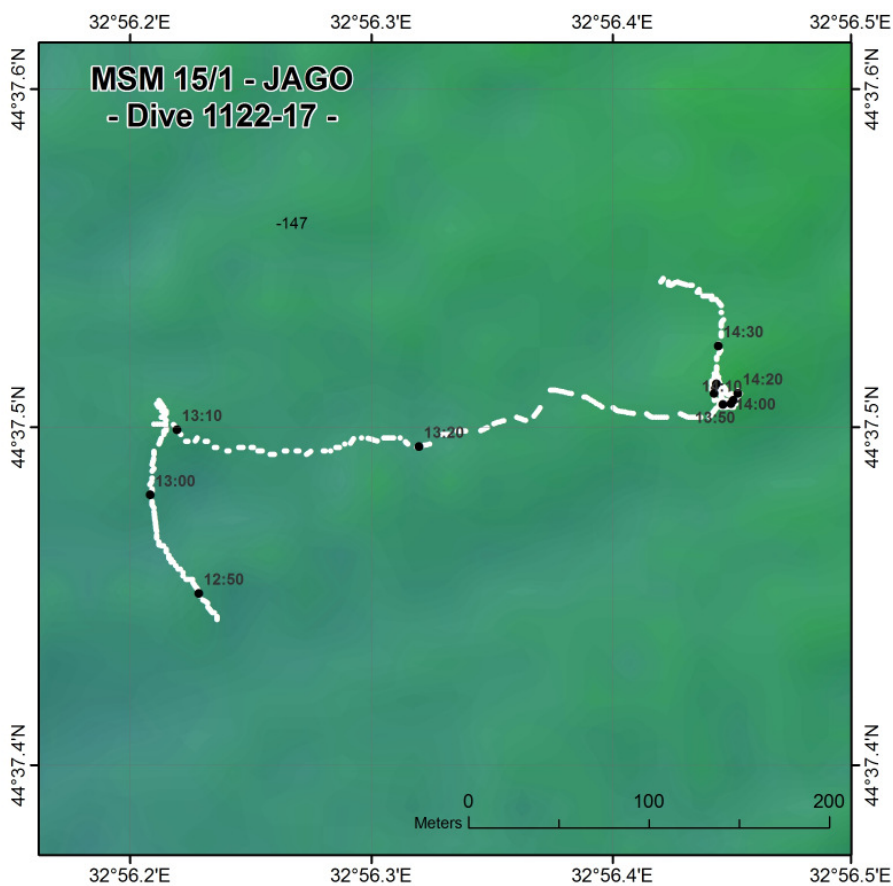
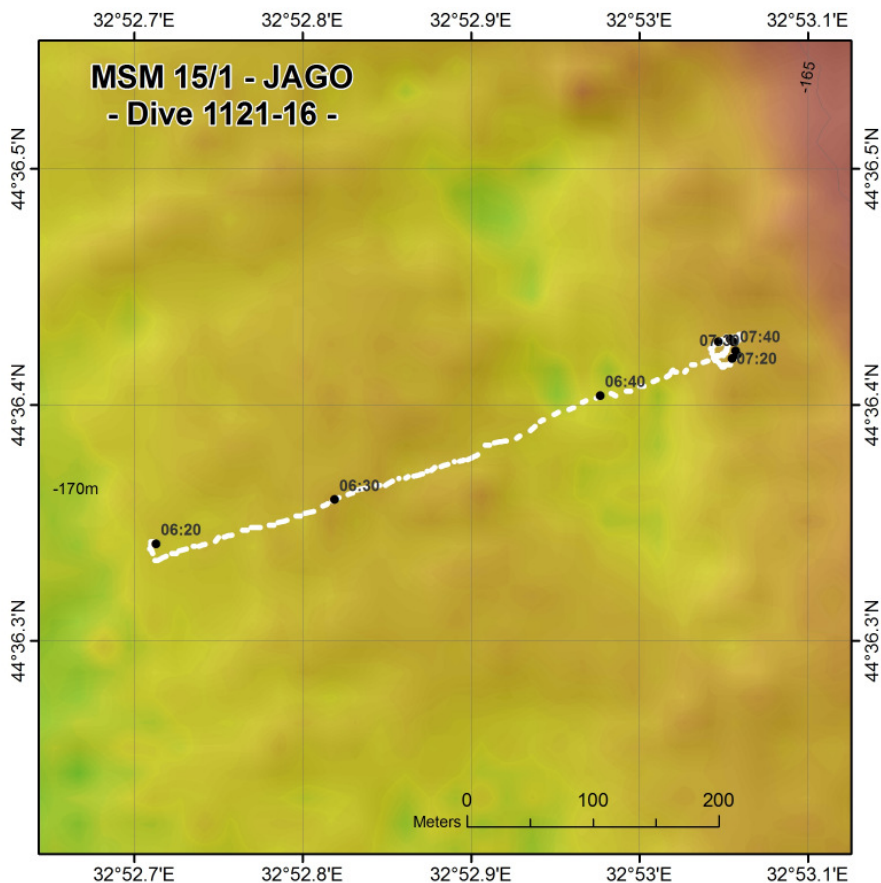


