Underwater Gear Track Data from ANT-XXIX/8

Processing Report for USBL Posidonia Data on RV “Polarstern”

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1 Introduction

This report describes the processing of raw data acquired by the acoustic underwater positioning system *IXSEA Posidonia* during RV “Polarstern” cruise ANT-XXIX/8. Instruments that were tracked during this cruise were: CTD/Water sampler, Television Multicorer (TVMUC), Television Grab (TVG) and Ocean Floor Observation System (OFOS).

2 Sensor Information

The *IXSEA Posidonia* is an acoustic underwater positioning system used to determine and track positions of underwater vehicles and instruments. The system is composed of two ultra-short baselines (USBL) consisting of four hydrophones and one main transducer. A *Posidonia* transponder beacon has to be mounted on the instrument to be tracked before the launch. Once the gear is lowered into the water the system’s main transducer transmits an acoustic signal in shape of a 60° wide cone and a frequency of 10.5 kHz to the water. The transponder on the instrument receives this signal and replies with a 9.5 kHz acknowledge signal. This is being received by the four hydrophones of the vessel with small differences in travel time and phase from which a relative angle and distance to the transponder can be calculated. An absolute geographic transponder position and depth is then calculated by applying the ship’s current GPS position, the current motion state (roll, pitch and heading) and a sound velocity profile to compensate the refraction of the signal in the water column. The data is continuously acquired and distributed to the ship’s network to data visualization and mapping programs. The ping rate (reoccurrence time) was set to 10 seconds during this cruise.

3 Processing Workflow

The different steps of processing and validation are visualized in fig. 1. Raw *Posidonia* data (NMEA telegrams, $PTSAG) is first converted to GIS-readable formats. During visual inspection significant outliers are removed manually. Afterwards the data is filtered by applying a speed filter which eliminates points that have a greater distance to the original track than the tracked instrument could actually have travelled during the given time interval. The data is linearly interpolated to a 1-second interval to be able to reference other instruments’ data or images by time. Output files are written in plain-text (ASCII) format (see next chapter for format description) for each station and navigation overview maps are created.

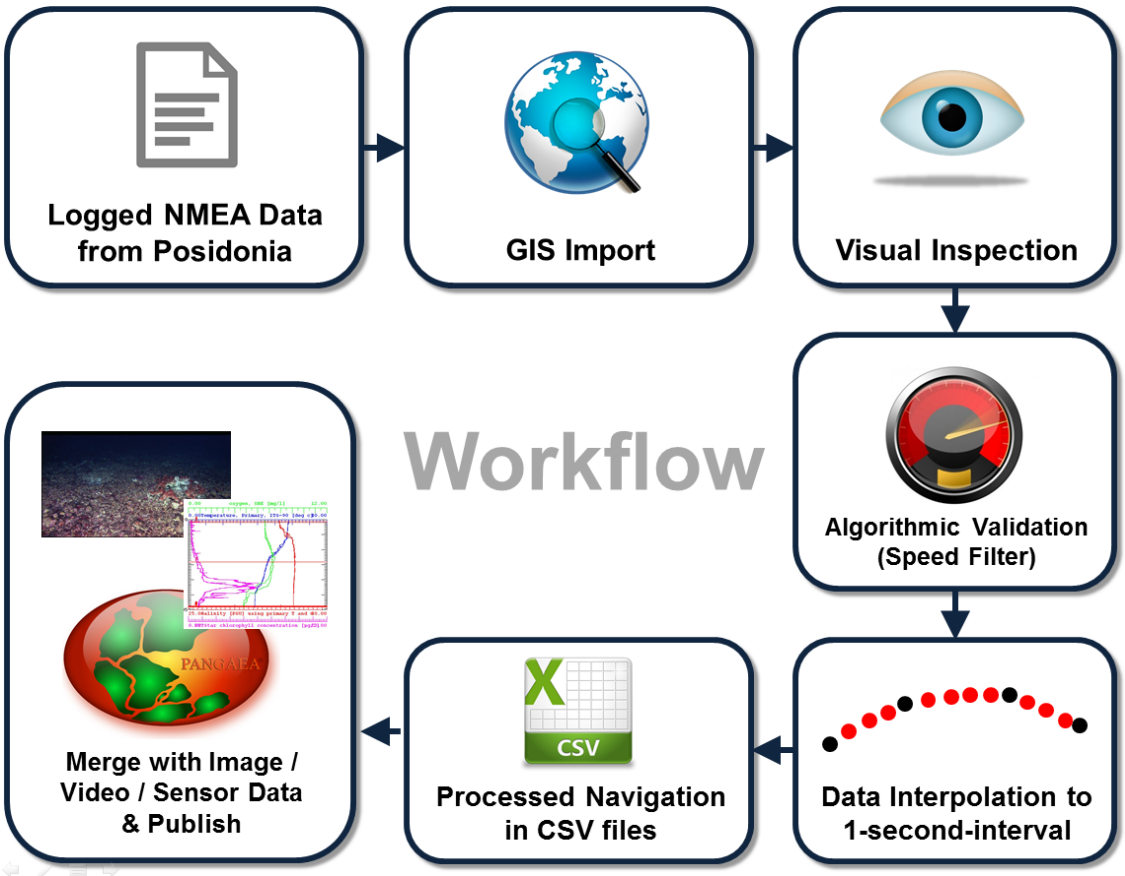


Figure 1: Processing workflow

4 Output Data Format

Result of the processing is a validated and interpolated navigation in 1-second-intervals, held in ASCII table files (tab delimited) as well as an overview map. The file name format is: *<CruiseNo>-<StationNumber>-<StationCast>_<Instrument>.nav* (Example: *ps81-0628-1_CTD.nav*)

The internal file format is shown here:

Column No.	Value	Unit, [Range]
1	Latitude	Decimal Degree, -90°/+90°
2	Longitude	Decimal Degree, -180°/+180°
3	Depth	Meters, positive down
4	Date / Time UTC	ISO-8601-conform, YYYY-MM-DD**T**hh:mm:ss

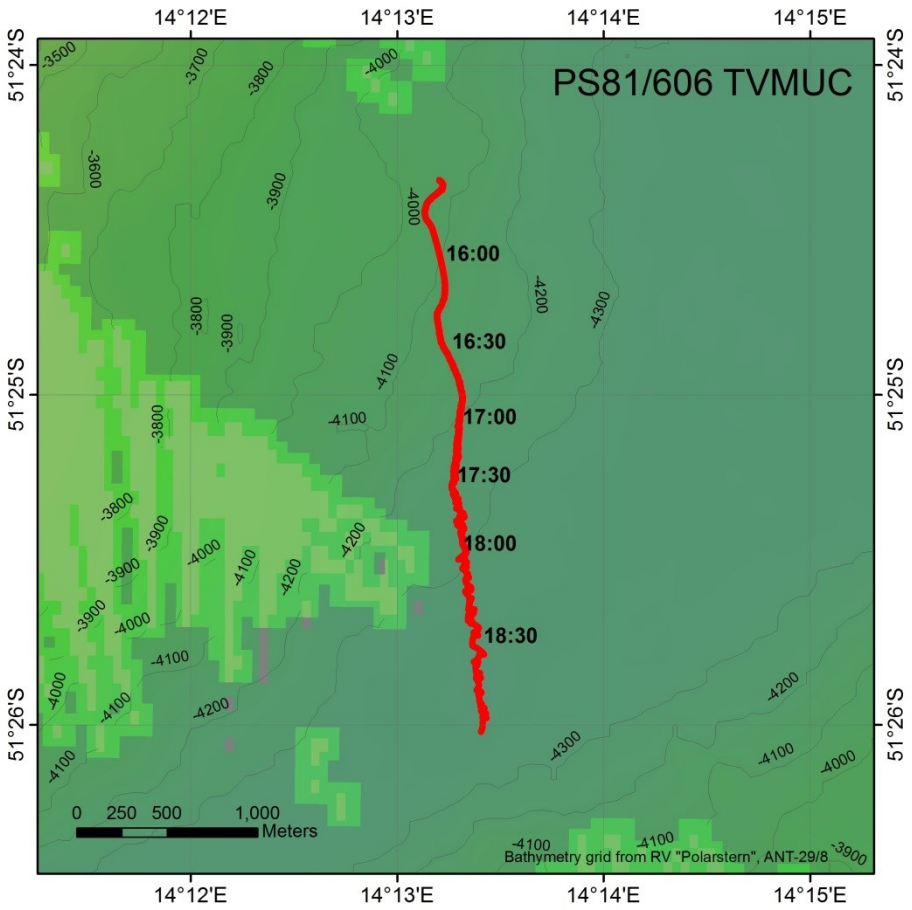
5 Statistics

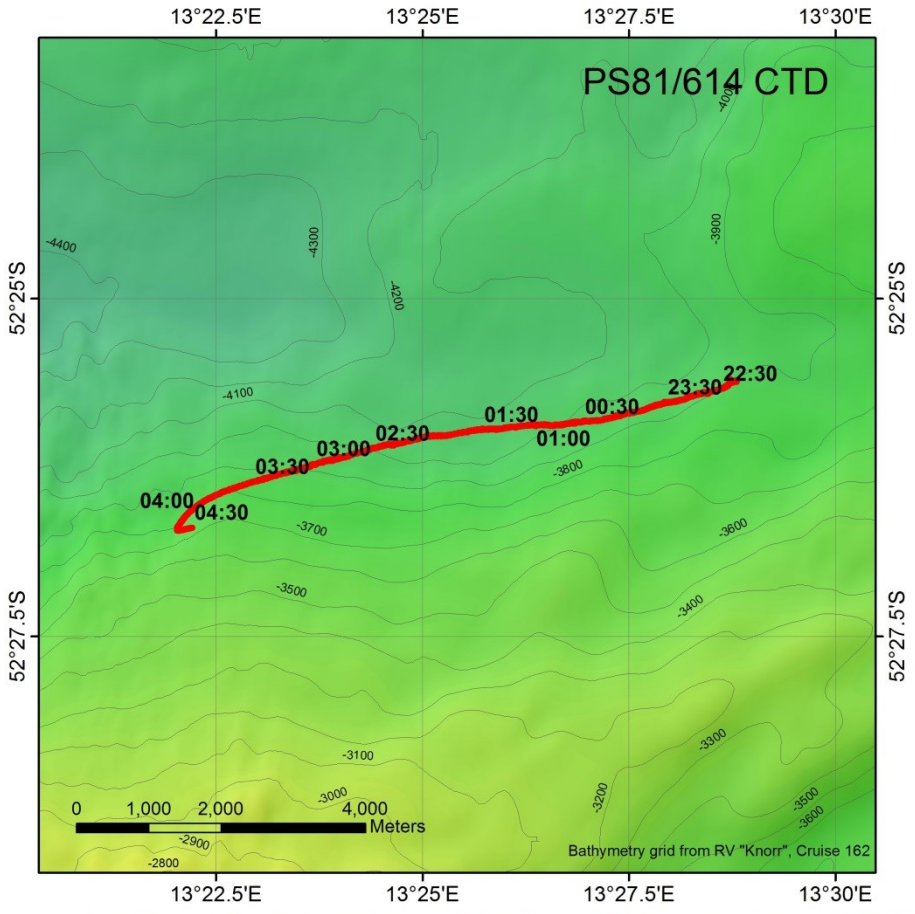
Overview of *Posidonia*-tracked instrument stations:

