# Underwater Gear Track Data from PS86

## 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 PS86. Instruments that were tracked during this cruise were: CTD/Water sampler, Television Multicorer (TVMUC) 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.

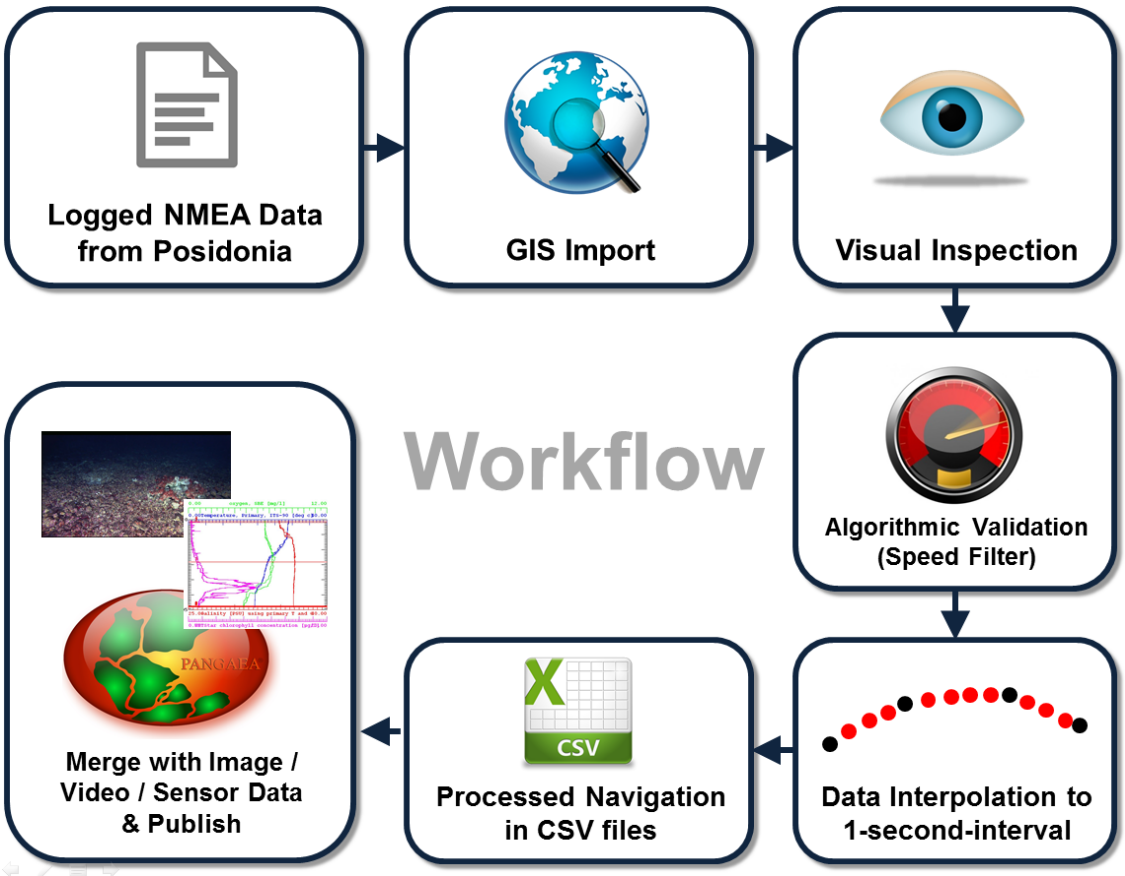



**Figure 1: Processing workflow**

## 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_1sec.txt* (Example: *ps86-018-1_CTD_nav_1sec.txt*)

The internal file format is shown here:

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

# 5 Statistics

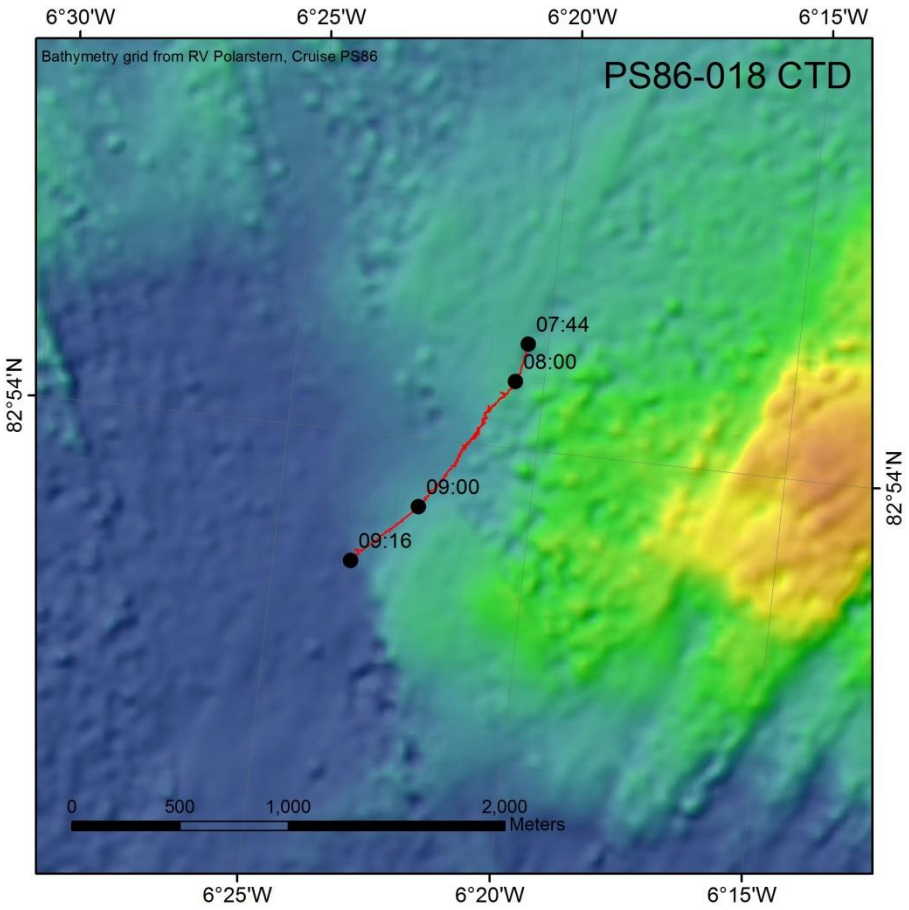
Overview of *Posidonia*-tracked instrument stations:

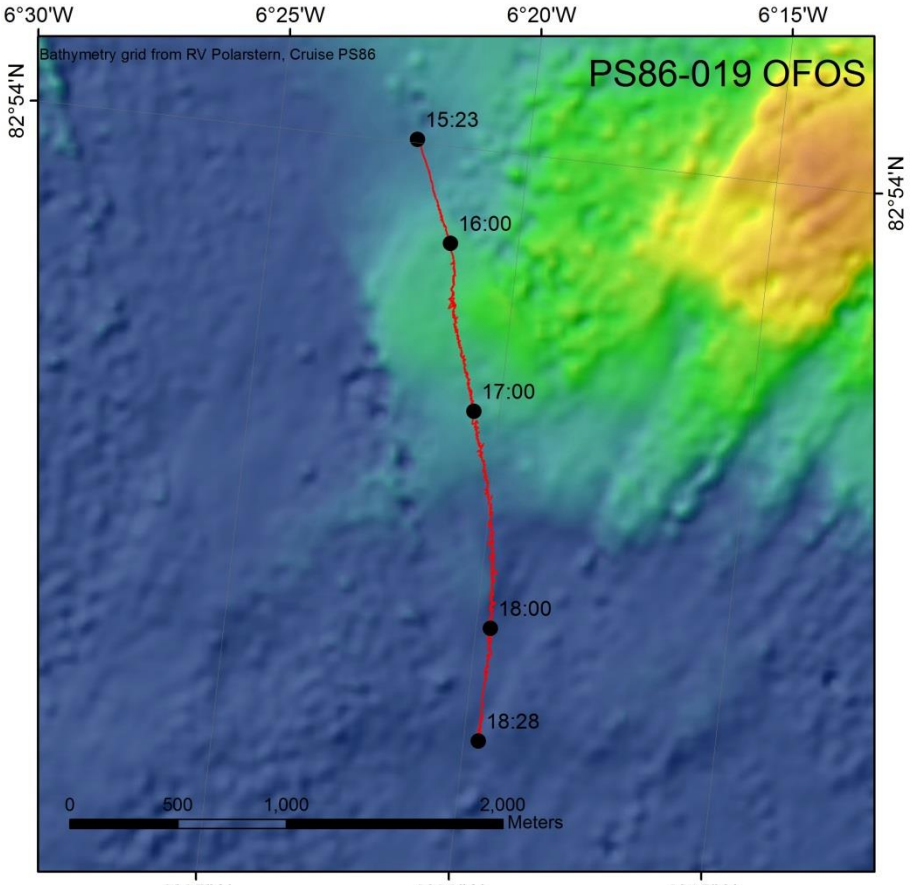
| Station No. | Gear | Start time | End time | No. of 1s Positions |
|---|---|---|---|---|
| PS86/0018-1 | CTD | 2014-07-12T07:44:29 | 2014-07-12T09:16:06 | 5499 |
| PS86/0019-1 | OFOS | 2014-07-12T15:23:32 | 2014-07-12T18:28:47 | 11117 |
| PS86/0020-1 | TVMUC | 2014-07-12T20:12:31 | 2014-07-12T22:03:04 | 6635 |
| PS86/0021-1 | CTD | 2014-07-13T02:17:21 | 2014-07-13T06:17:12 | 14393 |
| PS86/0023-1 | CTD | 2014-07-13T16:48:21 | 2014-07-13T19:05:45 | 8246 |
| PS86/0024-1 | OFOS | 2014-07-13T21:16:14 | 2014-07-14T01:51:26 | 16514 |
| PS86/0028-1 | TVMUC | 2014-07-14T19:18:31 | 2014-07-14T20:44:52 | 5183 |
| PS86/0029-1 | CTD | 2014-07-14T23:00:06 | 2014-07-15T06:07:22 | 25638 |
| PS86/0030-1 | OFOS | 2014-07-15T07:48:25 | 2014-07-15T12:53:05 | 18282 |
| PS86/0033-1 | CTD | 2014-07-15T21:53:41 | 2014-07-16T00:05:32 | 7913 |
| PS86/0035-1 | OFOS | 2014-07-16T13:13:10 | 2014-07-16T19:48:17 | 23709 |
| PS86/0036-1 | CTD | 2014-07-16T21:40:19 | 2014-07-17T03:21:25 | 20468 |
| PS86/0039-1 | OFOS | 2014-07-17T17:35:52 | 2014-07-17T20:23:15 | 10045 |
| PS86/0040-1 | CTD | 2014-07-17T22:40:19 | 2014-07-18T05:26:37 | 24380 |
| PS86/0041-1 | TVMUC | 2014-07-18T07:43:44 | 2014-07-18T11:40:55 | 14233 |
| PS86/0043-1 | CTD | 2014-07-18T21:15:27 | 2014-07-19T02:29:07 | 18822 |
| PS86/0046-1 | OFOS | 2014-07-19T12:33:11 | 2014-07-19T16:18:38 | 13529 |
| PS86/0048-1 | CTD | 2014-07-20T07:16:58 | 2014-07-20T09:50:23 | 9207 |
| PS86/0049-1 | CTD | 2014-07-20T12:01:48 | 2014-07-20T14:45:58 | 9852 |
| PS86/0050-1 | OFOS | 2014-07-20T16:29:51 | 2014-07-20T20:49:51 | 15602 |
| PS86/0054-1 | OFOS | 2014-07-21T19:13:29 | 2014-07-21T22:16:11 | 10964 |
| PS86/0055-1 | CTD | 2014-07-22T04:02:27 | 2014-07-22T09:10:30 | 18485 |
| PS86/0056-1 | OFOS | 2014-07-22T13:26:55 | 2014-07-22T17:11:42 | 13489 |
| PS86/0057-1 | CTD | 2014-07-22T20:05:55 | 2014-07-22T21:48:56 | 6183 |
| PS86/0061-1 | TVMUC | 2014-07-23T18:47:57 | 2014-07-23T21:23:56 | 9361 |
| PS86/0065-1 | OFOS | 2014-07-24T15:11:57 | 2014-07-24T21:09:34 | 21459 |
| PS86/0066-1 | CTD | 2014-07-24T23:26:22 | 2014-07-25T03:38:16 | 15116 |
| PS86/0068-1 | OFOS | 2014-07-25T11:21:32 | 2014-07-25T17:56:23 | 23693 |
| PS86/0069-1 | CTD | 2014-07-25T21:46:56 | 2014-07-26T03:59:37 | 22363 |
| PS86/0076-1 | TVMUC | 2014-07-27T17:56:03 | 2014-07-27T19:05:11 | 4150 |