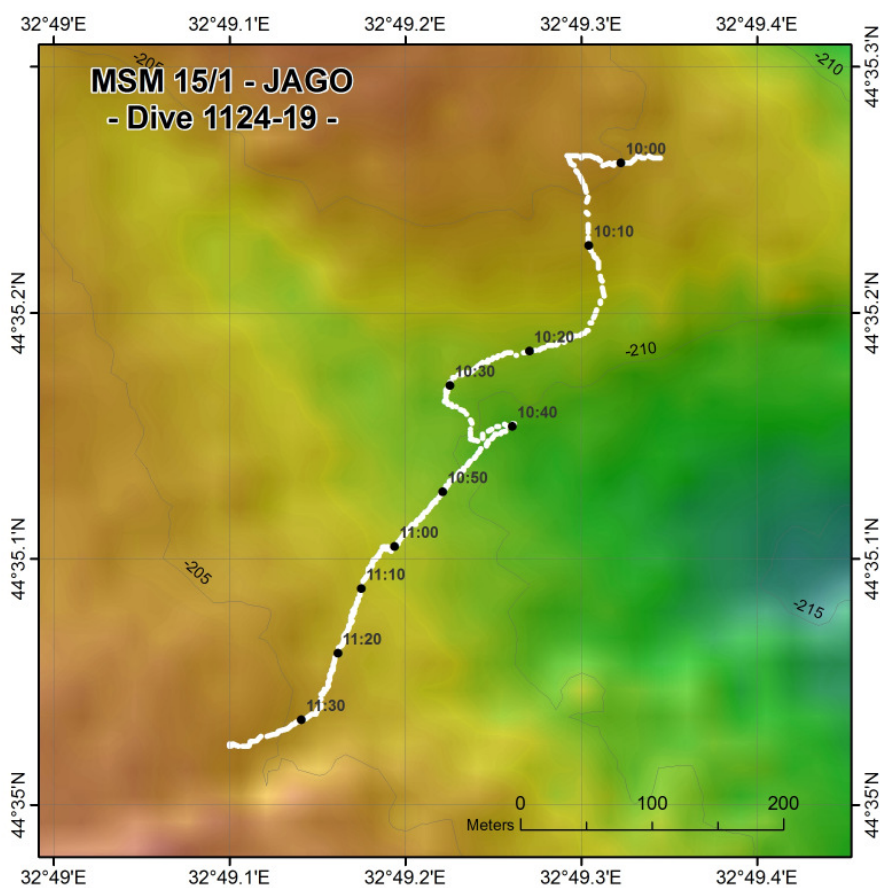
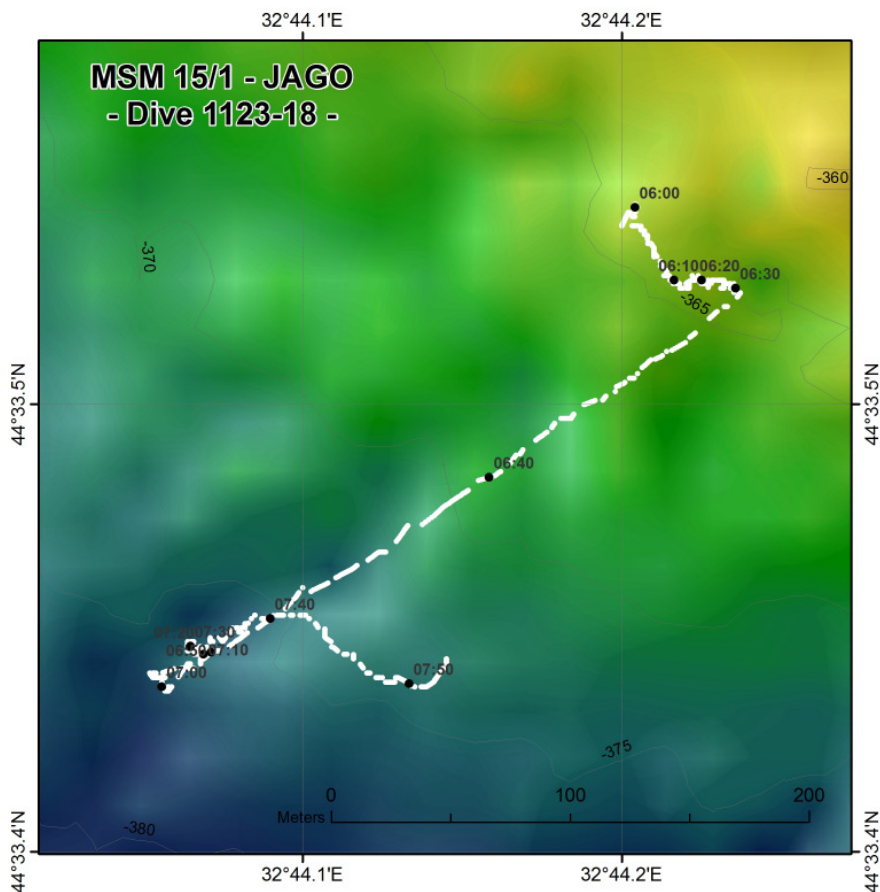