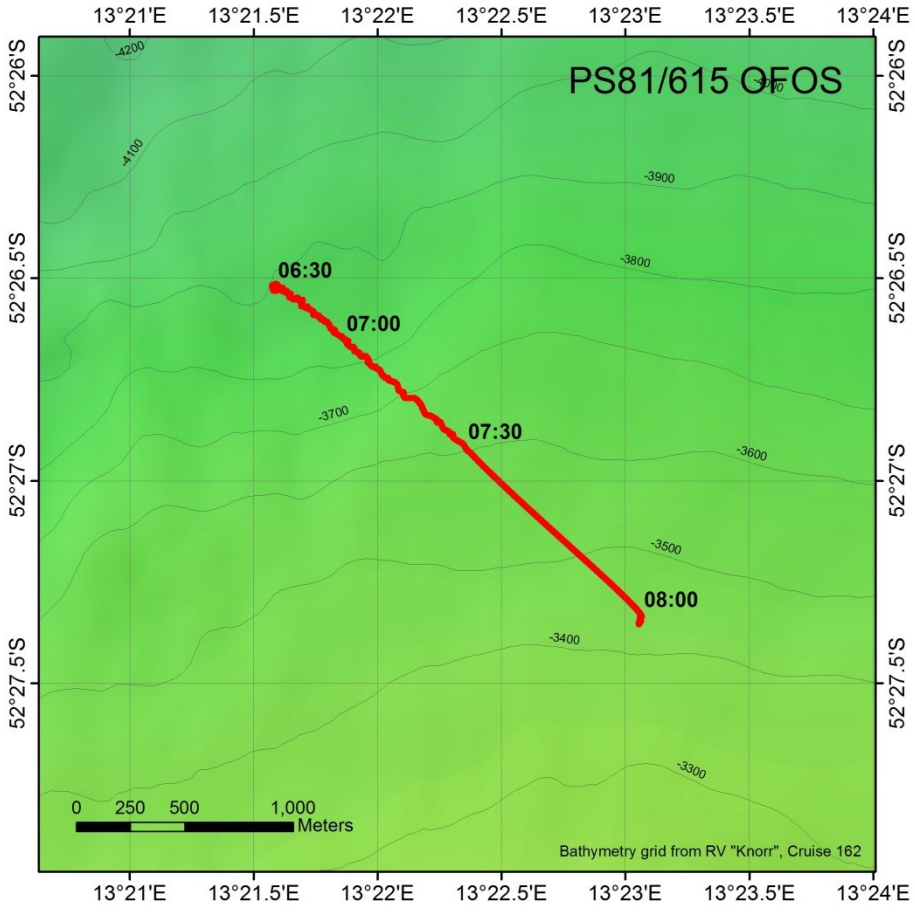
Station No.	Gear	Start time	End time	No. of 1s Positions
PS81/606-1	TVMUC	16.11.2013 15:33	16.11.2013 18:52:50	11989
PS81/614-1	CTD	19.11.2013 21:35	20.11.2013 04:30:31	24881
PS81/615-1	OFOS	20.11.2013 06:20	20.11.2013 08:08:50	6514
PS81/626-1	TVMUC	22.11.2013 10:30	22.11.2013 16:00:01	16167
PS81/627-1	OFOS	23.11.2013 10:59	23.11.2013 16:26:32	19650
PS81/628-1	CTD	23.11.2013 19:29	24.11.2013 04:0910	31207
PS81/629-1	CTD	25.11.2013 08:46	25.11.2013 17:27:15	31258
PS81/630-1	OFOS	25.11.2013 18:02	26.11.2013 00:54:56	24764
PS81/631-1	CTD	26.11.2013 02:57	26.11.2013 08:32:26	20086
PS81/633-1	OFOS	26.11.2013 12:46	26.11.2013 19:46:16	25178
PS81/637-1	OFOS	27.11.2013 19:38	28.11.2013 02:25:26	24412
PS81/638-1	CTD	28.11.2013 04:44	28.11.2013 09:14:51	16216
PS81/639-1	TVMUC	28.11.2013 12:25	28.11.2013 15:54:57	12545
PS81/645-1	CTD	30.11.2013 04:26	30.11.2013 09:53:30	19623
PS81/646-1	TVMUC	30.11.2013 11:41	30.11.2013 14:47:36	11158
PS81/647-1	OFOS	01.12.2013 01:56	01.12.2013 07:12:42	18977
PS81/648-1	CTD	01.12.2013 09:54	01.12.2013 14:45:17	17480
PS81/649-1	TVMUC	01.12.2013 16:38	01.12.2013 19:11:01	9177
PS81/650-1	OFOS	01.12.2013 20:31	02.12.2013 02:51:02	22768
PS81/651-1	CTD	02.12.2013 07:27	02.12.2013 12:53:03	19560
PS81/659-1	TVMUC	05.12.2013 02:55	05.12.2013 05:07:36	7907
PS81/660-1	CTD	05.12.2013 08:21	05.12.2013 16:17:48	28578
PS81/661-1	TVMUC	05.12.2013 17:35	05.12.2013 19:41:41	7556
PS81/666-1	OFOS	07.12.2013 10:02	07.12.2013 13:19:05	11767
PS81/667-1	TVGRAB	07.12.2013 15:27	07.12.2013 17:53:04	8734
PS81/668-1	TVGRAB	07.12.2013 20:53	07.12.2013 23:13:59	8433
PS81/670-1	OFOS	08.12.2013 13:32	08.12.2013 17:17:12	13473
PS81/671-1	OFOS	08.12.2013 18:19	08.12.2013 21:10:50	10315
PS81/672-1	TVGRAB	08.12.2013 22:21	09.12.2013 00:03:01	6111
PS81/680-1	OFOS	11.12.2013 09:07	11.12.2013 13:02:13	14056
PS81/681-1	TVMUC	11.12.2013 15:03	11.12.2013 16:44:29	6073

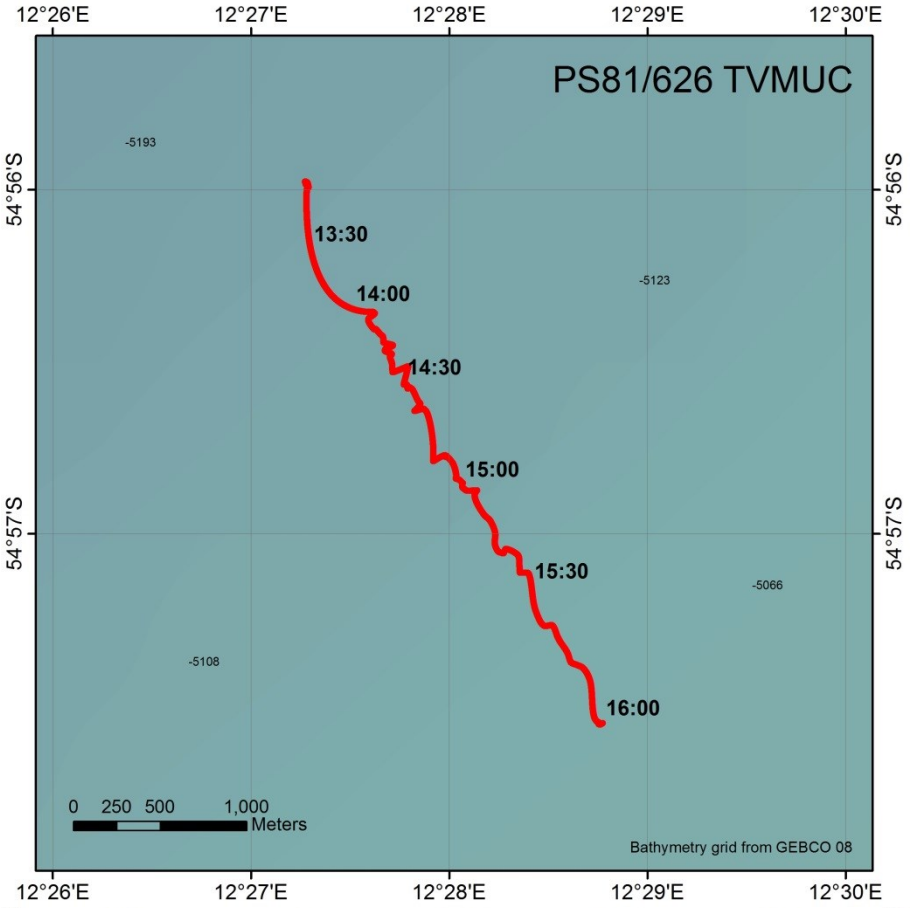
6 Station maps

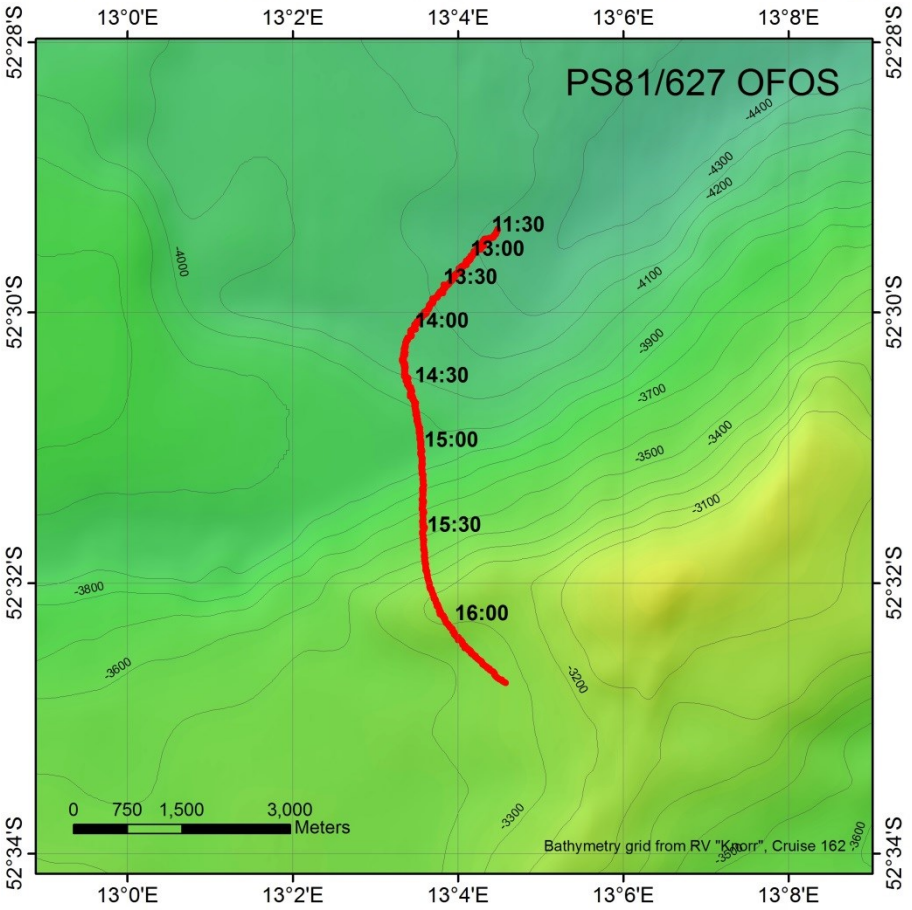
The station maps give an overview of the processed navigation track. In the upper right corner the cruise and station number is shown as well as the instrument type. For each map the best available bathymetry for the map extent has been chosen. The bathymetry grid source is shown in the lower right corner.