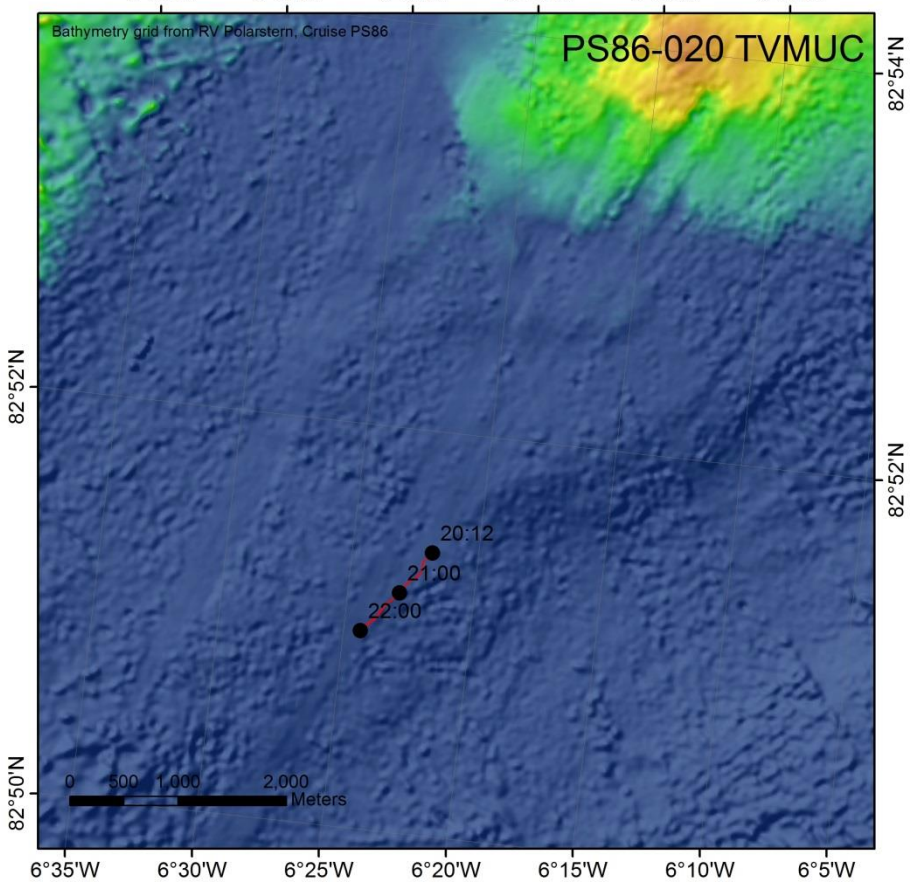
| | | | | |
|---|---|---|---|---|
| PS86/0077-1 | OFOS | 2014-07-27T22:46:29 | 2014-07-28T01:25:39 | 9552 |
| PS86/0082-1 | OFOS | 2014-07-28T21:39:40 | 2014-07-29T01:08:11 | 12513 |
| PS86/0083-1 | CTD | 2014-07-29T03:28:06 | 2014-07-29T04:05:37 | 2253 |
| PS86/0084-1 | OFOS | 2014-07-29T10:54:12 | 2014-07-29T14:34:17 | 13207 |
| PS86/0085-1 | OFOS | 2014-07-29T17:35:31 | 2014-07-29T20:25:03 | 10174 |
| PS86/0086-1 | OFOS | 2014-07-29T22:24:42 | 2014-07-30T01:27:00 | 10940 |

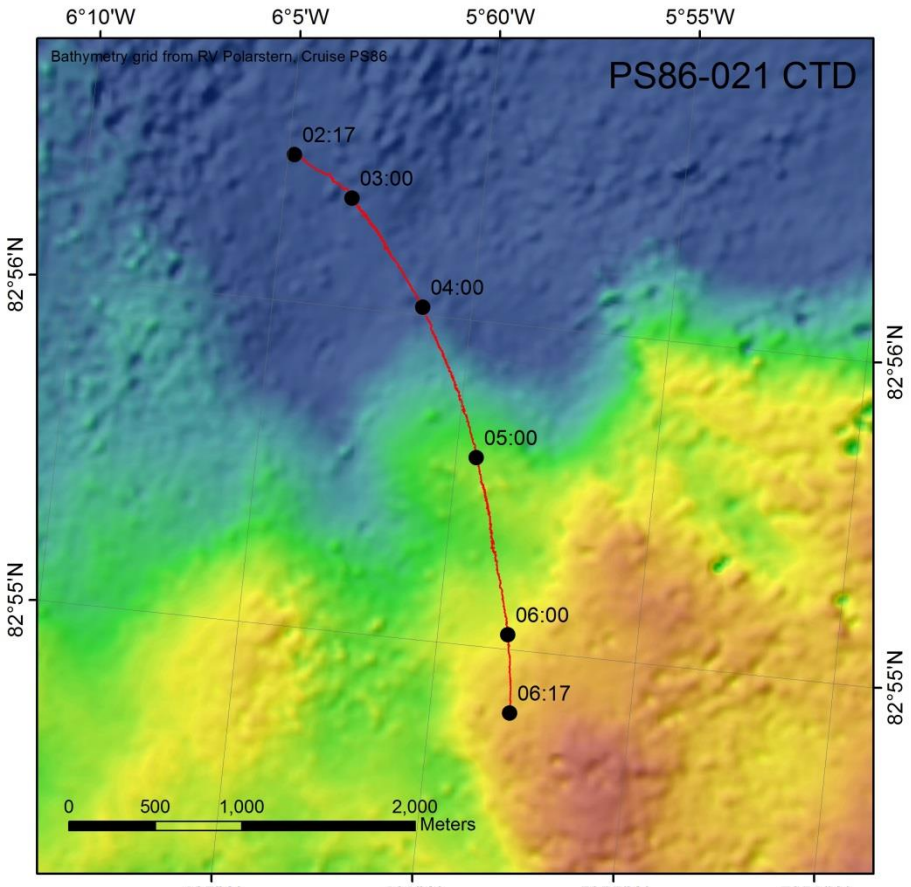
# 6 Station maps

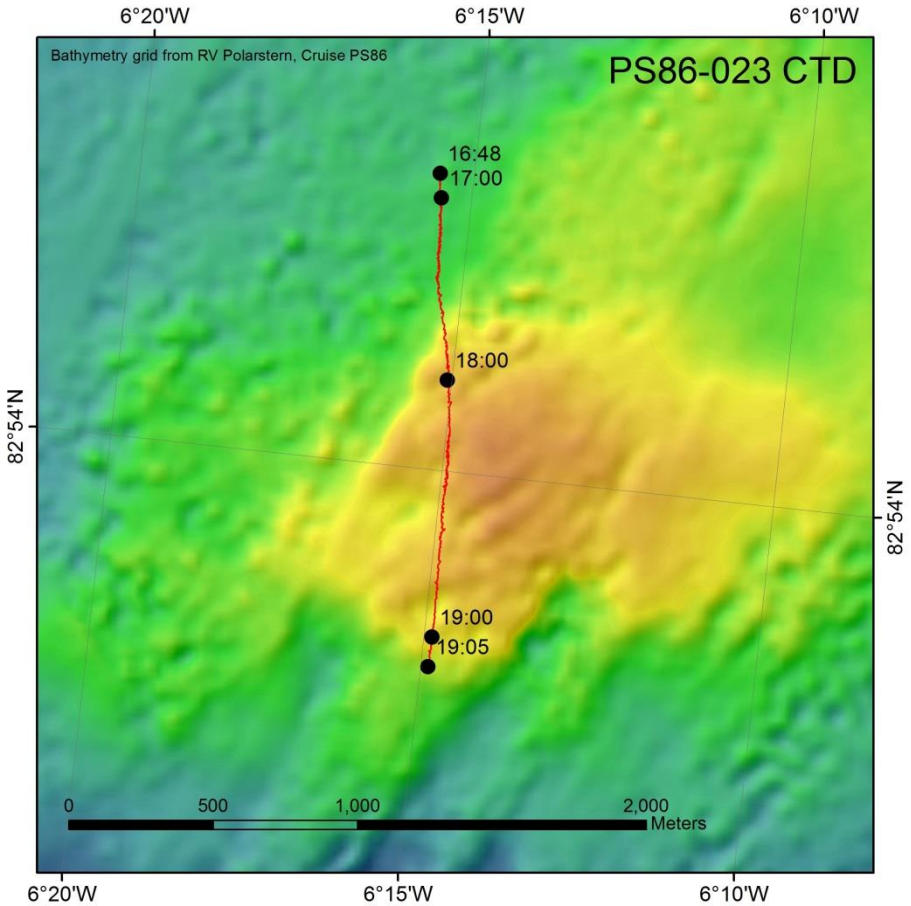
The station maps give an overview of the processed navigation track. In the upper right corner the cruise and station number is shown as well as the instrument type. For each map the best available bathymetry for the map extent has been chosen. The bathymetry grid source is shown in the lower right corner.