## **MSM15-1 processing log** **MEDUSA Navigation data**

### **a) Original data**

The original navigation data was extracted from the USBL-Positioning system via the DSHIP database on board of R/V "Maria S. Merian" in 1 second interval.

These data sets contain:

USBL position from Posidonia  
Timestamp  
Immersion

### **b) Processing**

#### **I. Processing steps:**

1. Extraction of source data from DSHIP data base
2. Manual validation of erroneous positions by reviewing speed, time and distance jumps
3. Removing of invalid positions
4. Interpolating missing data
5. Conversion of data to daily files of 1 and 10 second resolution

#### **II. Processed data:**

Result of the processing is the verified navigation in 1 second and in 10 second interval, held in ASCII table files (tab delimited) with the following format:

Column 1: Latitude [decimal degree]  
Column 2: Longitude [decimal degree]  
Column 3: Date [Format: DD.MM.YYYY HH:MM:SS]  
Column 4: Immersion [metres]  
Column 5: Flag

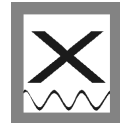
The flag string consists of four digits with the following meaning:

Digit 1:  
[0]: Position based on USBL sensor  
[1]: Interpolated position

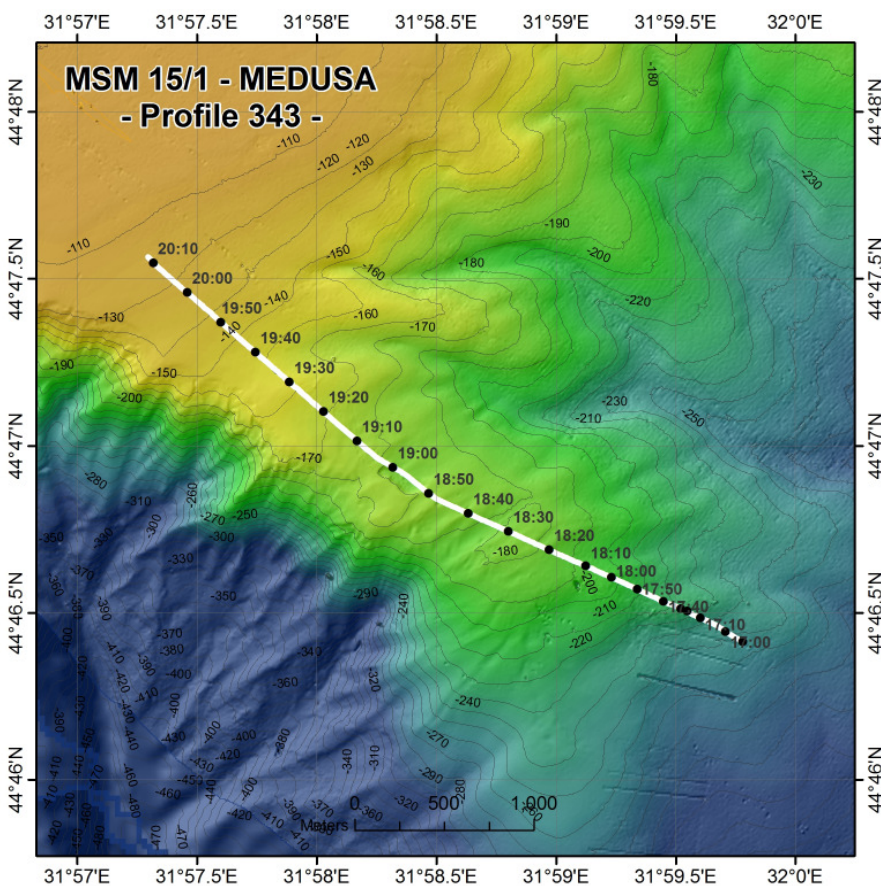
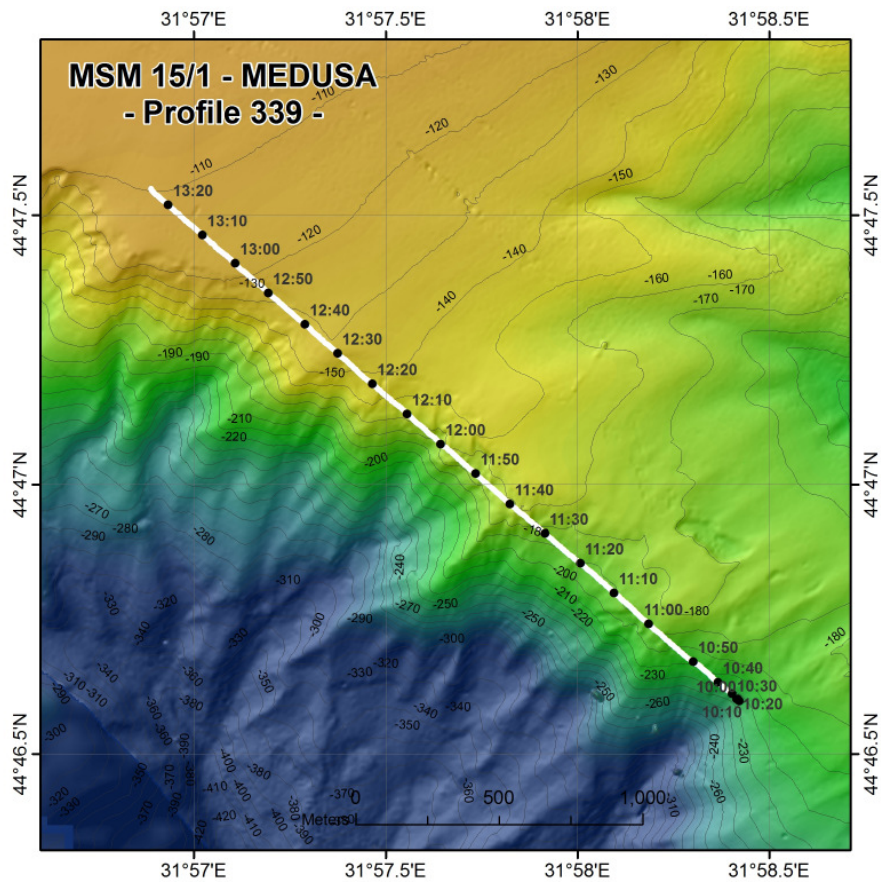
#### **III. Statistic**