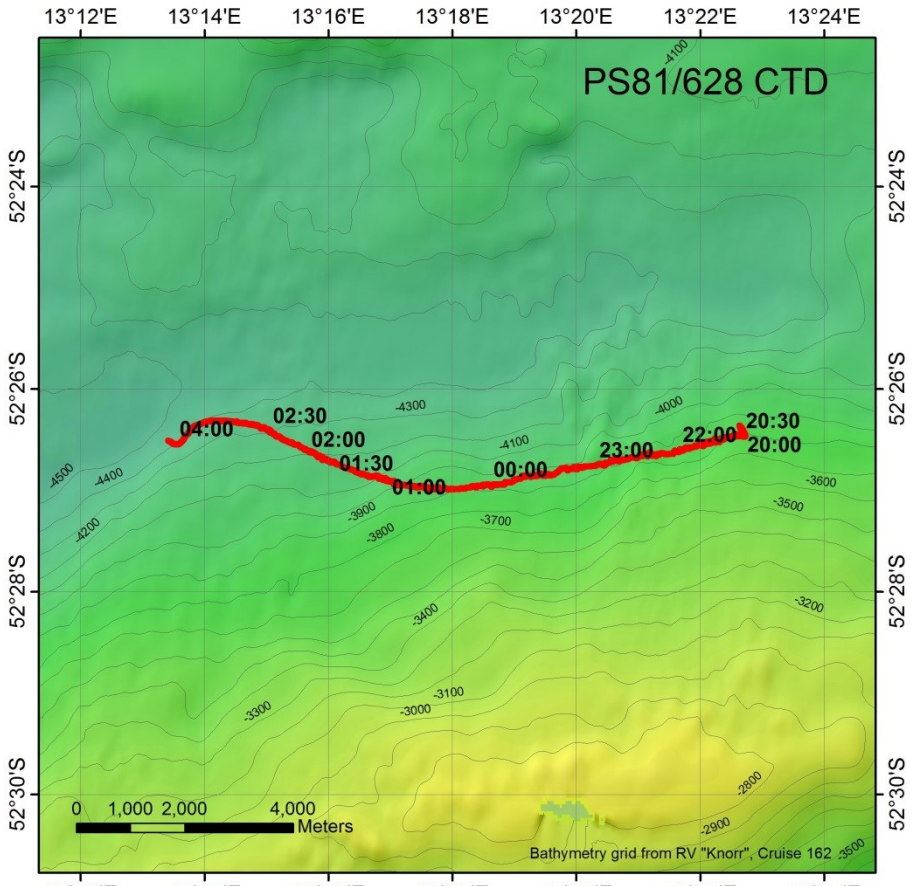


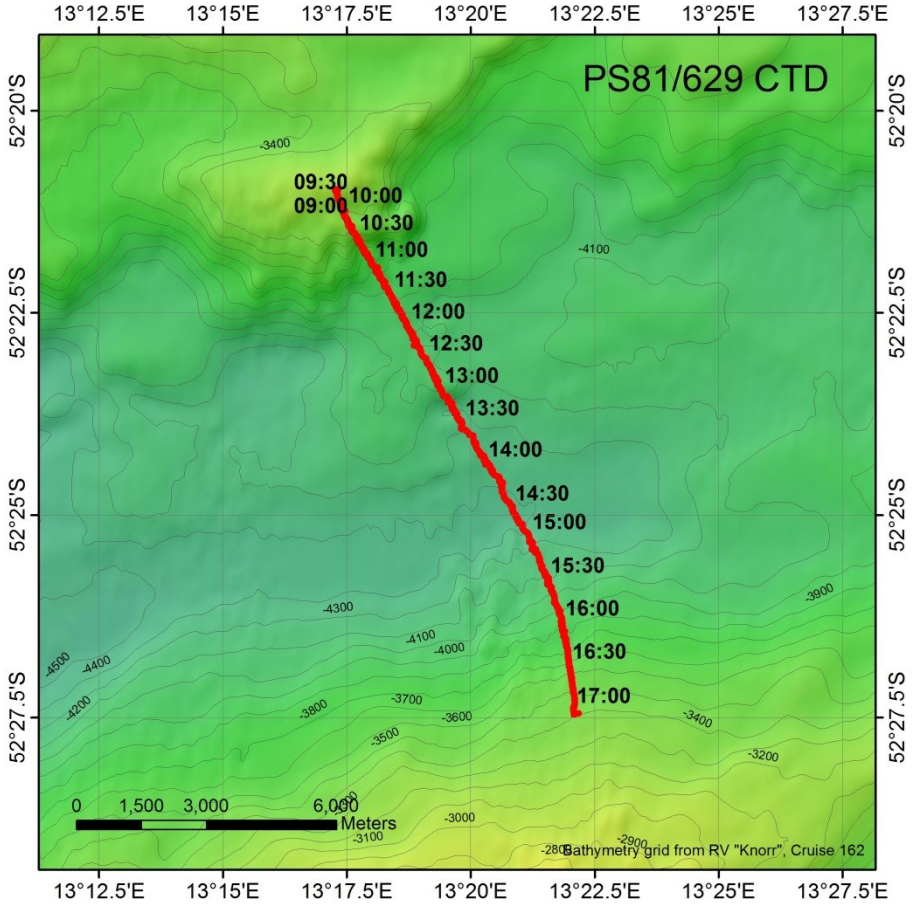

PS81/614 CTD
13°22.5'E
13°25'E
13°27.5'E
13°30'E
52°25'S
52°27.5'S
22:30
23:30
00:30
01:30
01:00
02:30
03:00
03:30
04:00
04:30
-4400
-4300
-4200
-4100
-4000
-3900
-3800
-3700
-3600
-3500
-3400
-3300
-3200
-3100
-3000
-2900
-2800
0 1,000 2,000 4,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

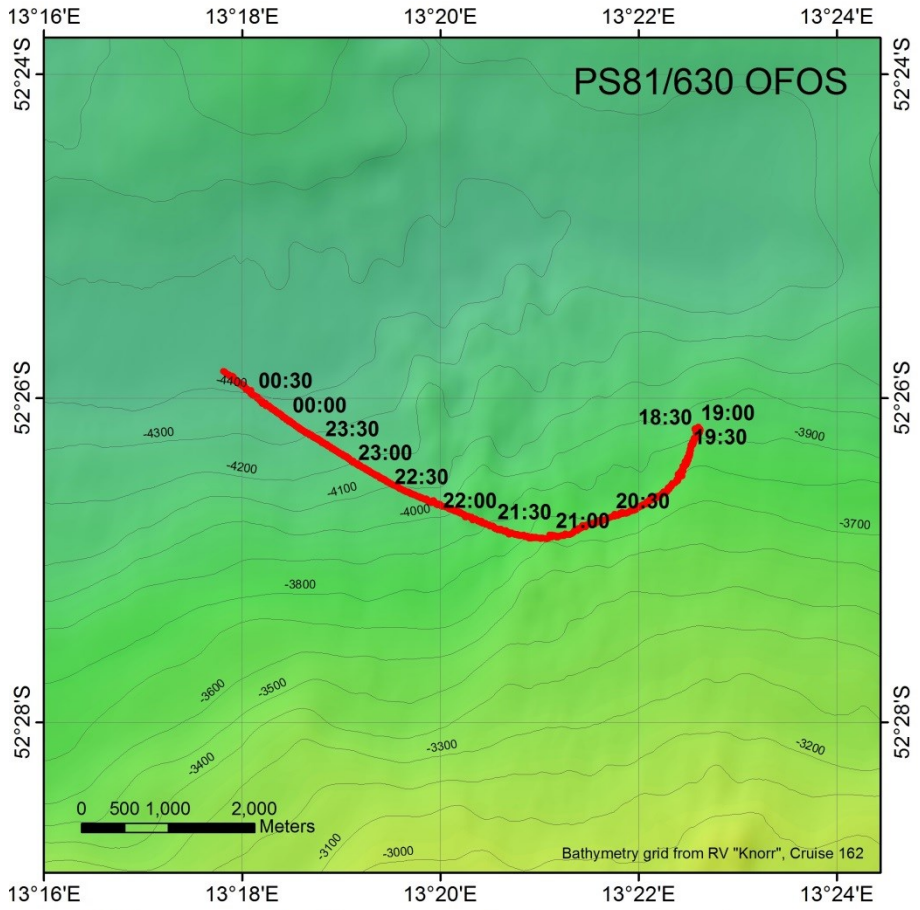

PS81/615 OFOS
13°21'E
13°21.5'E
13°22'E
13°22.5'E
13°23'E
13°23.5'E
13°24'E
52°26'S
52°26.5'S
52°27'S
52°27.5'S
06:30
07:00
07:30
08:00
-4200
-4100
-3900
-3800
-3700
-3600
-3500
-3400
-3300
0 250 500 1,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

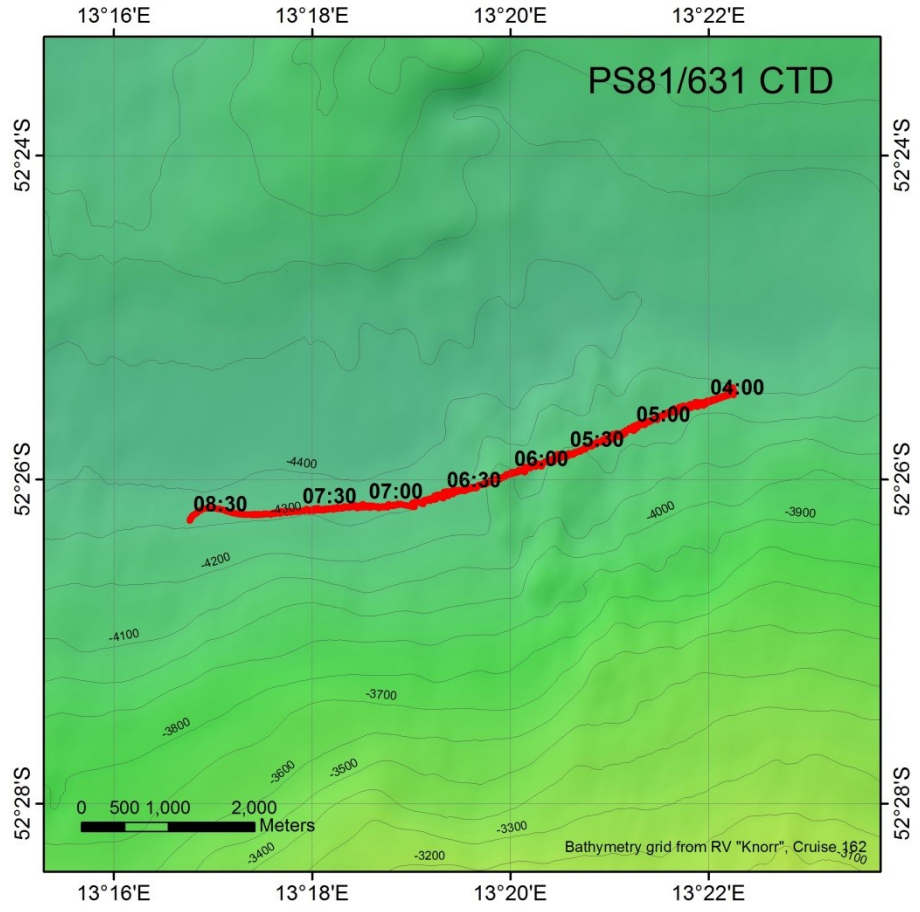

PS81/626 TVMUC
12°26'E
12°27'E
12°28'E
12°29'E
12°30'E
54°56'S
54°57'S
-5193
-5123
-5066
-5108
13:30
14:00
14:30
15:00
15:30
16:00
0 250 500 1,000
Meters
Bathymetry grid from GEBCO 08

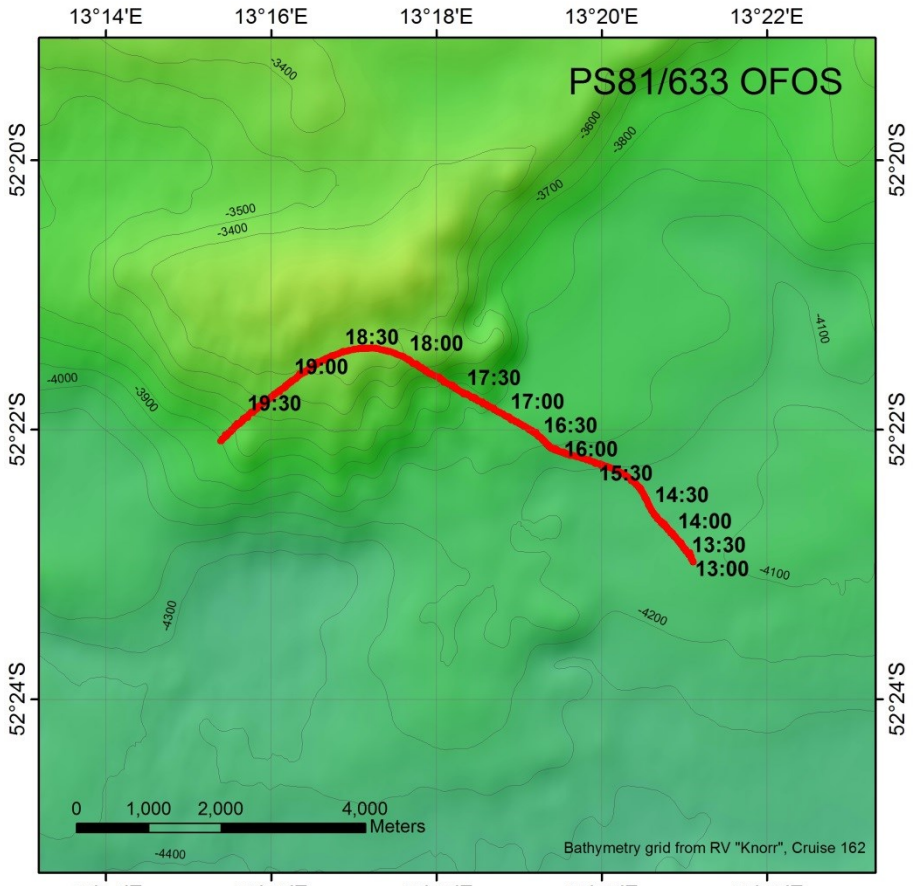

PS81/627 OFOS
13°0'E
13°2'E
13°4'E
13°6'E
13°8'E
52°28'S
52°30'S
52°32'S
52°34'S
-4400
-4300
-4200
-4100
-4000
-3900
-3800
-3700
-3600
-3500
-3400
-3300
-3200
-3100
11:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
0 750 1,500 3,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