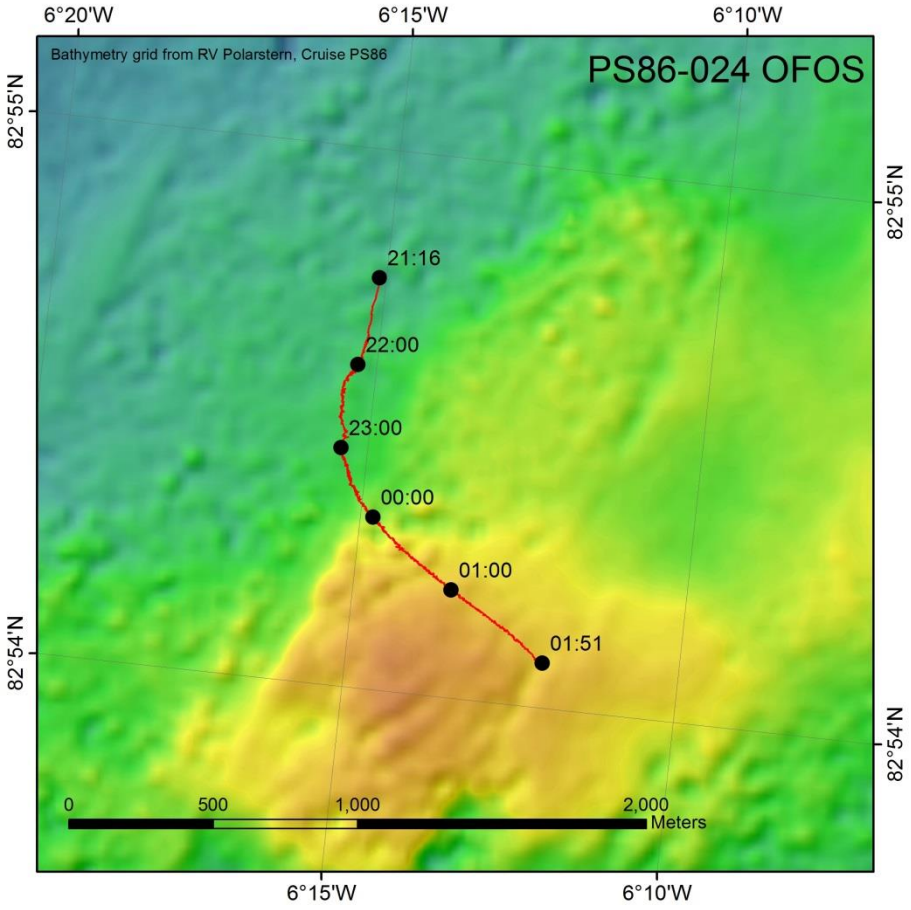


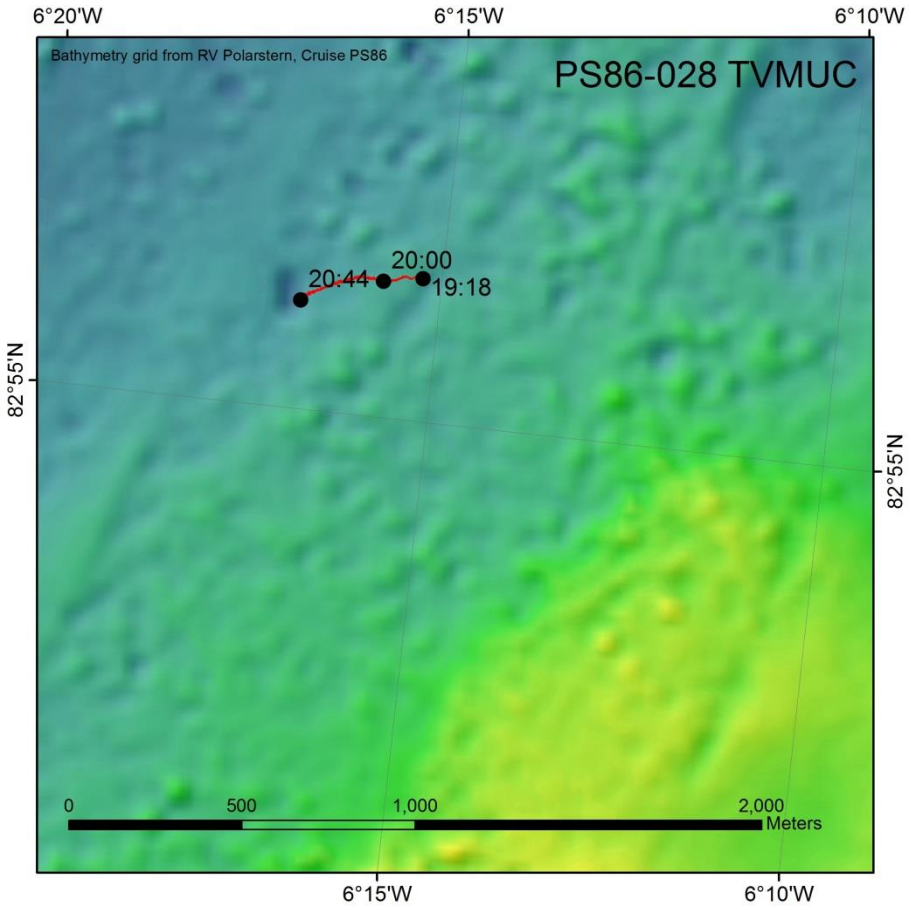

6°30'W
6°25'W
6°20'W
6°15'W
82°54'N
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-019 OFOS
15:23
16:00
17:00
18:00
18:28
0
500
1,000
2,000
Meters

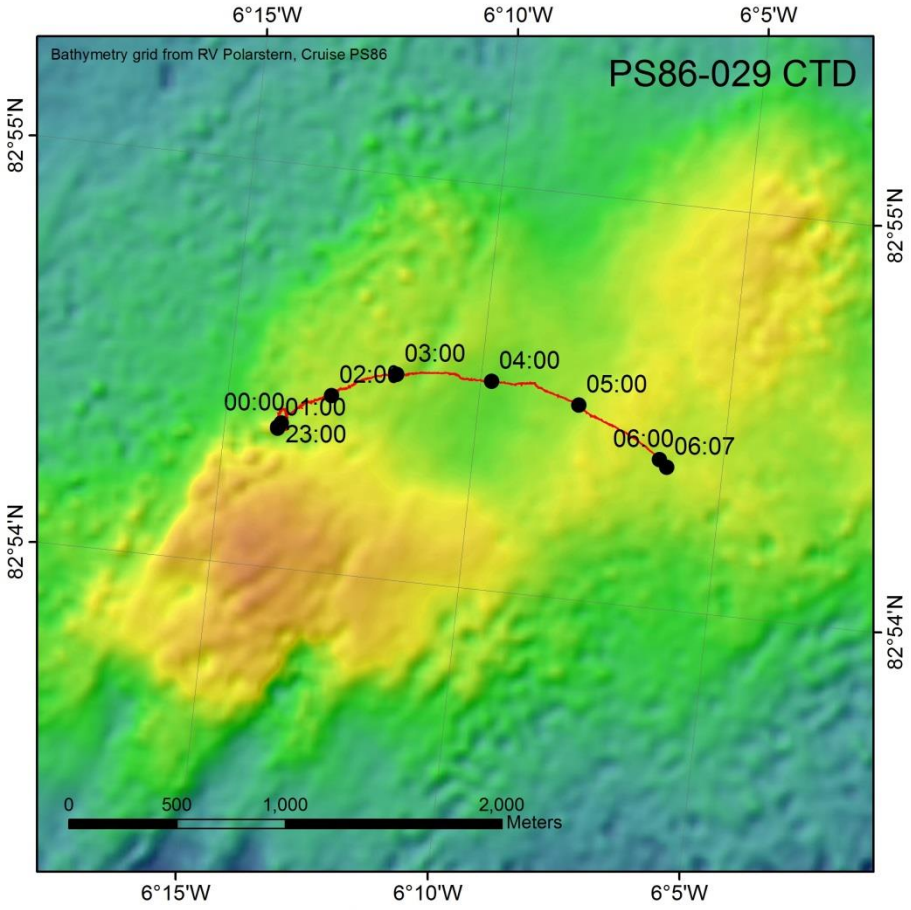

6°35'W
6°30'W
6°25'W
6°20'W
6°15'W
6°10'W
6°5'W
82°54'N
82°52'N
82°50'N
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-020 TVMUC
20:12
21:00
22:00
0
500
1,000
2,000
Meters

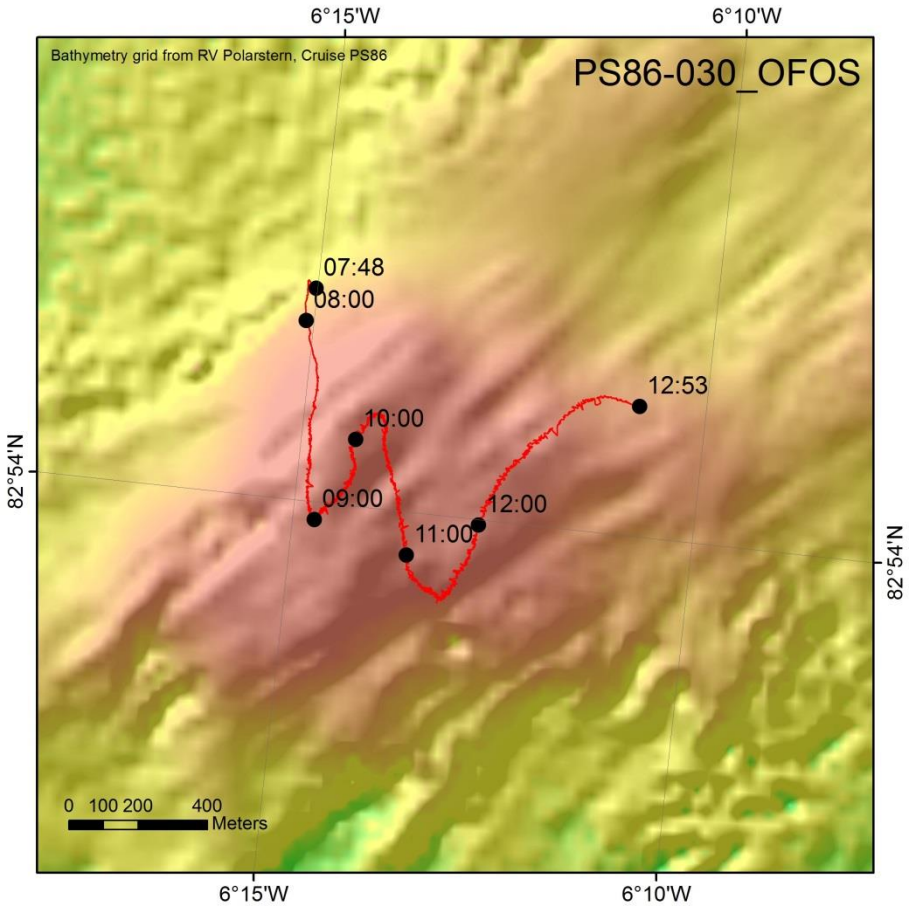

6°10'W
6°5'W
5°60'W
5°55'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-021 CTD
02:17
03:00
04:00
05:00
06:00
06:17
82°56'N
82°55'N
0
500
1,000
2,000
Meters
6°5'W
6°0'W
5°55'W
5°50'W