Dive Number	Starttime	Endtime	Number of 1 s Positions	Interpolated Positions [%]
MSM15/339-1	20.04.2010 09:58:07	20.04.2010 13:26:47	12520	80.240
MSM15/343-1	20.04.2010 16:48:14	20.04.2010 20:14:58	12404	81.450
MSM15/353-1	21.04.2010 08:52:06	21.04.2010 14:46:56	21290	81.865
MSM15/356-1	21.04.2010 16:43:36	21.04.2010 20:47:33	14637	82.114
MSM15/359-1	22.04.2010 07:02:01	22.04.2010 11:09:47	14866	81.865
MSM15/367-1	22.04.2010 18:23:00	22.04.2010 20:31:50	7730	82.367

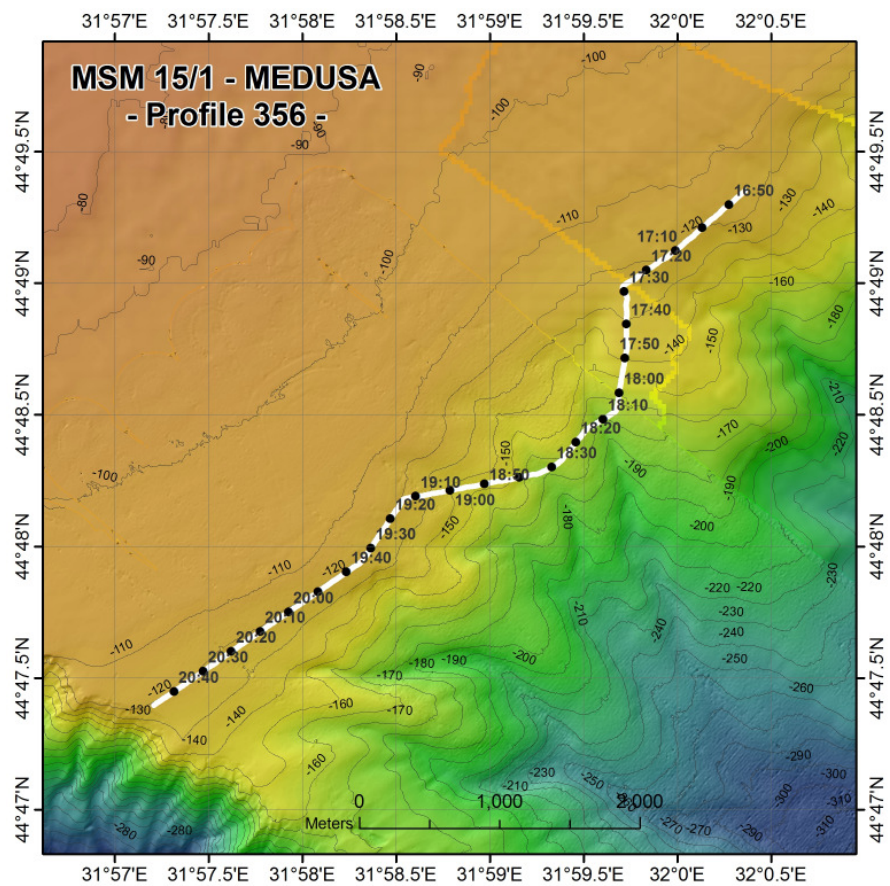
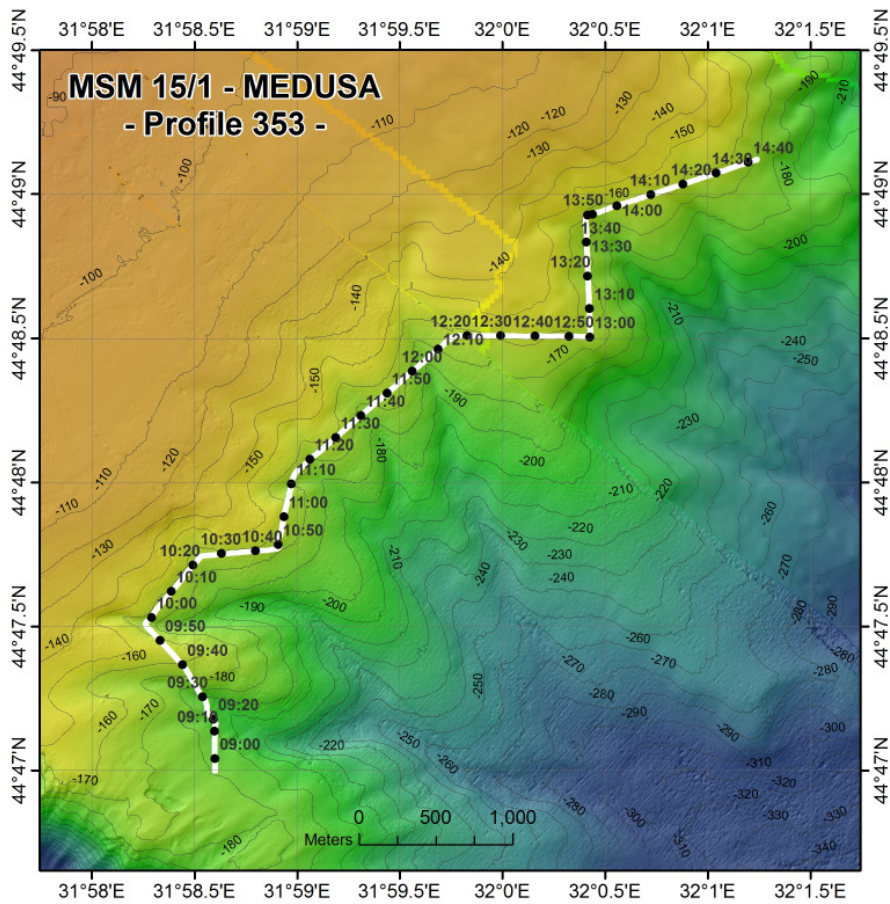