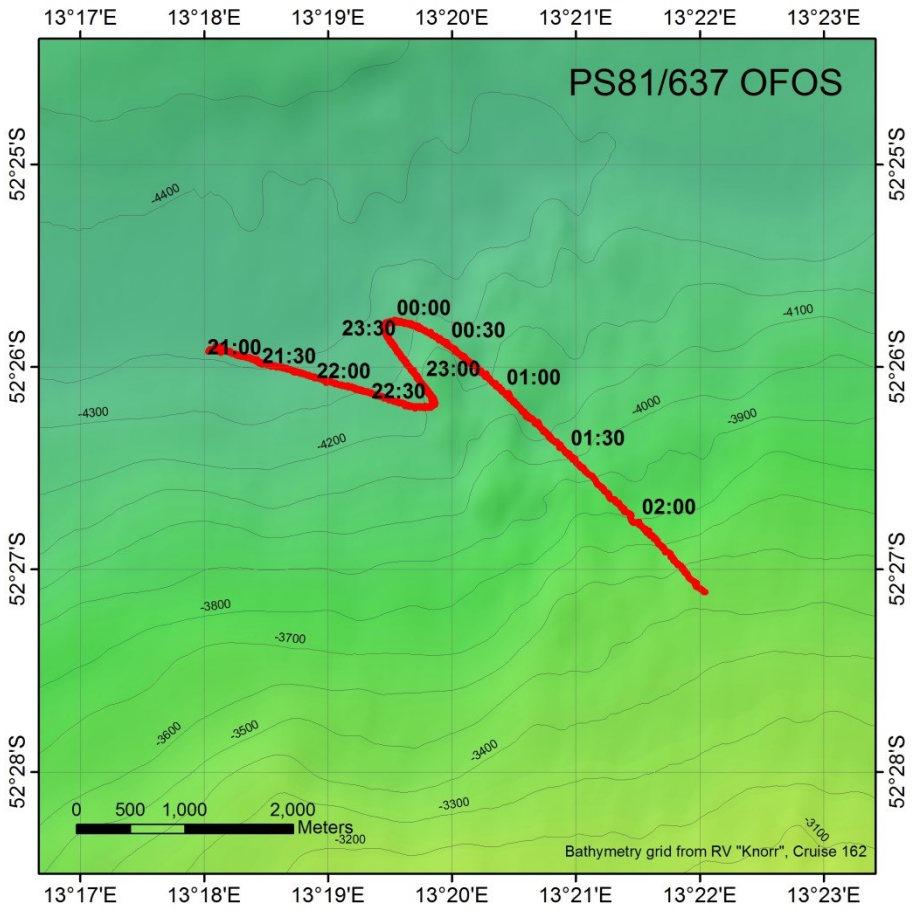

PS81/628 CTD
13°12'E
13°14'E
13°16'E
13°18'E
13°20'E
13°22'E
13°24'E
52°24'S
52°26'S
52°28'S
52°30'S
04:00
02:30
02:00
01:30
01:00
00:00
23:00
22:00
20:30
20:00
0 1,000 2,000 4,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

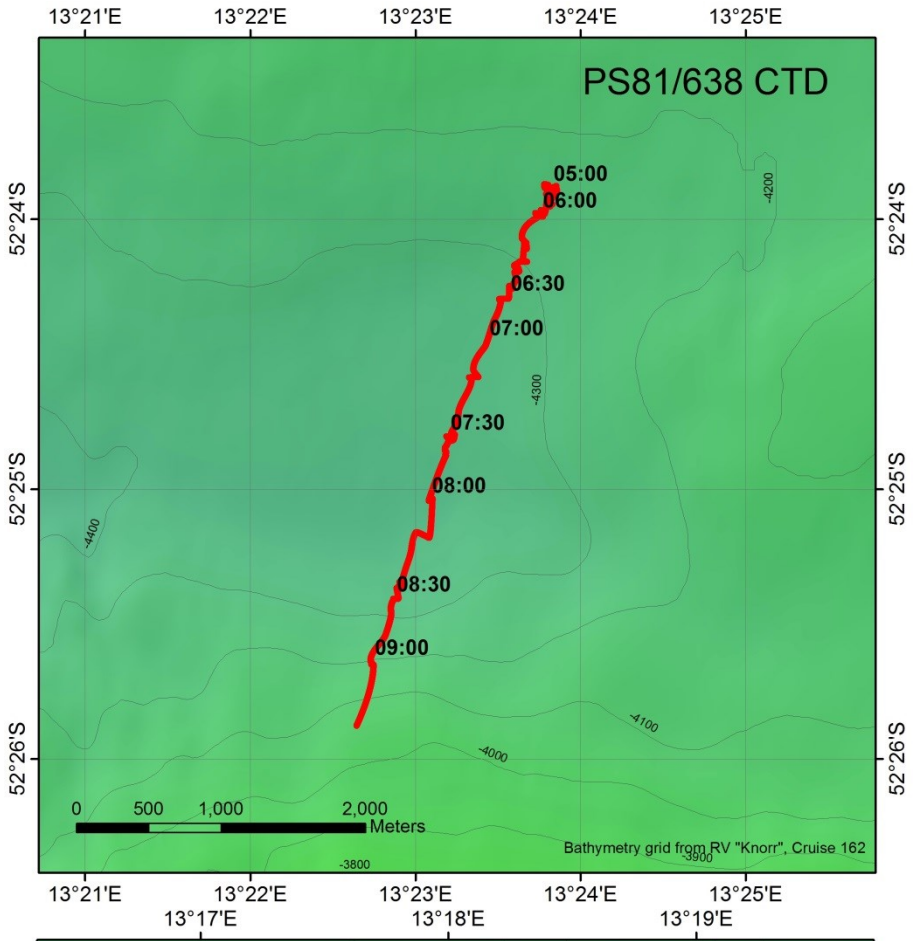

PS81/629 CTD
13°12.5'E
13°15'E
13°17.5'E
13°20'E
13°22.5'E
13°25'E
13°27.5'E
52°20'S
52°22.5'S
52°25'S
52°27.5'S
09:30
09:00
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
16:30
17:00
0 1,500 3,000 6,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

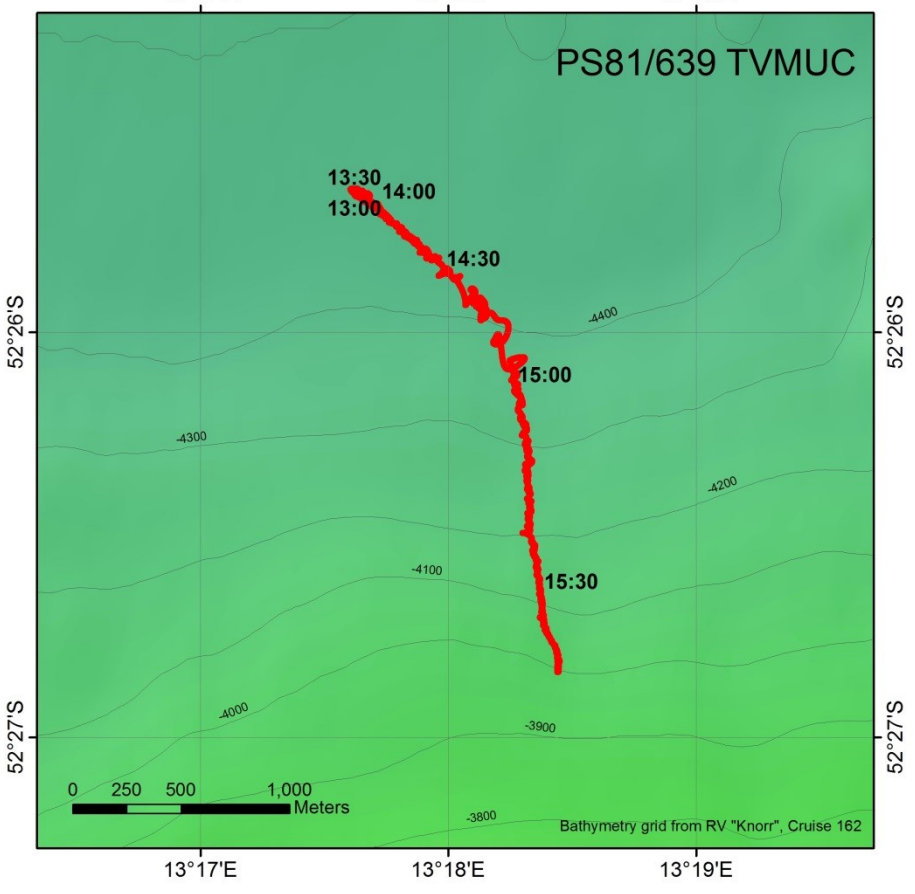

PS81/630 OFOS
13°16'E
13°18'E
13°20'E
13°22'E
13°24'E
52°24'S
52°26'S
52°28'S
00:30
00:00
23:30
23:00
22:30
22:00
21:30
21:00
20:30
18:30
19:00
19:30
-4300
-4200
-4100
-4000
-3900
-3800
-3700
-3600
-3500
-3400
-3300
-3200
-3100
-3000
0 500 1,000 2,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

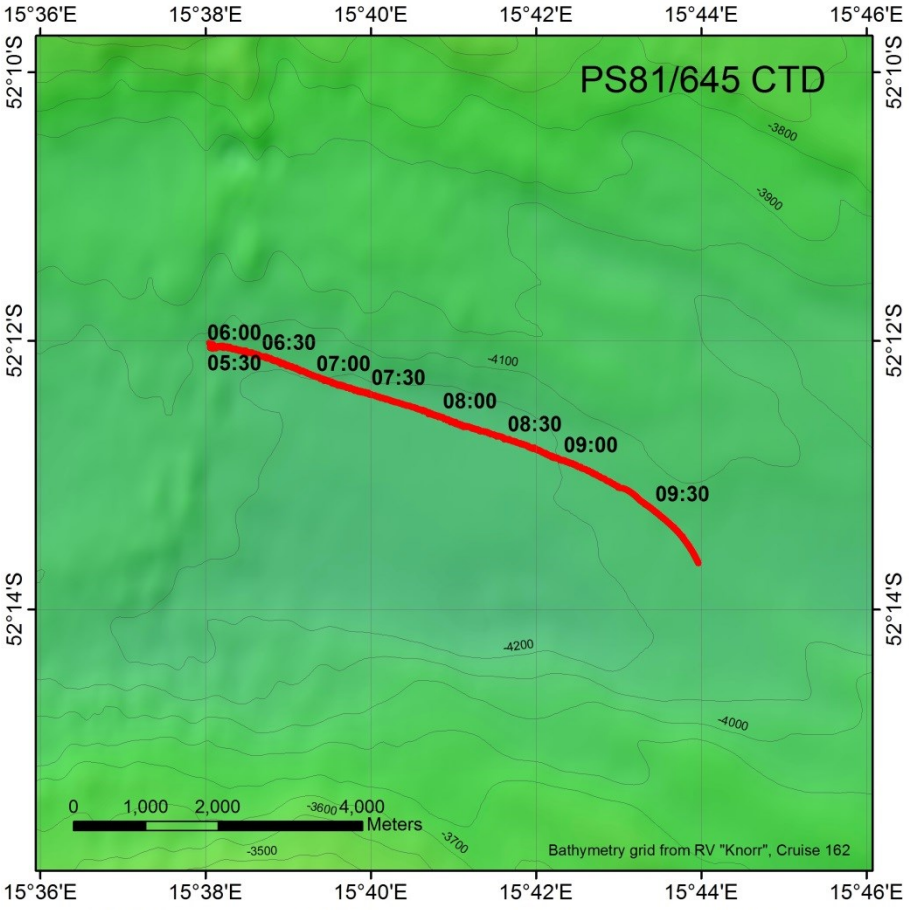

PS81/631 CTD
13°16'E
13°18'E
13°20'E
13°22'E
52°24'S
52°26'S
52°28'S
04:00
05:00
05:30
06:00
06:30
07:00
07:30
08:30
-4400
-4300
-4200
-4100
-4000
-3900
-3800
-3700
-3600
-3500
-3400
-3300
-3200
0 500 1,000 2,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