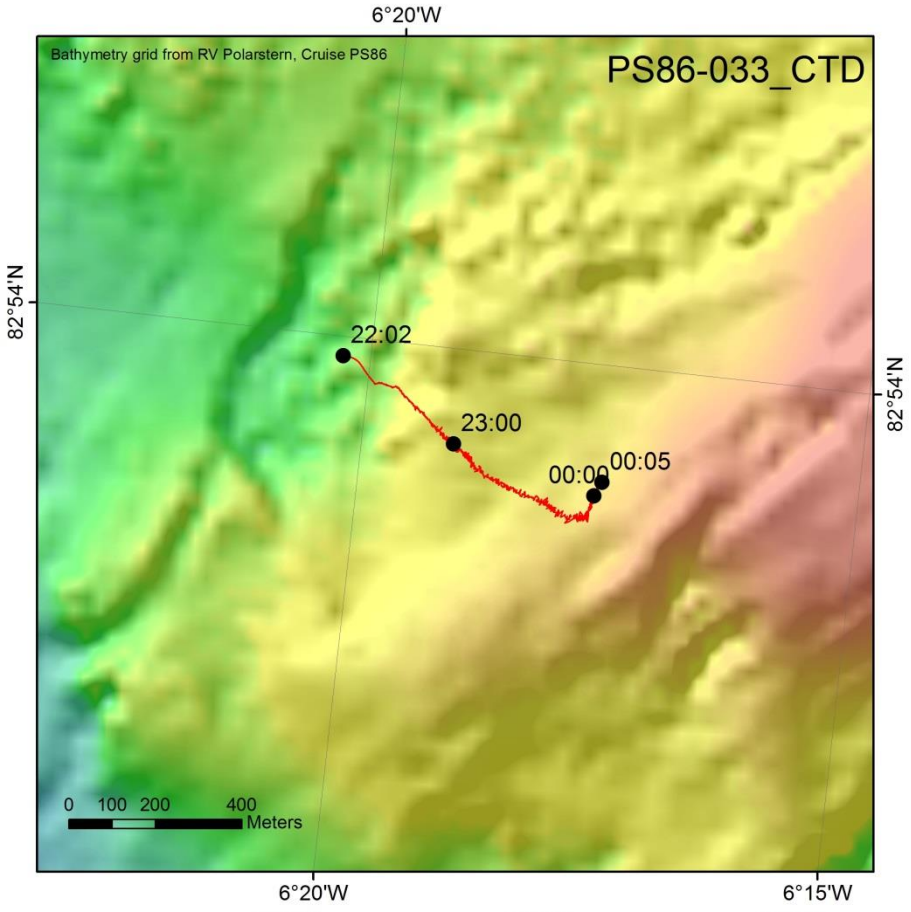

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-023 CTD
16:48
17:00
18:00
19:00
19:05
82°54'N
0
500
1,000
2,000
Meters

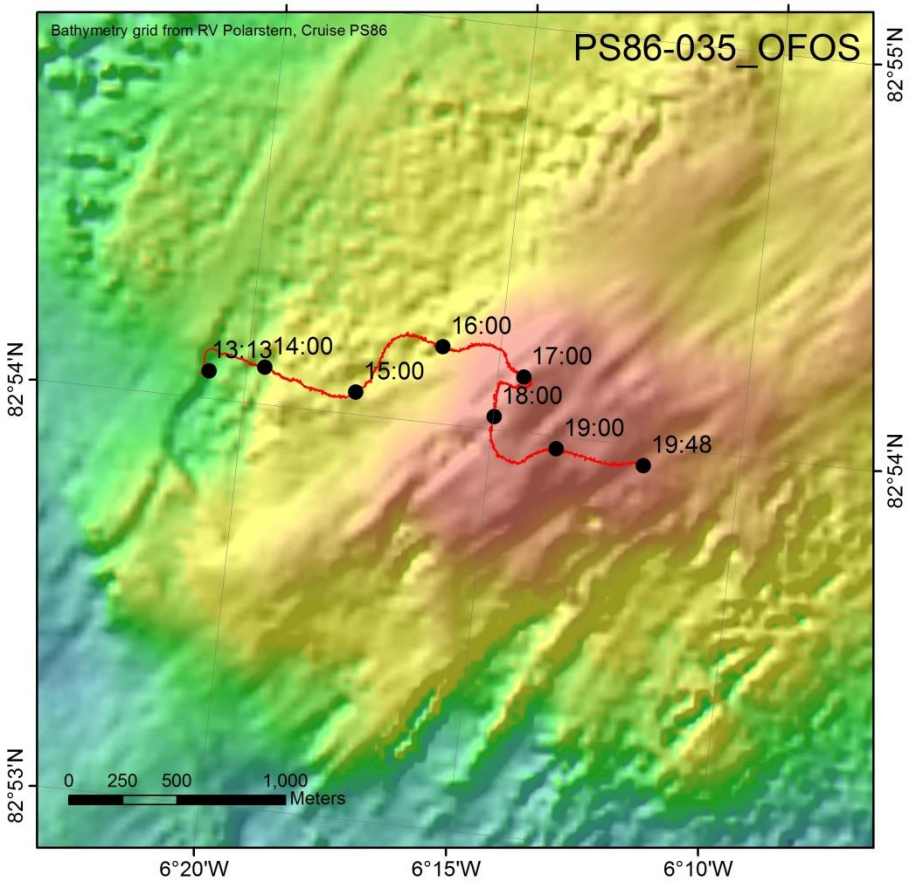

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-024 OFOS
82°55'N
82°54'N
21:16
22:00
23:00
00:00
01:00
01:51
0
500
1,000
2,000
Meters

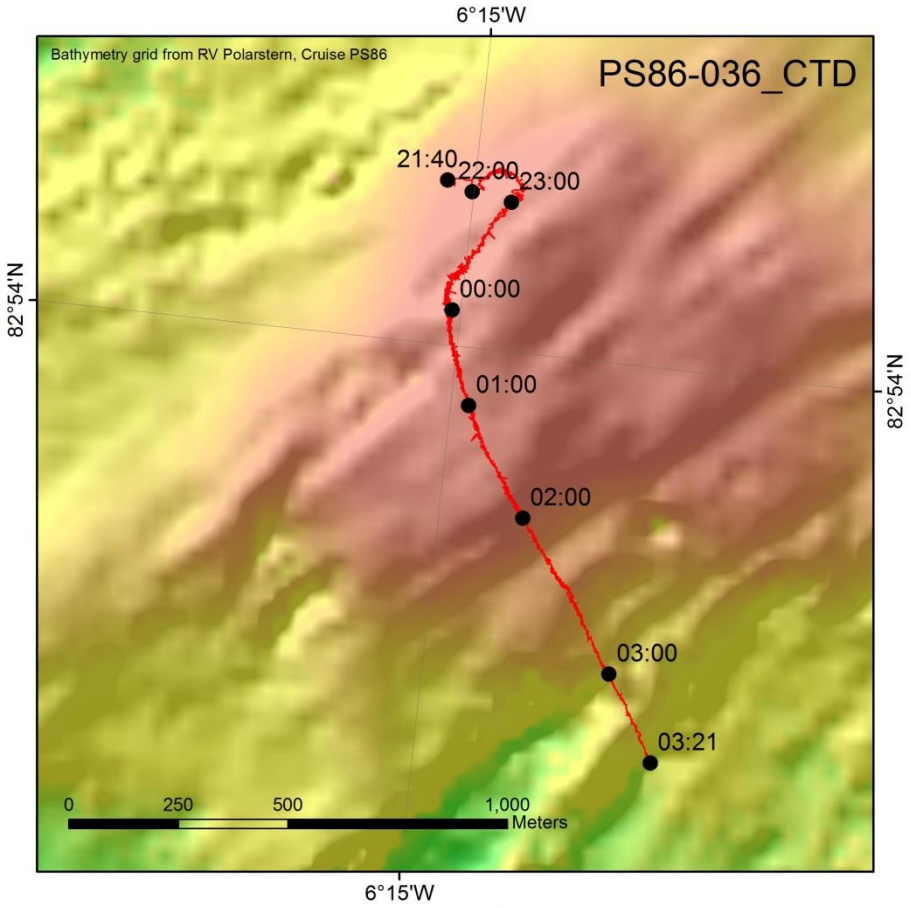

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-028 TVMUC
82°55'N
20:00
20:44
19:18
0
500
1,000
2,000
Meters

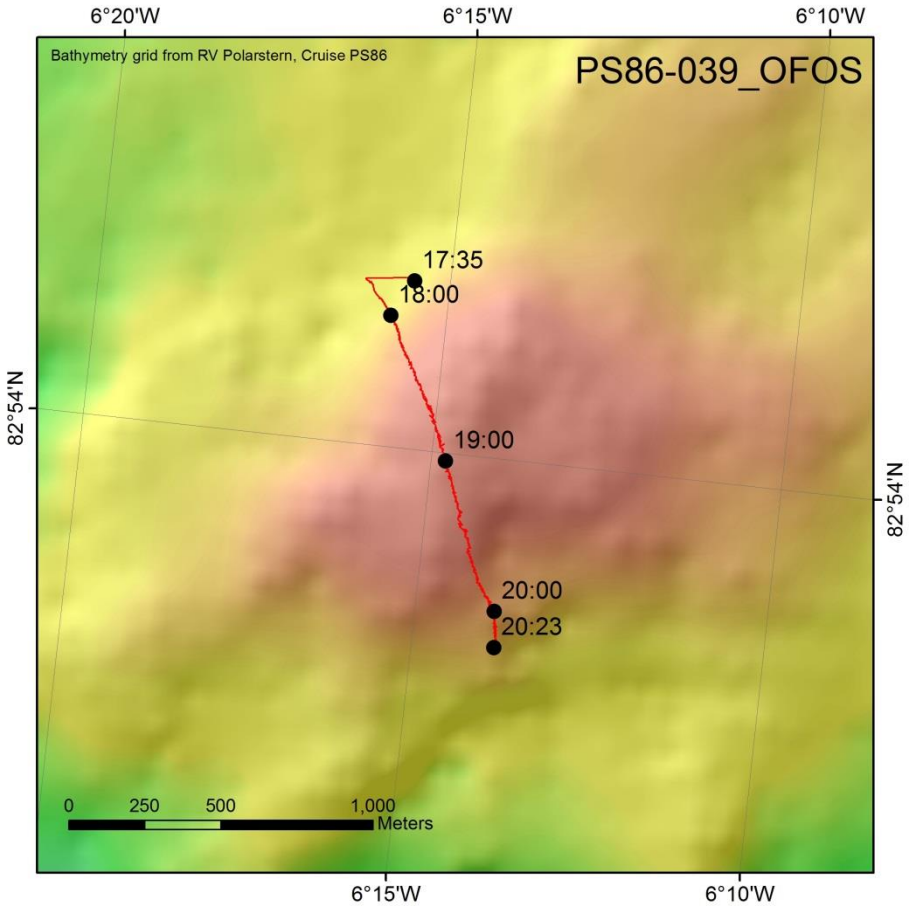

6°15'W
6°10'W
6°5'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-029 CTD
82°55'N
82°54'N
00:00
01:00
23:00
02:00
03:00
04:00
05:00
06:00
06:07
0
500
1,000
2,000
Meters