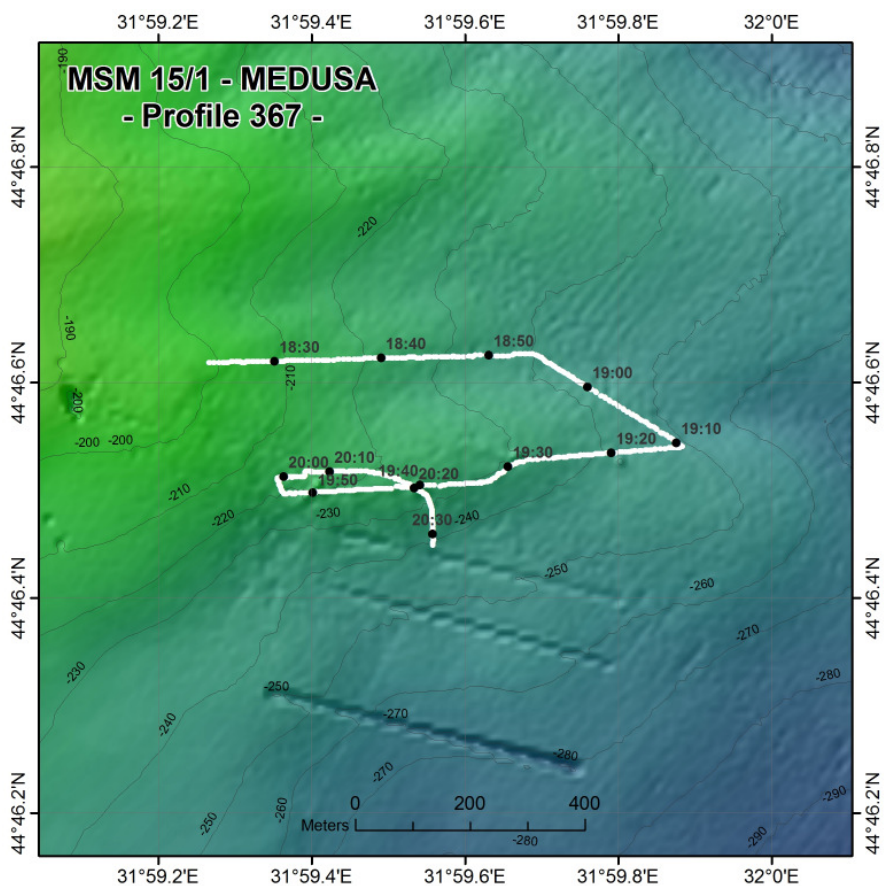
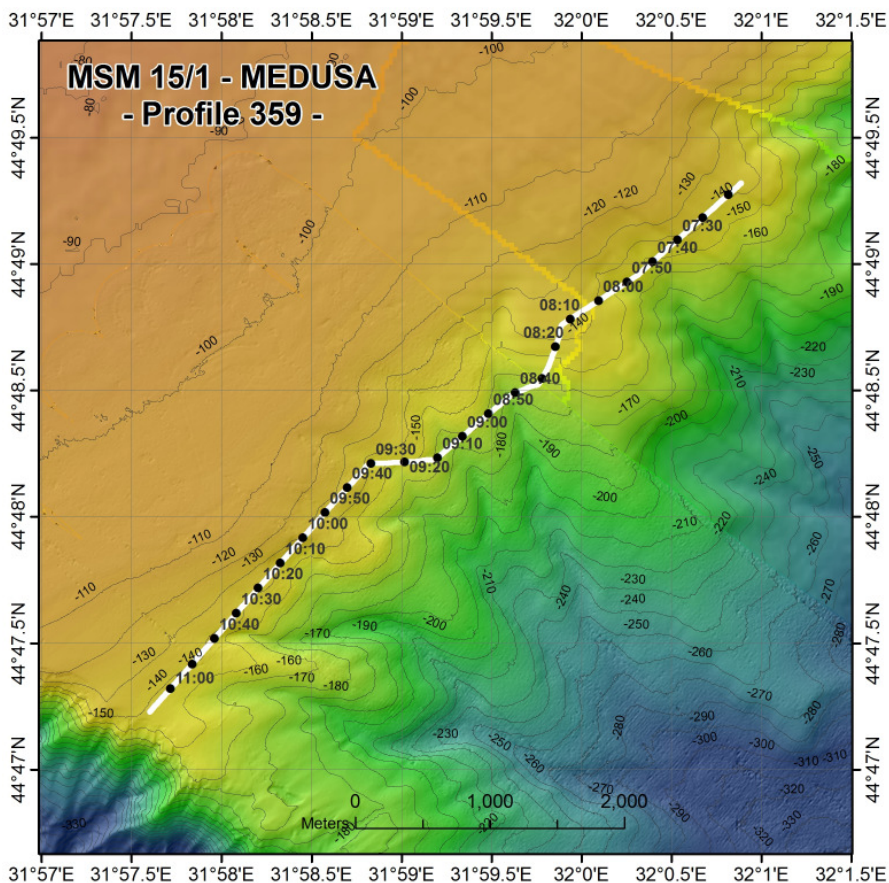