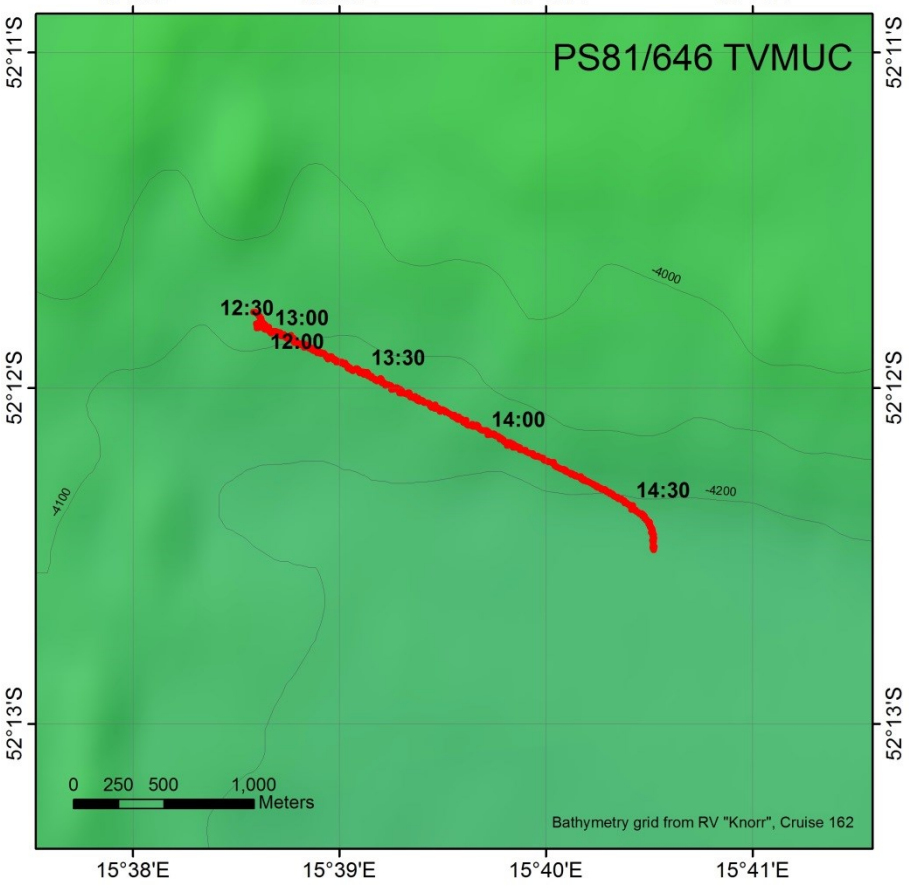

PS81/633 OFOS
13°14'E
13°16'E
13°18'E
13°20'E
13°22'E
52°20'S
52°22'S
52°24'S
18:30
18:00
19:00
17:30
19:30
17:00
16:30
16:00
15:30
14:30
14:00
13:30
13:00
0 1,000 2,000 4,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

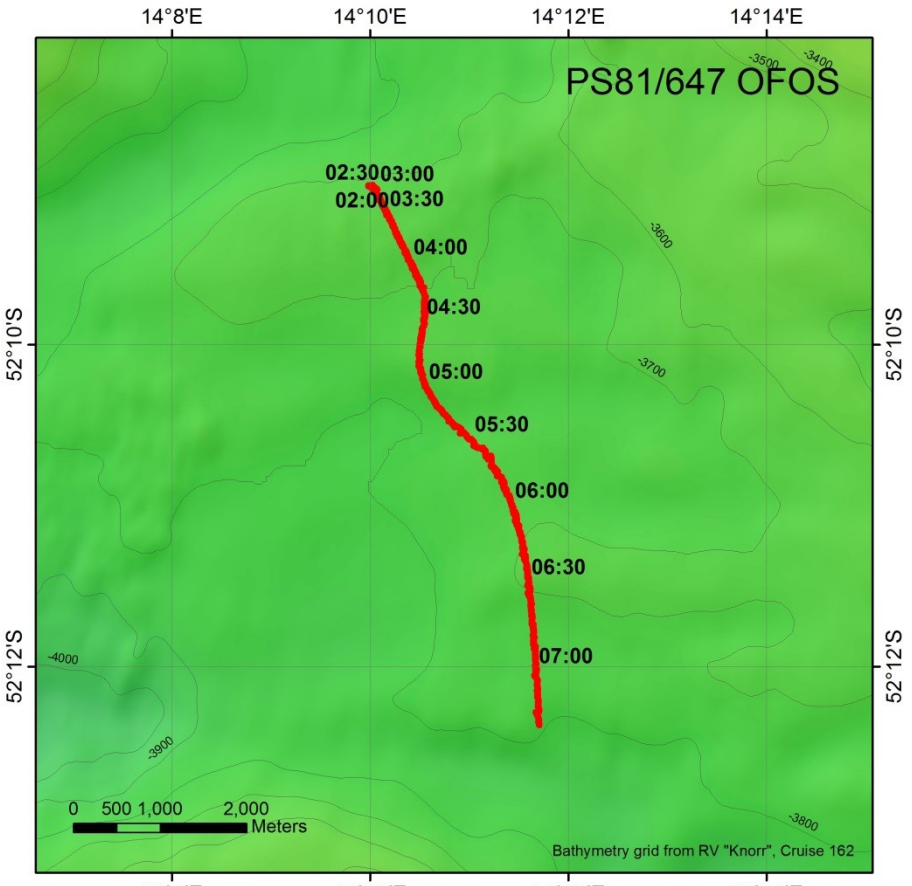

PS81/637 OFOS
13°17'E
13°18'E
13°19'E
13°20'E
13°21'E
13°22'E
13°23'E
52°25'S
52°26'S
52°27'S
52°28'S
00:00
23:30
00:30
21:00
21:30
22:00
23:00
01:00
22:30
01:30
02:00
0 500 1,000 2,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