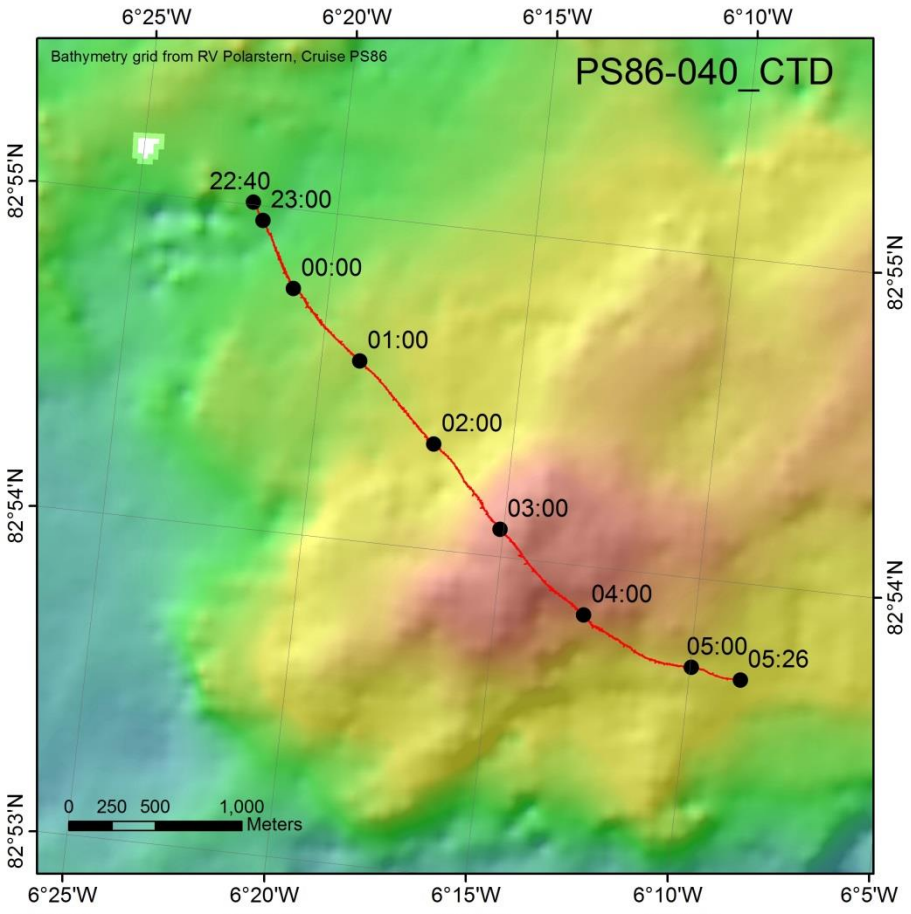

6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-030_OFOS
82°54'N
07:48
08:00
09:00
10:00
11:00
12:00
12:53
0
100
200
400
Meters

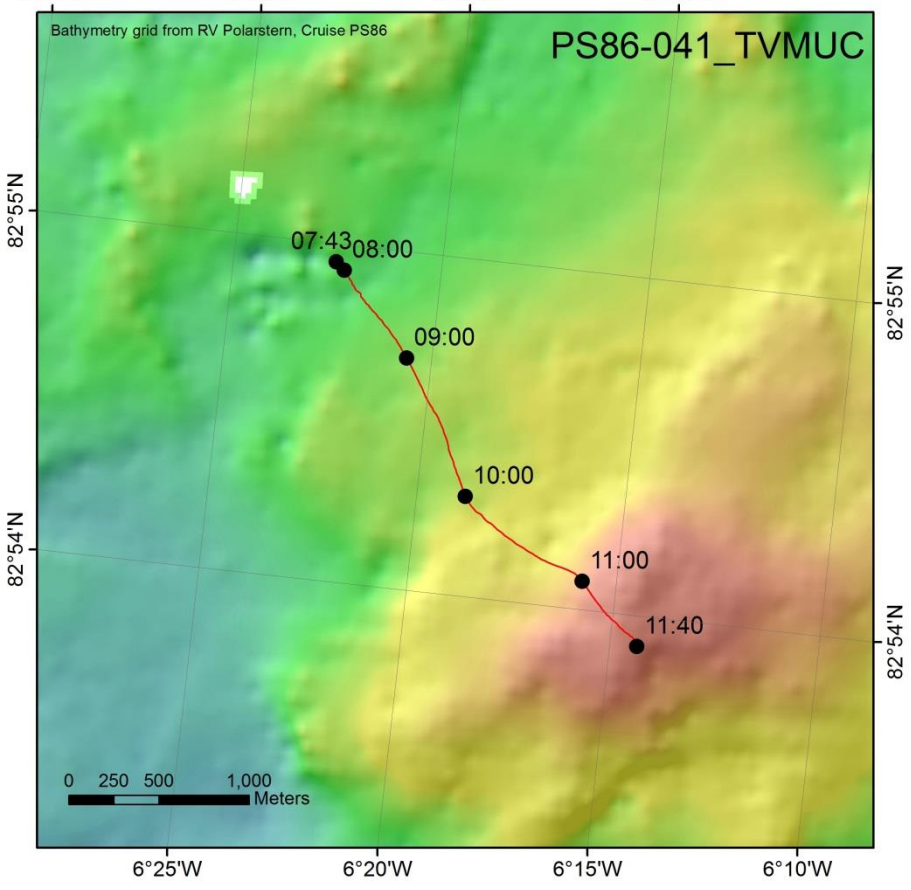

6°20'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-033_CTD
82°54'N
22:02
23:00
00:00
00:05
0 100 200 400
Meters
6°20'W
6°15'W

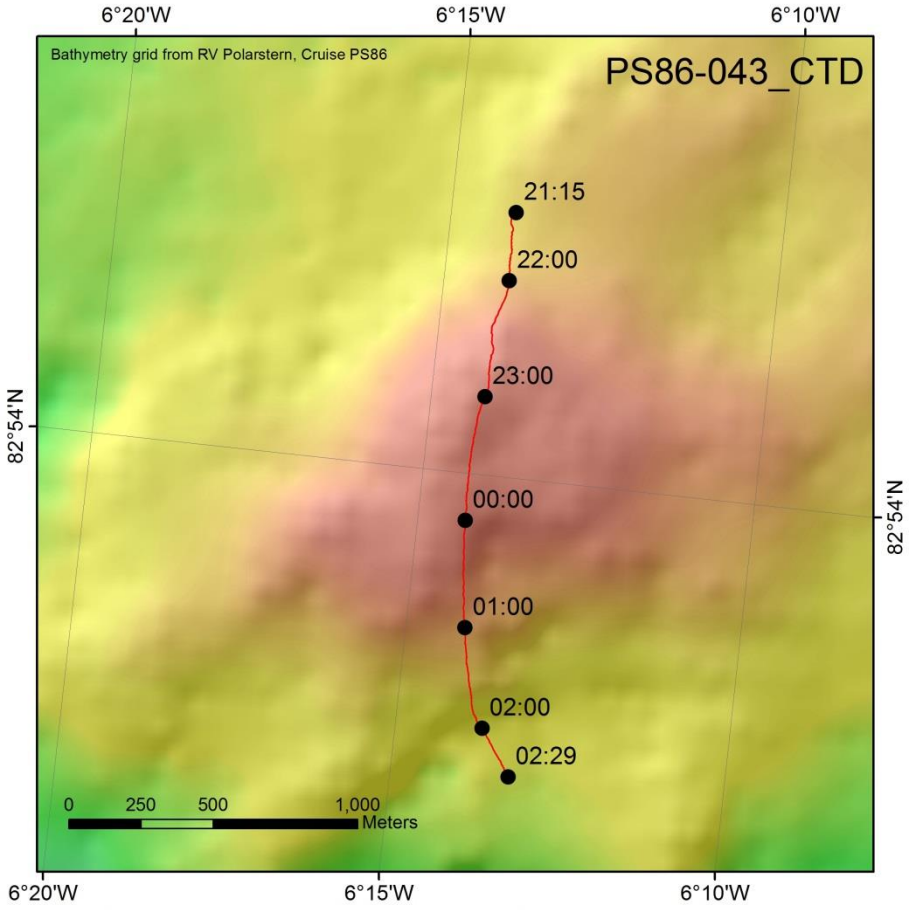

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-035_OFOS
82°55'N
82°54'N
82°53'N
13:13
14:00
15:00
16:00
17:00
18:00
19:00
19:48
0 250 500 1,000
Meters
6°20'W
6°15'W
6°10'W

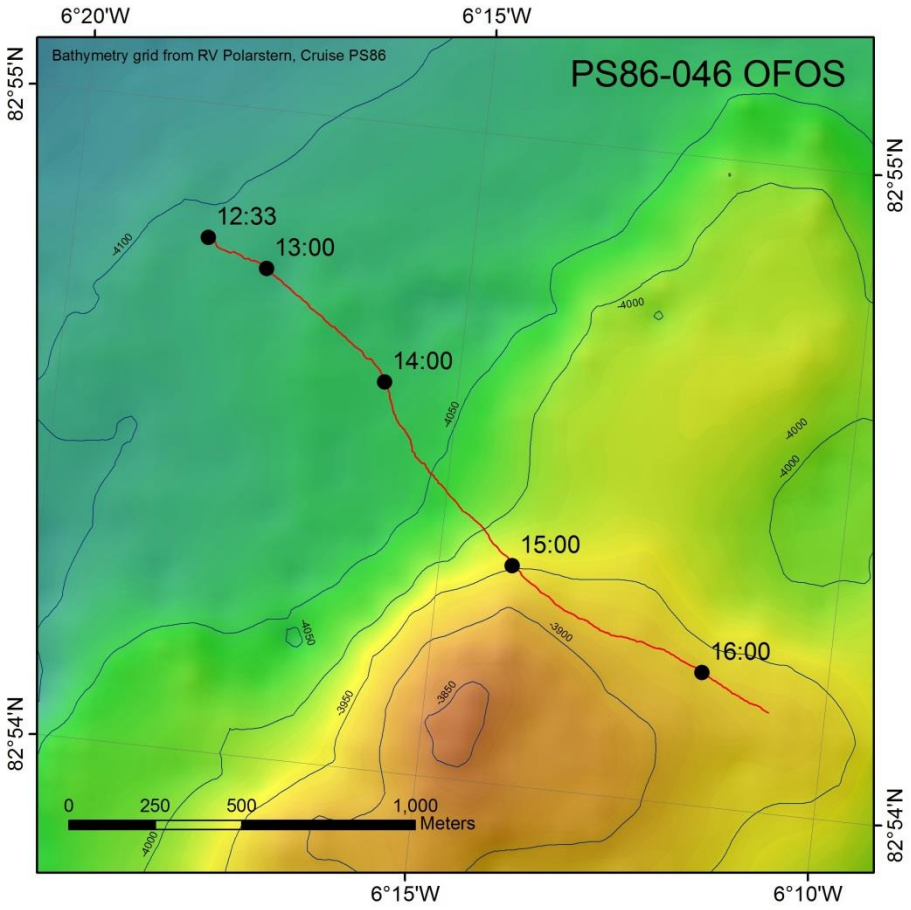

6°15'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-036_CTD
21:40
22:00
23:00
00:00
01:00
02:00
03:00
03:21
82°54'N
0
250
500
1,000
Meters
6°15'W