### c) Dive maps











## **MSM15-1 processing log**

### **TV-MUC Navigation data**

#### **a) Original data**

The original navigation data was extracted from the USBL-Positioning system via the DSHIP database on board of R/V "Maria S. Merian" in 1 second interval.

These data sets contain:

- USBL position from Posidonia
- Timestamp
- Immersion

#### **b) Processing**

##### **I. Processing steps:**

1. Extraction of source data from DSHIP data base
2. Manual validation of erroneous positions by reviewing speed, time and distance jumps
3. Removing of invalid positions
4. Interpolating missing data
5. Conversion of data to daily files of 1 and 10 second resolution

##### **II. Processed data:**

Result of the processing is the verified navigation in 1 second and in 10 second interval, held in ASCII table files (tab delimited) with the following format:

- Column 1: Latitude [decimal degree]
- Column 2: Longitude [decimal degree]
- Column 3: Date [Format: DD.MM.YYYY HH:MM:SS]
- Column 4: Immersion [metres]
- Column 5: Flag

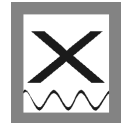
The flag string consists of four digits with the following meaning:

Digit 1:  
[0]: Position based on USBL sensor  
[1]: Interpolated position

##### **III. Statistic**

Dive Number	Starttime	Endtime	Number of 1 s Positions	Interpolated Positions [%]
MSM15/305-1	17.04.2010 09:44:11	17.04.2010 15:46:19	31729	90.422





c) Dive map