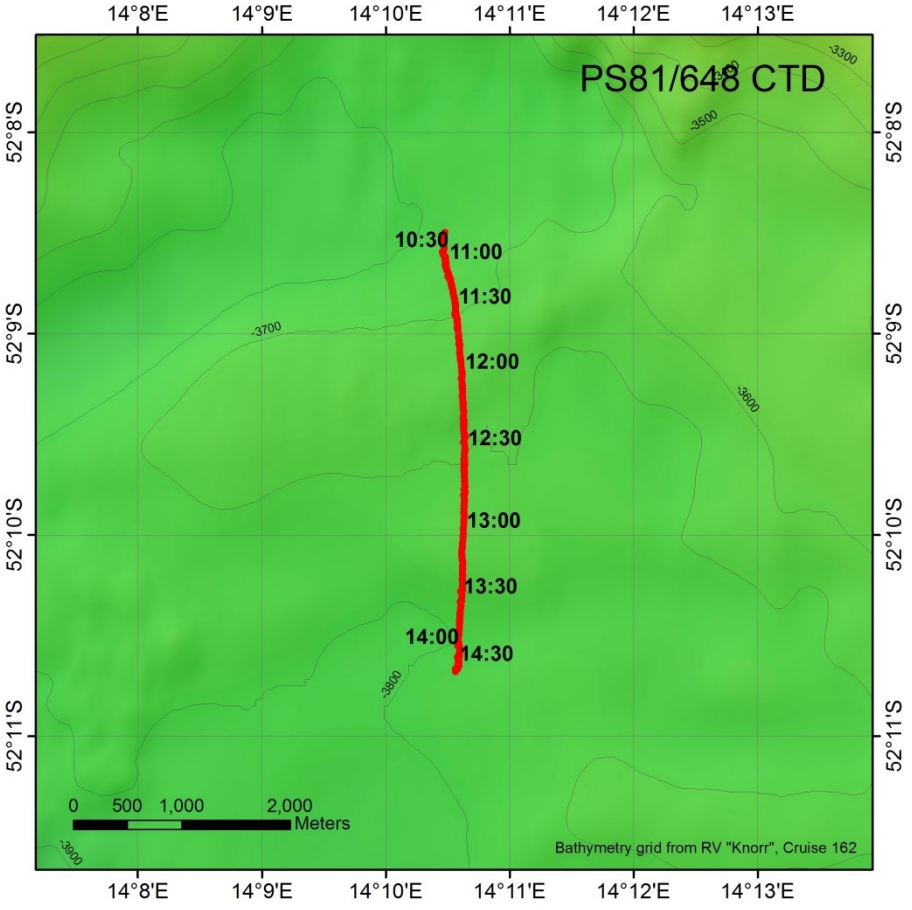

PS81/638 CTD
13°21'E
13°22'E
13°23'E
13°24'E
13°25'E
52°24'S
52°25'S
52°26'S
05:00
06:00
06:30
07:00
07:30
08:00
08:30
09:00
-4200
-4300
-4400
-4100
-4000
-3900
-3800
0 500 1,000 2,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/639 TVMUC
13°17'E
13°18'E
13°19'E
52°26'S
52°27'S
13:30
13:00
14:00
14:30
15:00
15:30
-4400
-4300
-4200
-4100
-4000
-3900
-3800
0 250 500 1,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/645 CTD
15°36'E
15°38'E
15°40'E
15°42'E
15°44'E
15°46'E
52°10'S
52°12'S
52°14'S
06:00
06:30
05:30
07:00
07:30
08:00
08:30
09:00
09:30
-3800
-3900
-4100
-4200
-4000
-3600
-3700
-3500
0 1,000 2,000 4,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/646 TVMUC
15°38'E
15°39'E
15°40'E
15°41'E
52°11'S
52°12'S
52°13'S
12:30
13:00
12:00
13:30
14:00
14:30
-4000
-4100
-4200
0 250 500 1,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/647 OFOS
14°8'E
14°10'E
14°12'E
14°14'E
52°10'S
52°12'S
02:30
03:00
02:00
03:30
04:00
04:30
05:00
05:30
06:00
06:30
07:00
-3500
-3400
-3600
-3700
-4000
-3900
-3800
0 500 1,000 2,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/648 CTD
14°8'E
14°9'E
14°10'E
14°11'E
14°12'E
14°13'E
52°8'S
52°9'S
52°10'S
52°11'S
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
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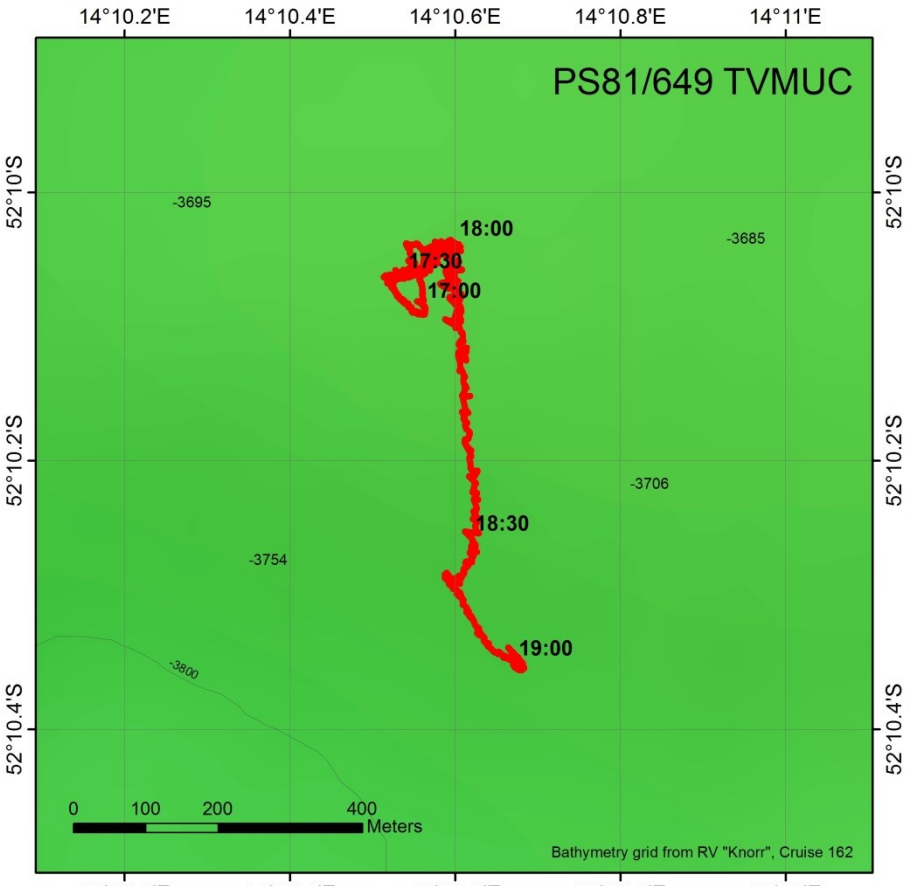
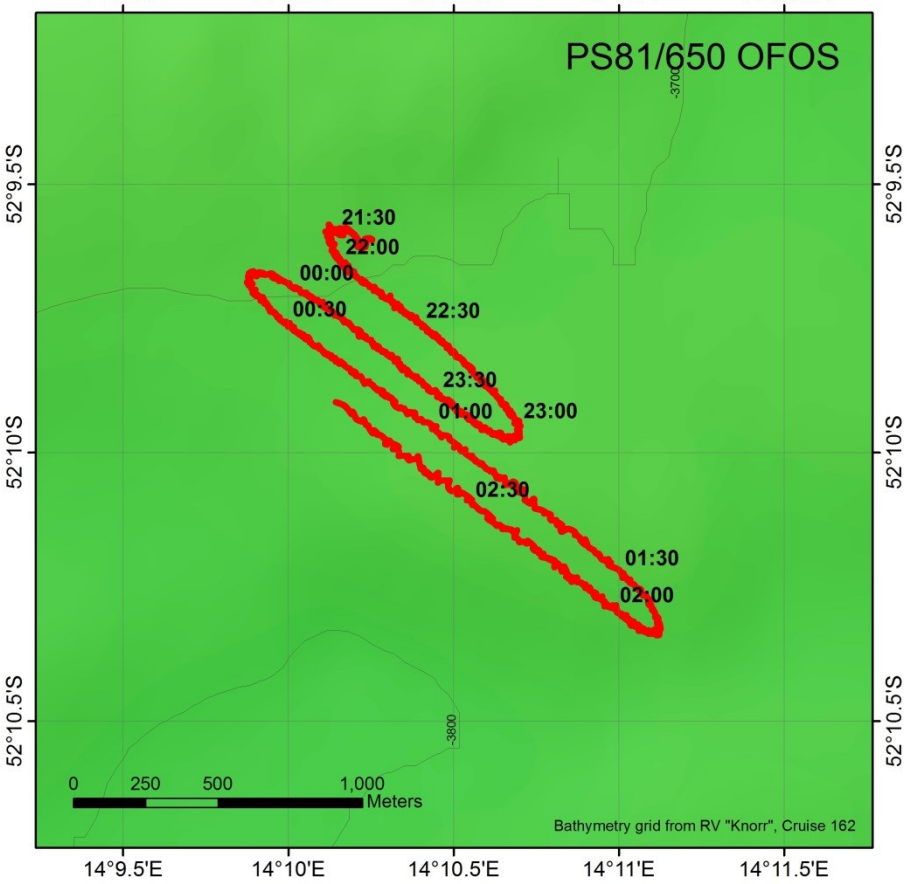
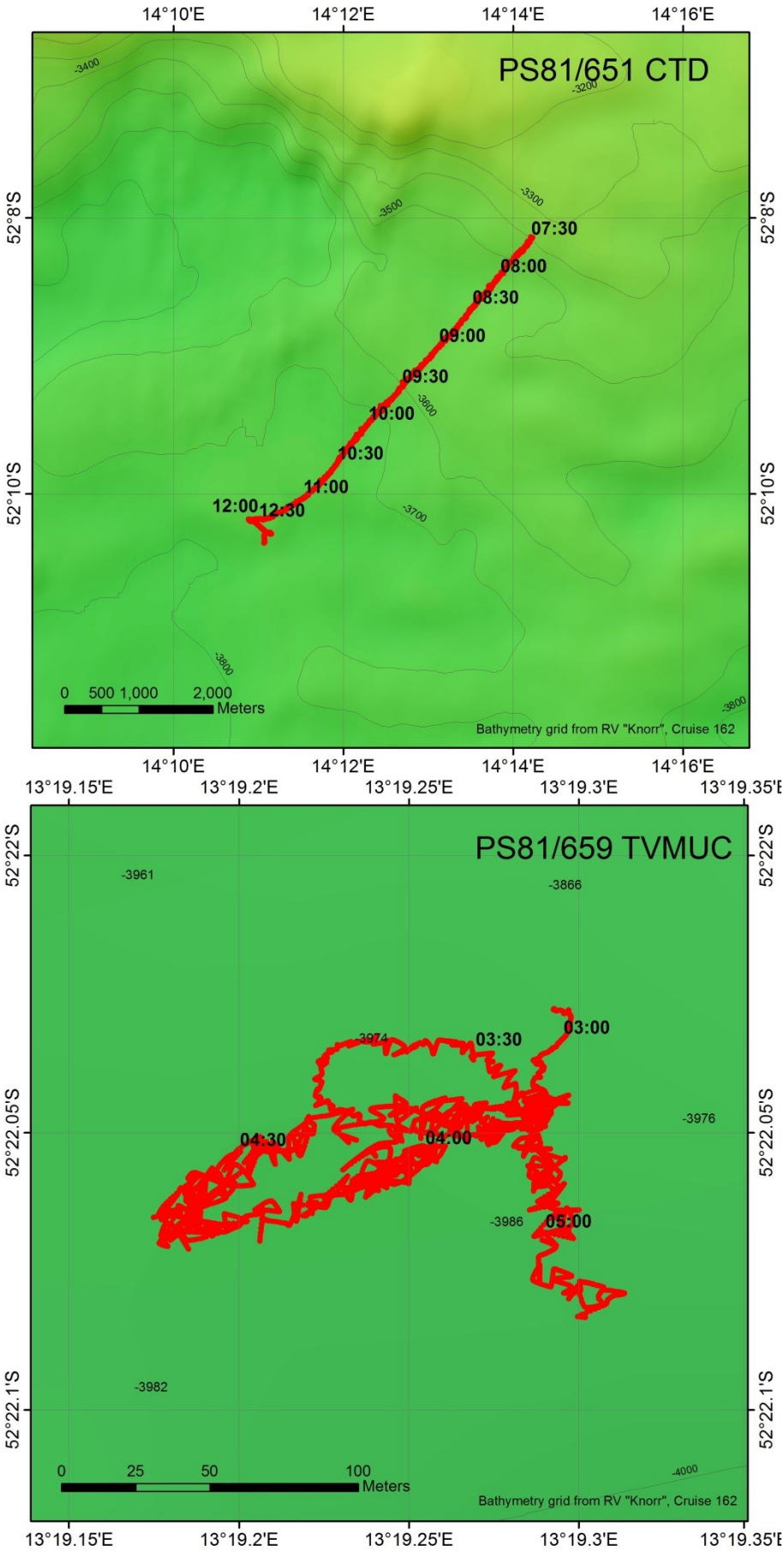
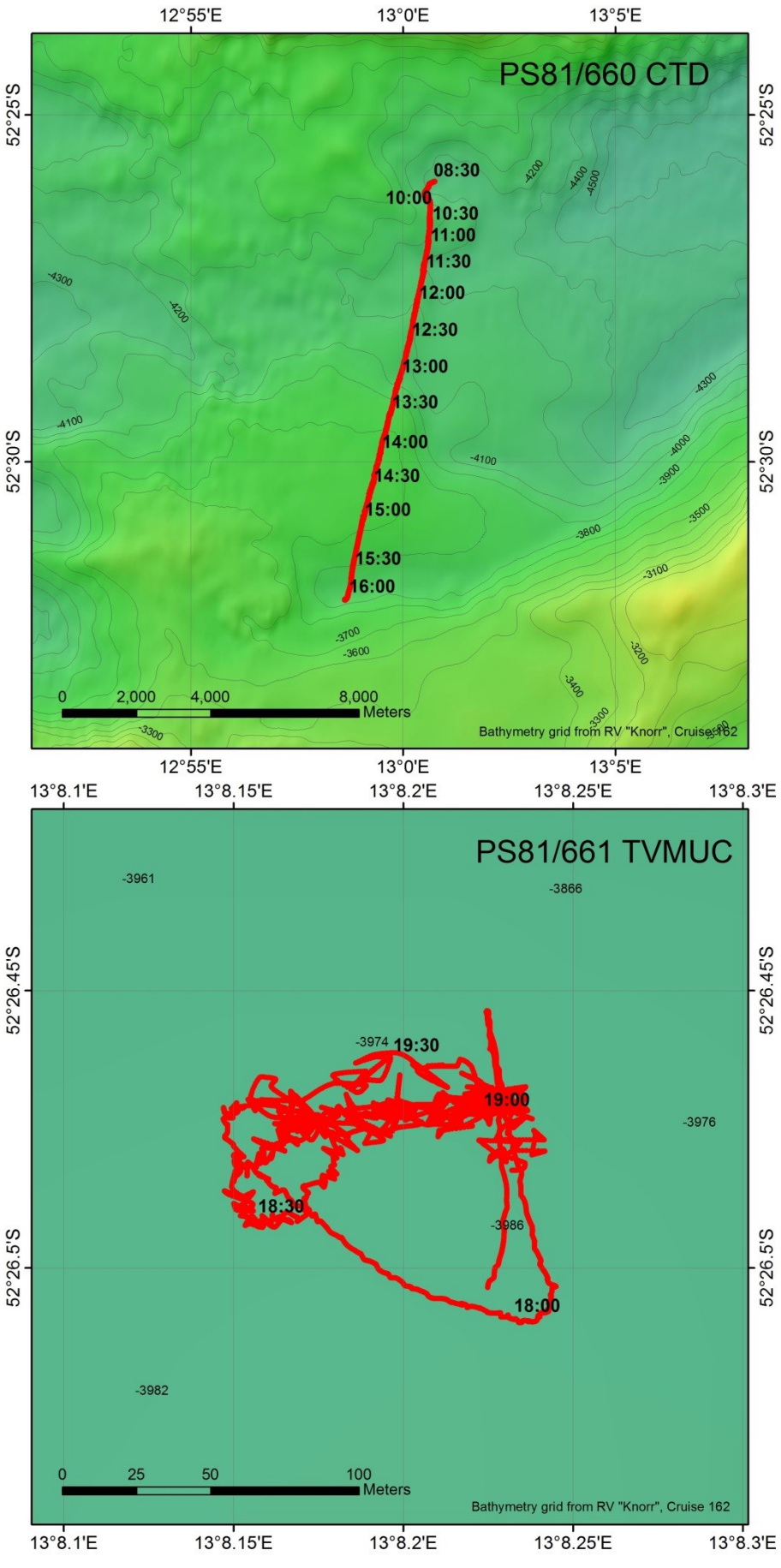
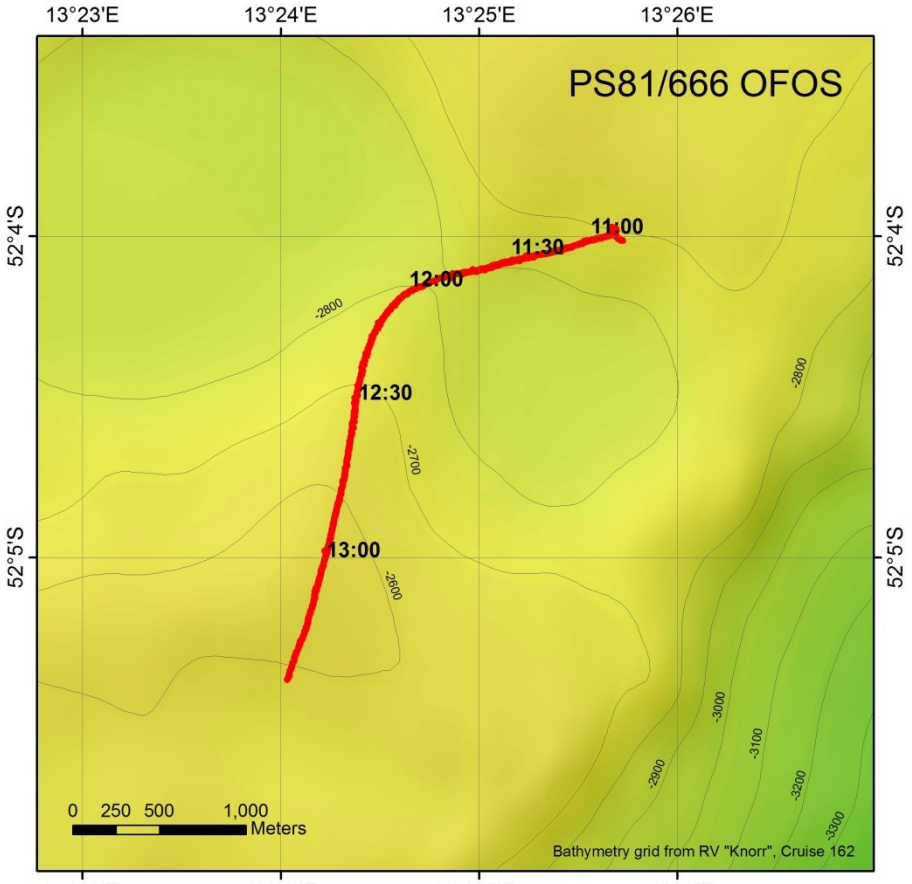
0 500 1,000 2,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