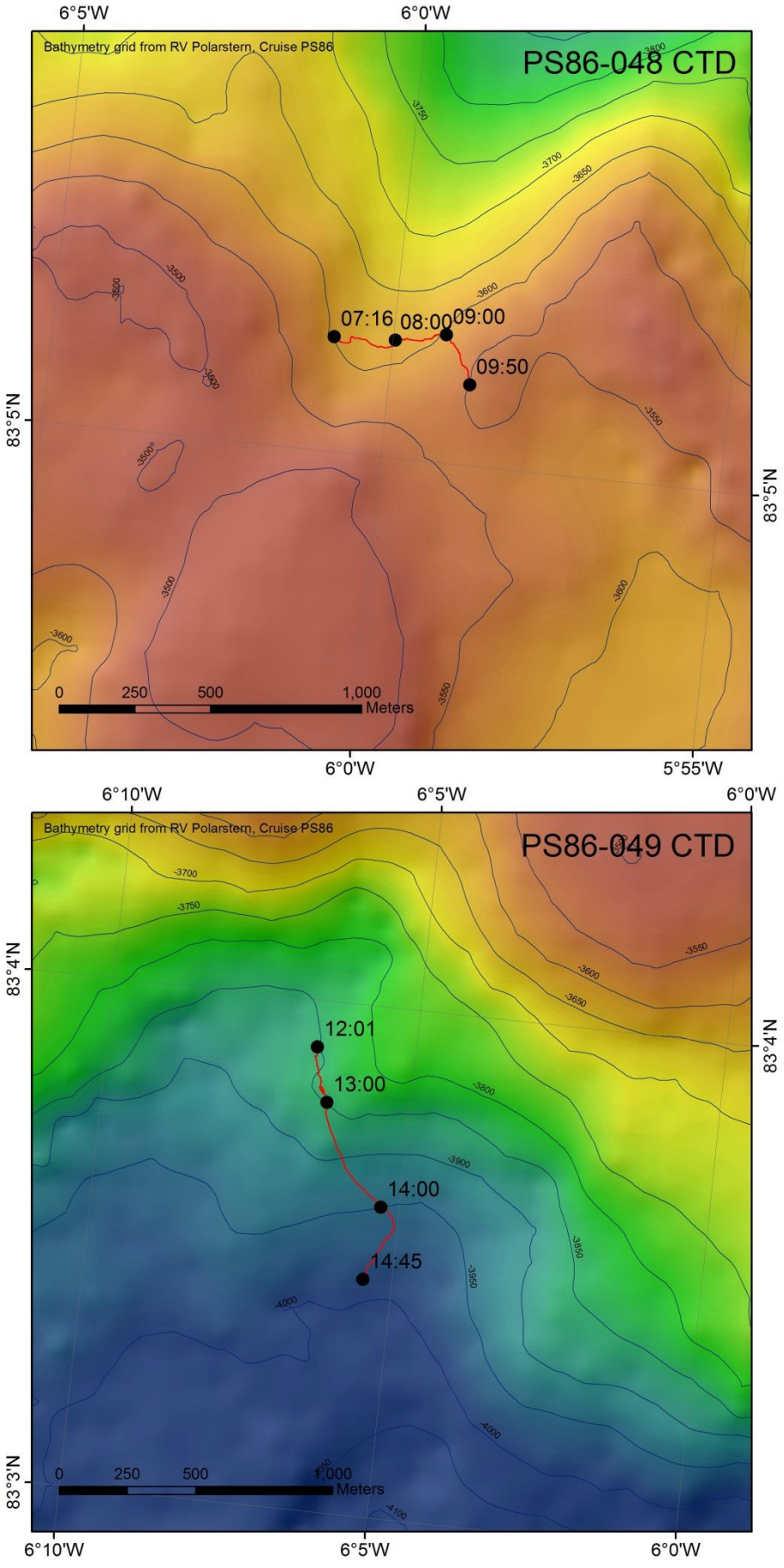

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-039_OFOS
17:35
18:00
19:00
20:00
20:23
82°54'N
0
250
500
1,000
Meters
6°15'W
6°10'W

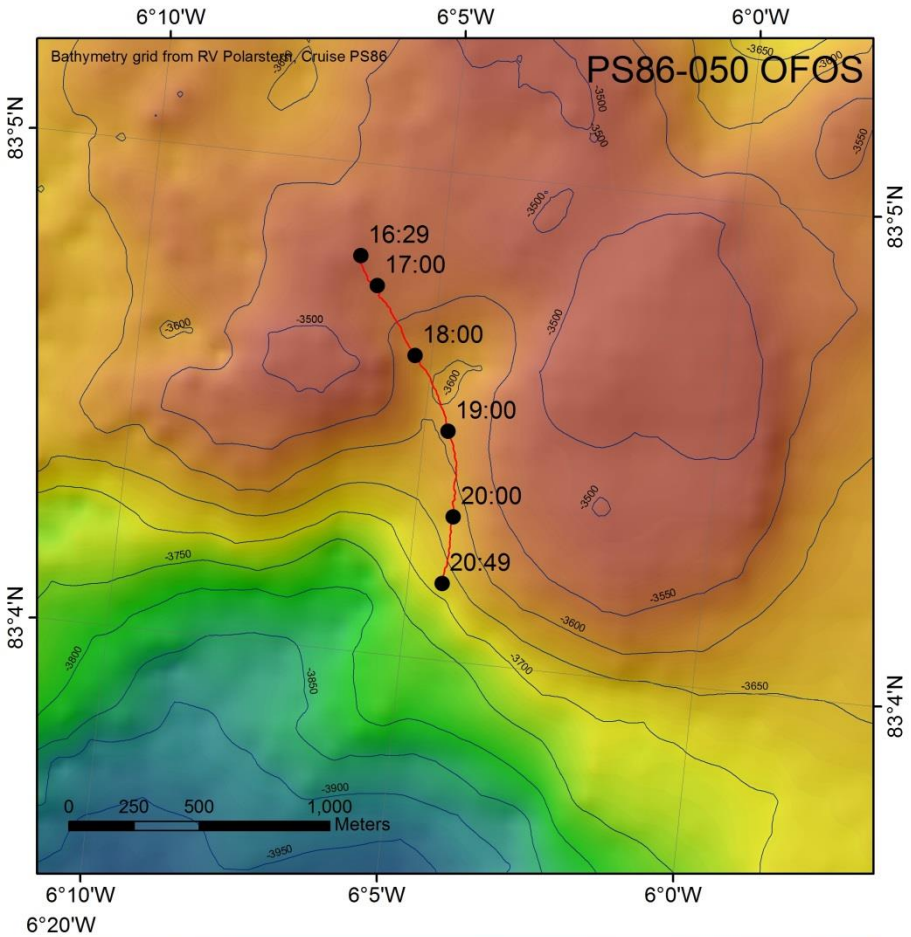

Bathymetry grid from RV Polarstern, Cruise PS86
PS86-040_CTD
6°25'W
6°20'W
6°15'W
6°10'W
6°5'W
82°55'N
82°54'N
82°53'N
22:40
23:00
00:00
01:00
02:00
03:00
04:00
05:00
05:26
0 250 500 1,000
Meters

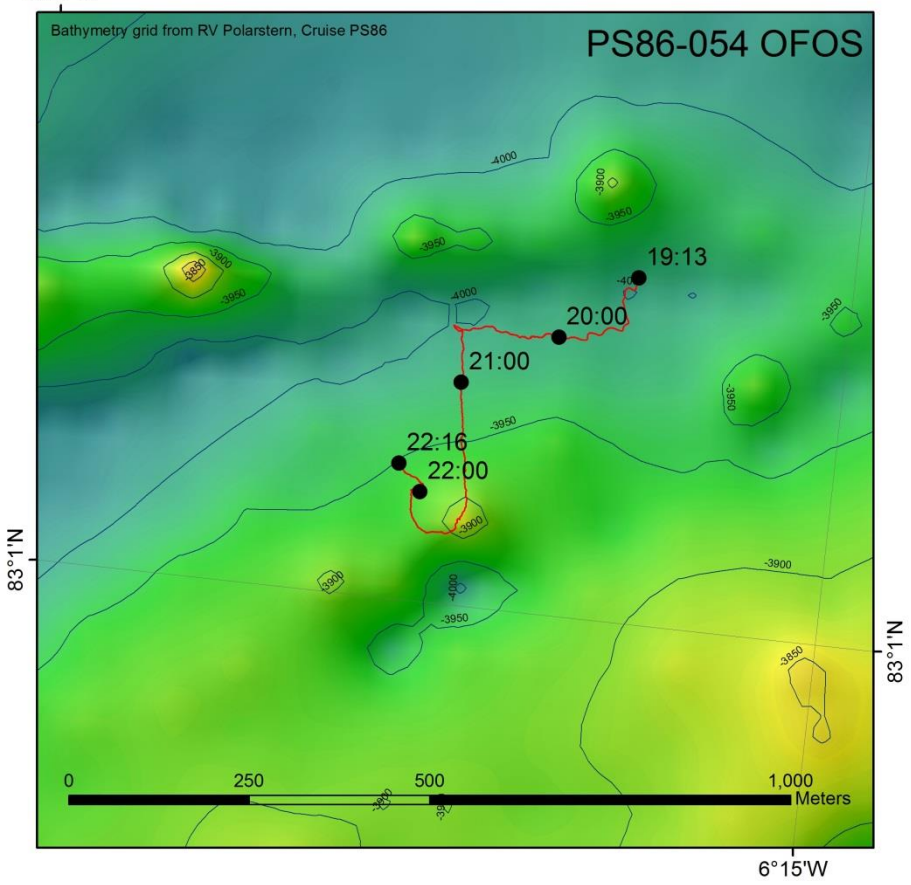

Bathymetry grid from RV Polarstern, Cruise PS86
PS86-041_TVMUC
6°30'W
6°25'W
6°20'W
6°15'W
6°10'W
82°55'N
82°54'N
07:43
08:00
09:00
10:00
11:00
11:40
0 250 500 1,000
Meters