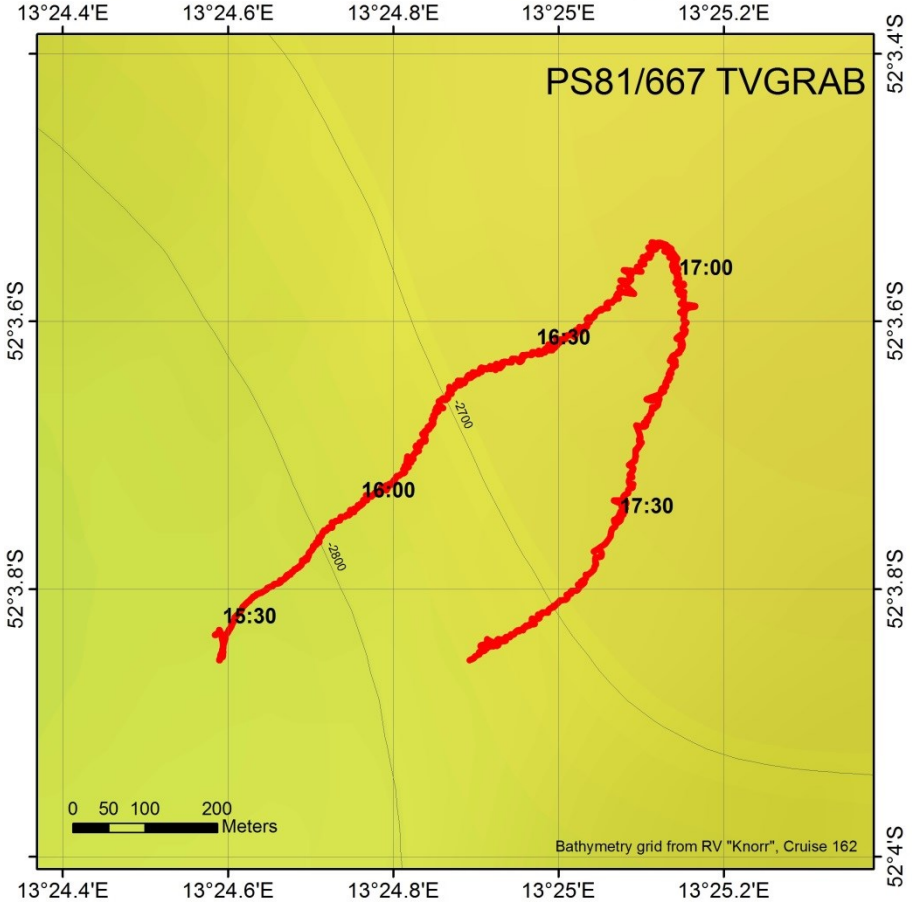

PS81/649 TVMUC
14°10.2'E
14°10.4'E
14°10.6'E
14°10.8'E
14°11'E
52°10'S
52°10.2'S
52°10.4'S
-3695
-3685
-3706
-3754
-3800
18:00
17:30
17:00
18:30
19:00
0
100
200
400
Meters
Bathymetry grid from RV "Knorr", Cruise 162

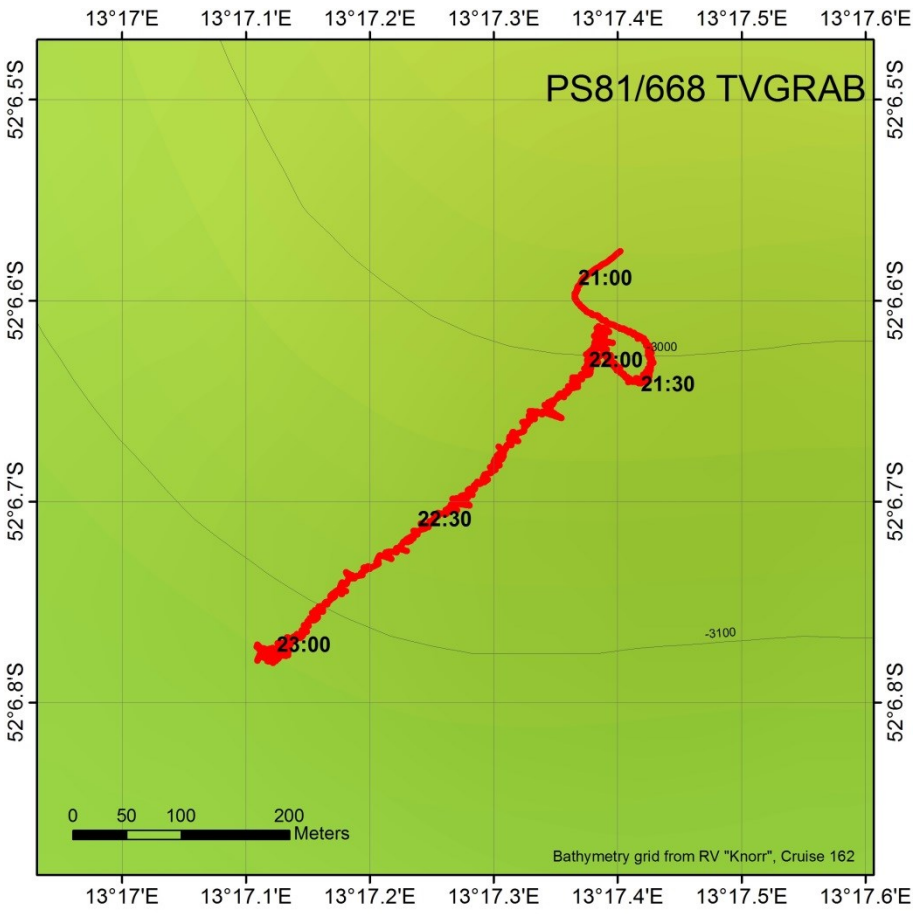

PS81/650 OFOS
14°9.5'E
14°10'E
14°10.5'E
14°11'E
14°11.5'E
52°9.5'S
52°10'S
52°10.5'S
-3700
-3800
21:30
22:00
00:00
00:30
22:30
23:30
01:00
23:00
02:30
01:30
02:00
0
250
500
1,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

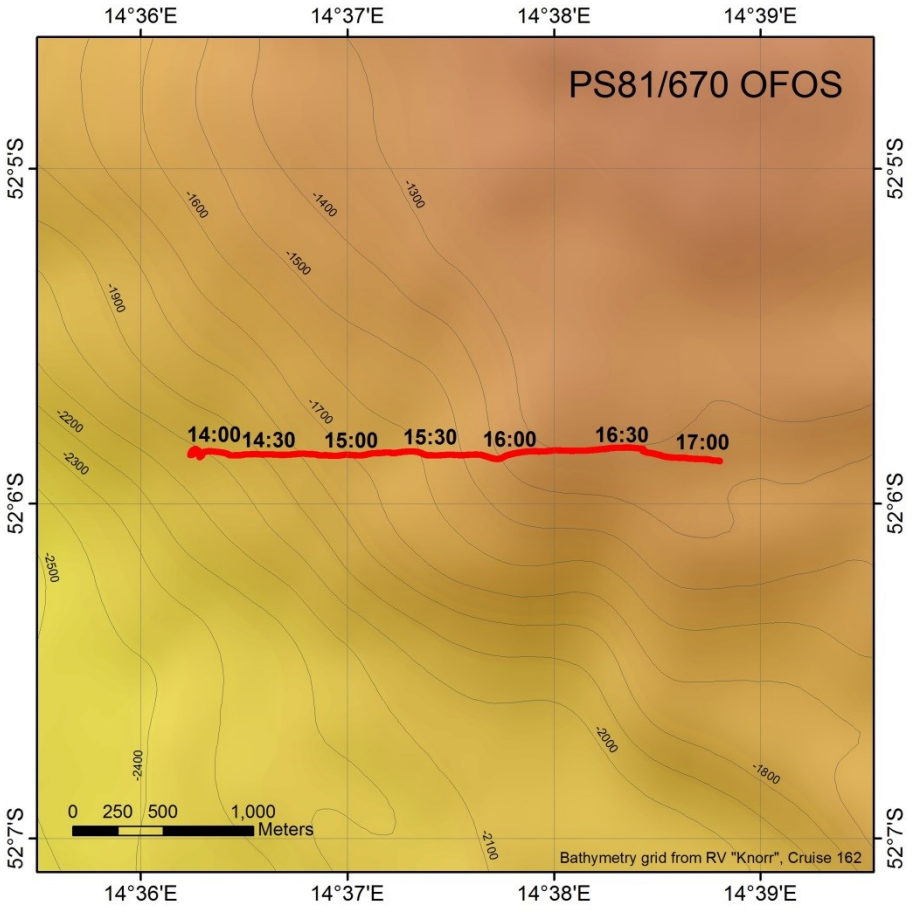

PS81/651 CTD
14°10'E
14°12'E
14°14'E
14°16'E
52°8'S
52°10'S
-3400
-3200
-3500
-3300
-3600
-3700
-3800
07:30
08:00
08:30
09:00
09:30
10:00
10:30
11:00
12:00
12:30
0 500 1,000 2,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162
PS81/659 TVMUC
13°19.15'E
13°19.2'E
13°19.25'E
13°19.3'E
13°19.35'E
52°22'S
52°22.05'S
52°22.1'S
-3961
-3866
-3974
-3976
-3986
-3982
-4000
03:00
03:30
04:00
04:30
05:00
0 25 50 100
Meters
Bathymetry grid from RV "Knorr", Cruise 162

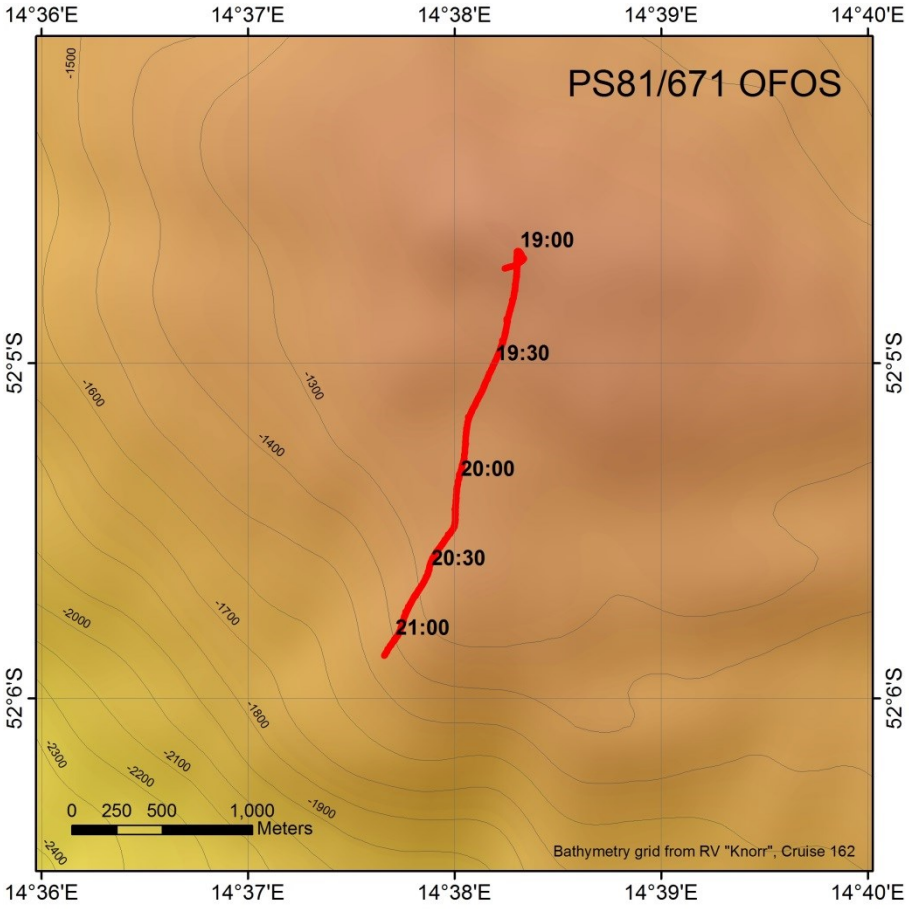

PS81/660 CTD
12°55'E
13°0'E
13°5'E
52°25'S
52°30'S
08:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
-4200
-4400
-4500
-4300
-4100
-4000
-3900
-3500
-3800
-3100
-3700
-3600
-3200
-3400
-3300
0 2,000 4,000 8,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162
13°8.1'E
13°8.15'E
13°8.2'E
13°8.25'E
13°8.3'E
PS81/661 TVMUC
52°26.45'S
52°26.5'S
-3961
-3866
-3974
19:30
19:00
-3976
18:30
-3986
18:00
-3982
0 25 50 100
Meters
Bathymetry grid from RV "Knorr", Cruise 162

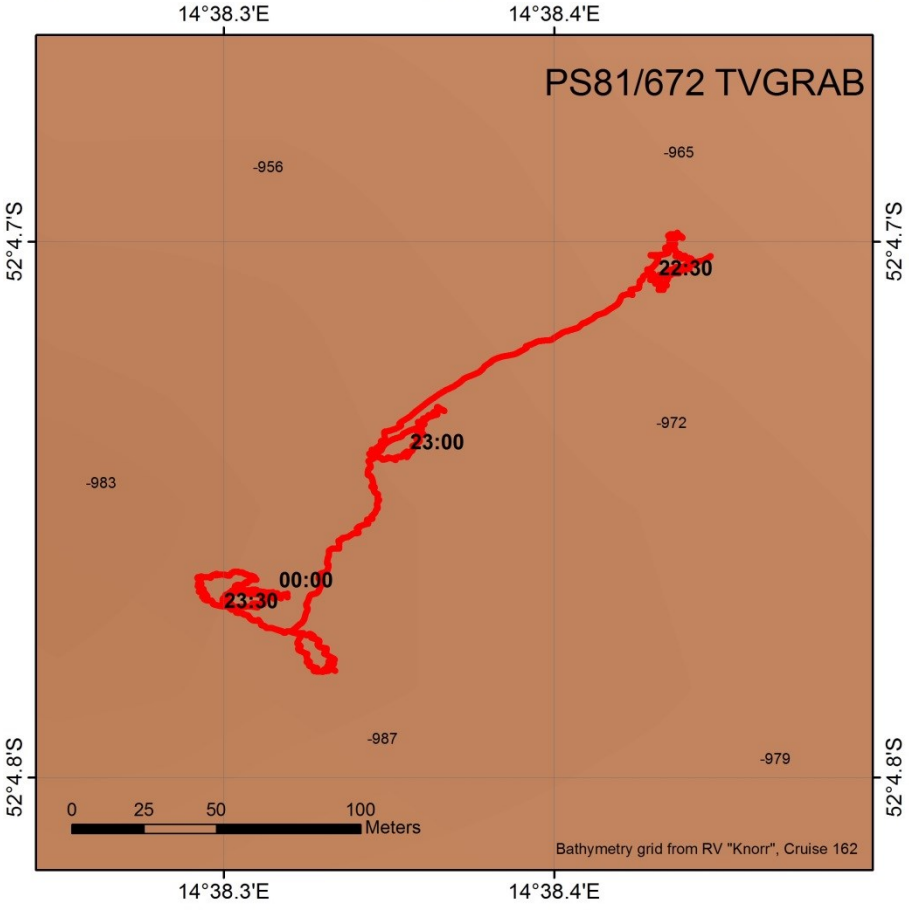

PS81/666 OFOS
13°23'E
13°24'E
13°25'E
13°26'E
52°4'S
52°5'S
11:00
11:30
12:00
12:30
13:00
-2800
-2700
-2600
-2900
-3000
-3100
-3200
-3300
0 250 500 1,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162

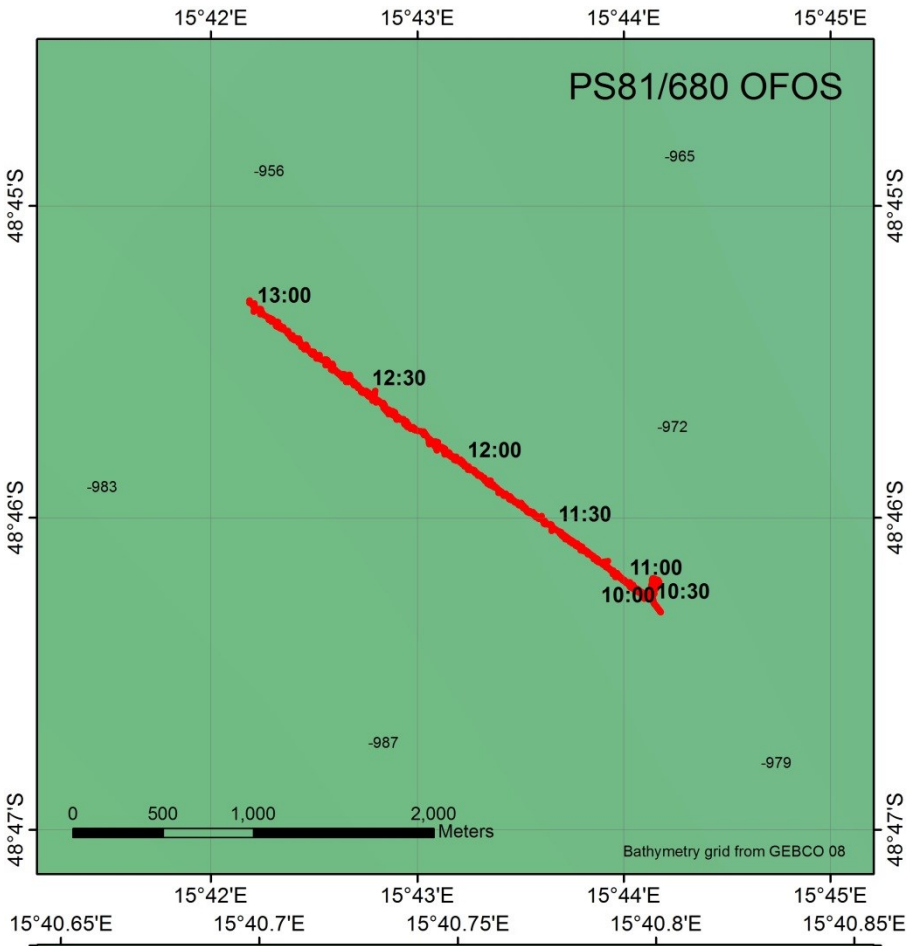

PS81/667 TVGRAB
13°24.4'E
13°24.6'E
13°24.8'E
13°25'E
13°25.2'E
52°3.4'S
52°3.6'S
52°3.8'S
52°4'S
17:00
16:30
16:00
15:30
17:30
-2700
-2800
0 50 100 200
Meters
Bathymetry grid from RV "Knorr", Cruise 162

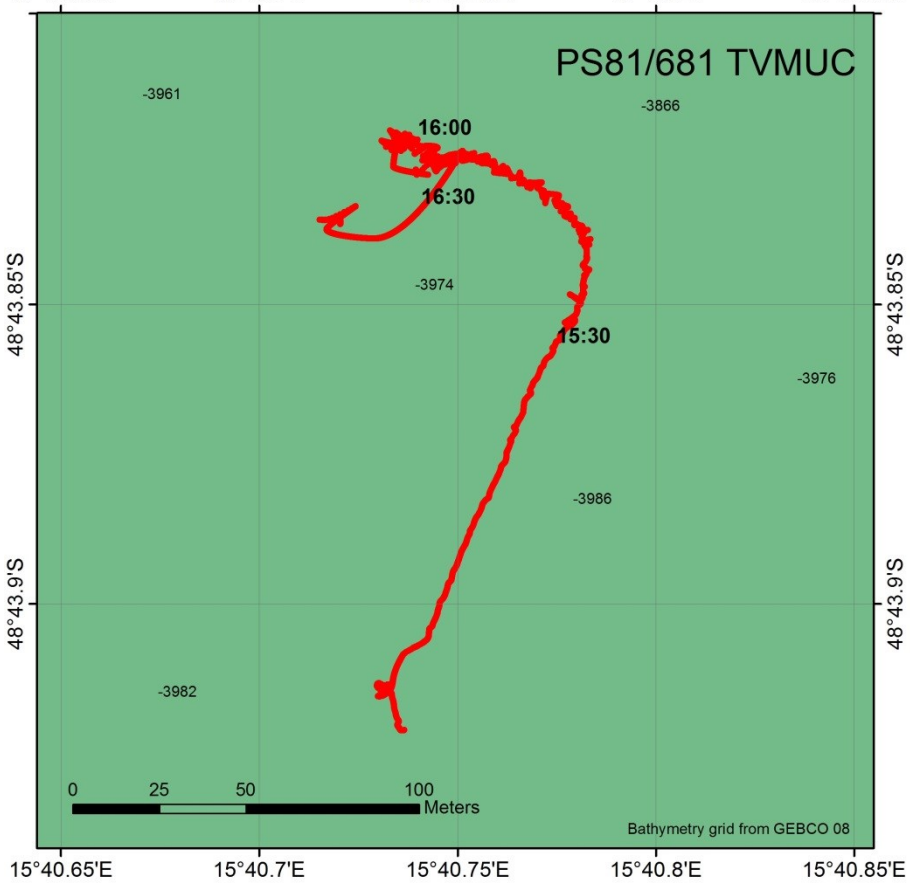

PS81/668 TVGRAB
13°17'E
13°17.1'E
13°17.2'E
13°17.3'E
13°17.4'E
13°17.5'E
13°17.6'E
52°6.5'S
52°6.6'S
52°6.7'S
52°6.8'S
21:00
22:00
21:30
22:30
23:00
-3000
-3100
0 50 100 200
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/670 OFOS
14°36'E
14°37'E
14°38'E
14°39'E
52°5'S
52°6'S
52°7'S
-1300
-1400
-1500
-1600
-1700
-1800
-1900
-2000
-2100
-2200
-2300
-2400
-2500
14:00
14:30
15:00
15:30
16:00
16:30
17:00
0 250 500 1,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/671 OFOS
14°36'E
14°37'E
14°38'E
14°39'E
14°40'E
52°5'S
52°6'S
19:00
19:30
20:00
20:30
21:00
-1500
-1600
-1300
-1400
-2000
-1700
-1800
-2300
-2100
-2200
-1900
-2400
0 250 500 1,000
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/672 TVGRAB
14°38.3'E
14°38.4'E
52°4.7'S
52°4.8'S
-956
-965
22:30
-972
23:00
-983
00:00
23:30
-987
-979
0 25 50 100
Meters
Bathymetry grid from RV "Knorr", Cruise 162


PS81/680 OFOS
15°42'E
15°43'E
15°44'E
15°45'E
48°45'S
48°46'S
48°47'S
-956
-965
-972
-983
-987
-979
13:00
12:30
12:00
11:30
11:00
10:30
10:00
0
500
1,000
2,000
Meters
Bathymetry grid from GEBCO 08


PS81/681 TVMUC
15°40.65'E
15°40.7'E
15°40.75'E
15°40.8'E
15°40.85'E
48°43.85'S
48°43.9'S
-3961
-3866
-3974
-3976
-3986
-3982
16:00
16:30
15:30
0
25
50
100
Meters
Bathymetry grid from GEBCO 08