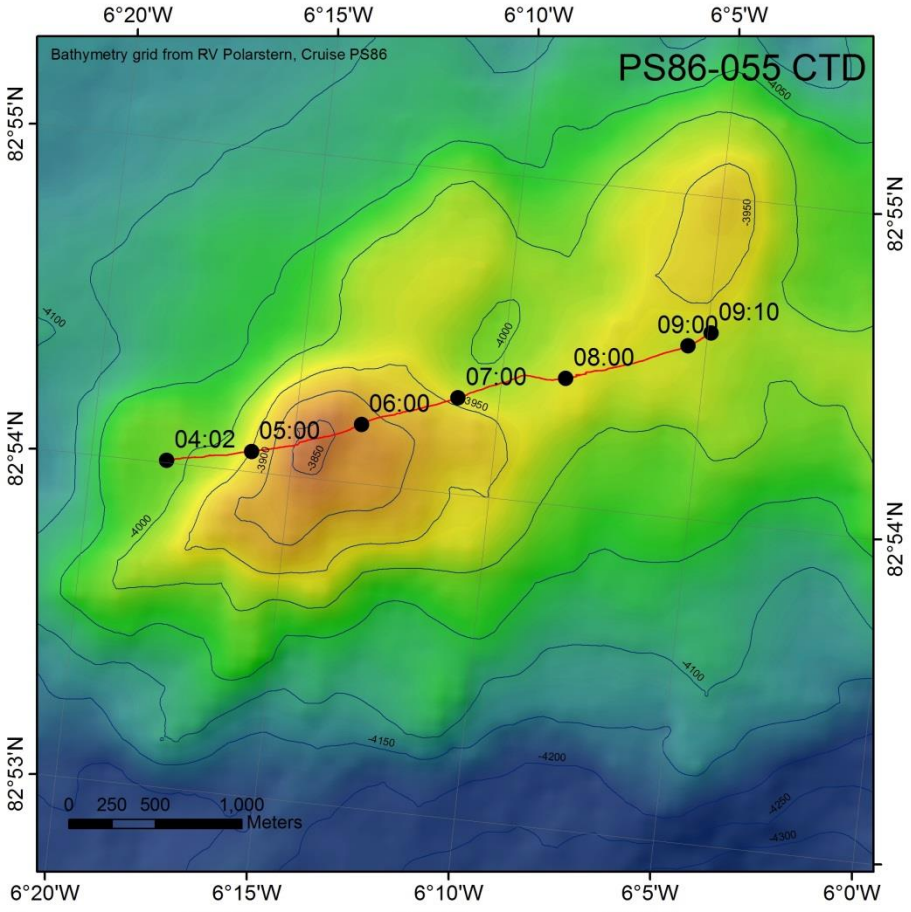

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-043_CTD
21:15
22:00
23:00
00:00
01:00
02:00
02:29
0 250 500 1,000
Meters
82°54'N

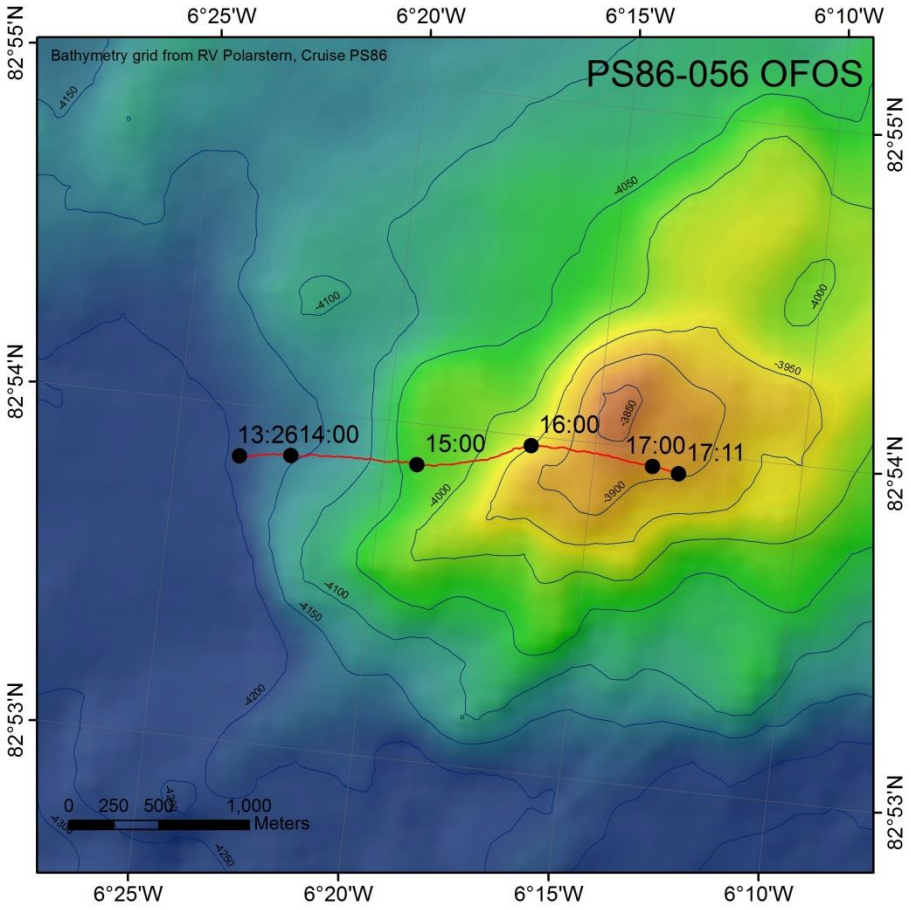

6°20'W
6°15'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-046 OFOS
82°55'N
82°54'N
12:33
13:00
14:00
15:00
16:00
-4100
-4000
-4050
-3950
-3900
-3850
0 250 500 1,000
Meters
6°15'W
6°10'W

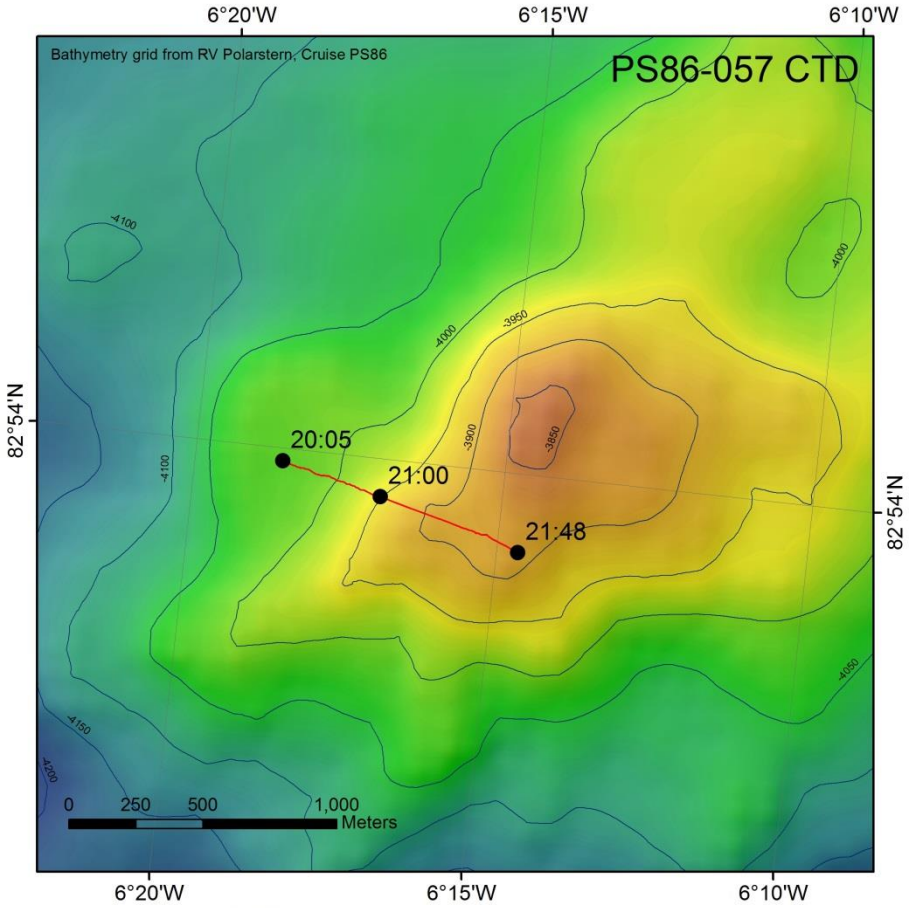

6°5'W
6°0'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-048 CTD
07:16
08:00
09:00
09:50
83°5'N
0
250
500
1,000
Meters
6°0'W
5°55'W
6°10'W
6°5'W
6°0'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-049 CTD
83°4'N
12:01
13:00
14:00
14:45
83°3'N
0
250
500
1,000
Meters
6°10'W
6°5'W
6°0'W

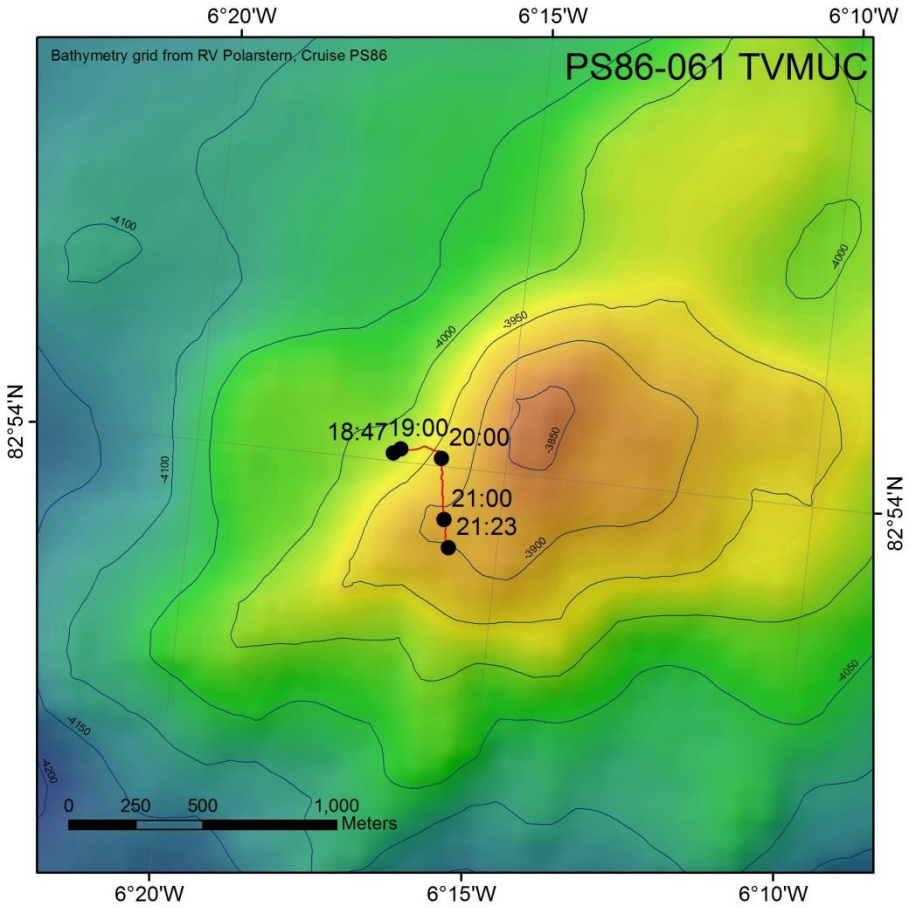

Bathymetry grid from RV Polarstern, Cruise PS86
PS86-050 OFOS
6°10'W
6°5'W
6°0'W
83°5'N
83°4'N
16:29
17:00
18:00
19:00
20:00
20:49
0 250 500 1,000
Meters

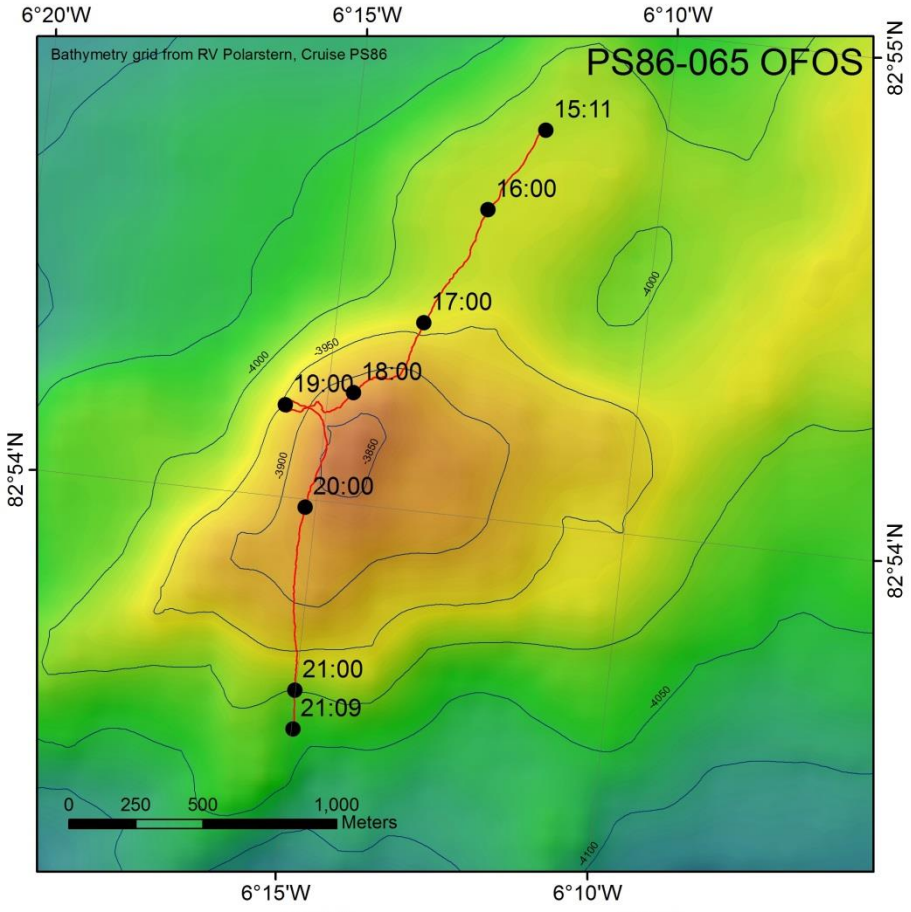

Bathymetry grid from RV Polarstern, Cruise PS86
PS86-054 OFOS
6°20'W
6°15'W
83°1'N
19:13
20:00
21:00
22:16
22:00
0 250 500 1,000
Meters

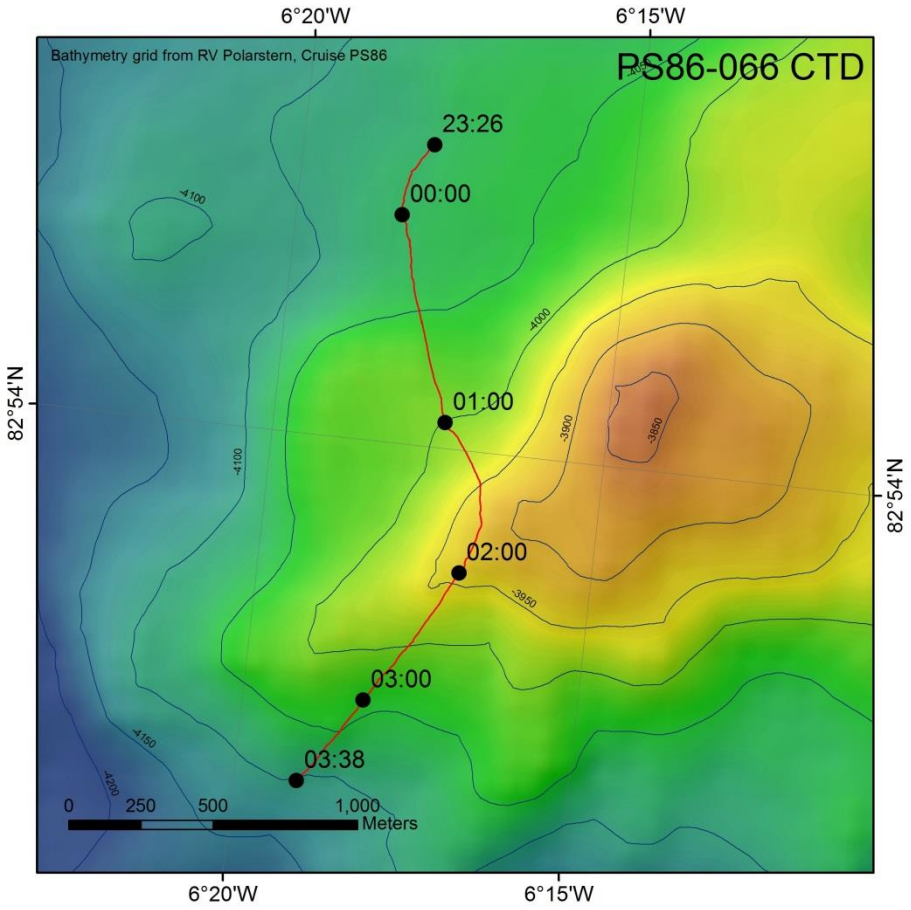

Bathymetry grid from RV Polarstern, Cruise PS86
PS86-055 CTD
6°20'W
6°15'W
6°10'W
6°5'W
6°0'W
82°55'N
82°54'N
82°53'N
04:02
05:00
06:00
07:00
08:00
09:00
09:10
0 250 500 1,000
Meters

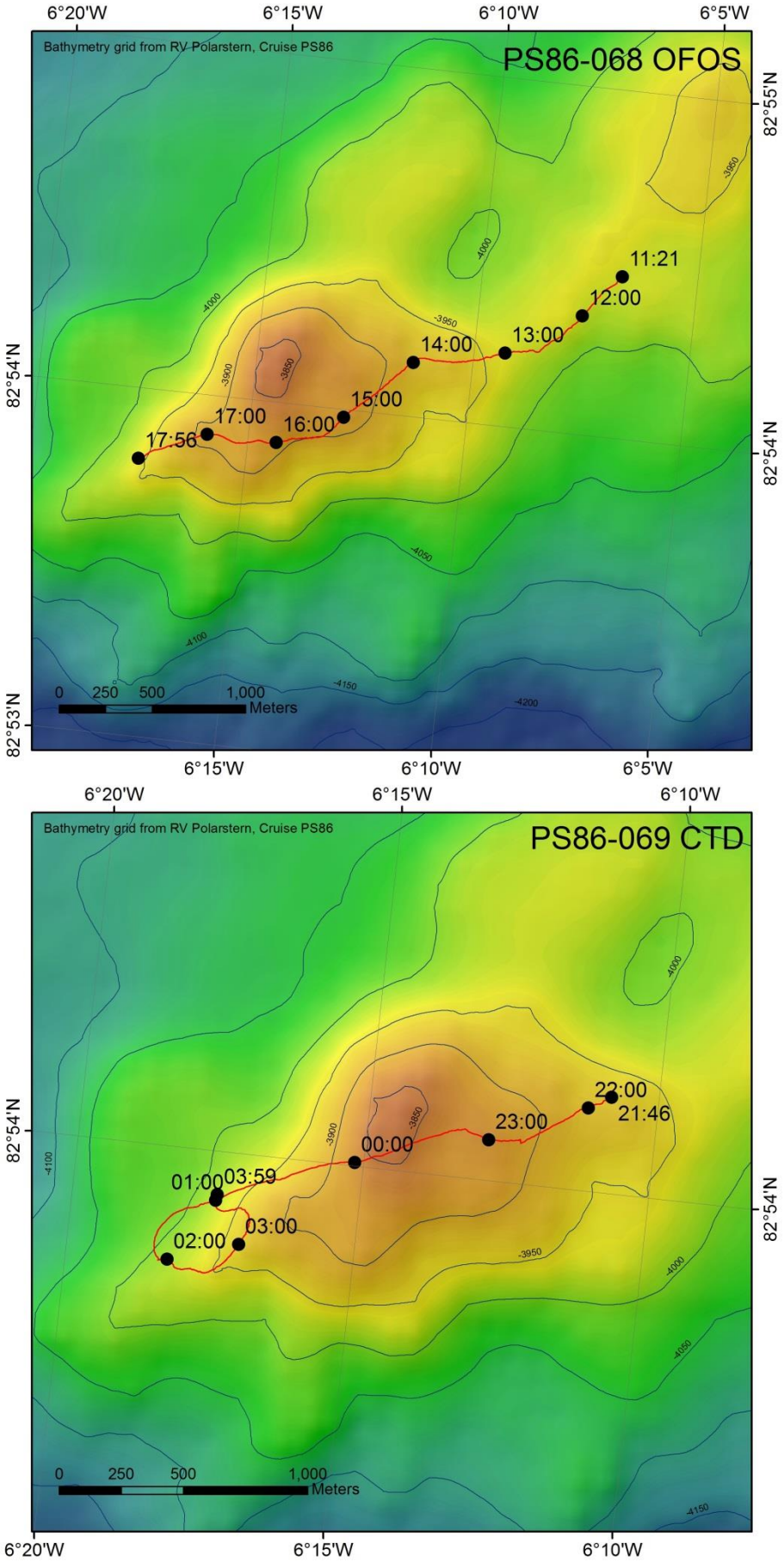

Bathymetry grid from RV Polarstern, Cruise PS86
PS86-056 OFOS
6°25'W
6°20'W
6°15'W
6°10'W
82°55'N
82°54'N
82°53'N
13:26
14:00
15:00
16:00
17:00
17:11
0 250 500 1,000
Meters

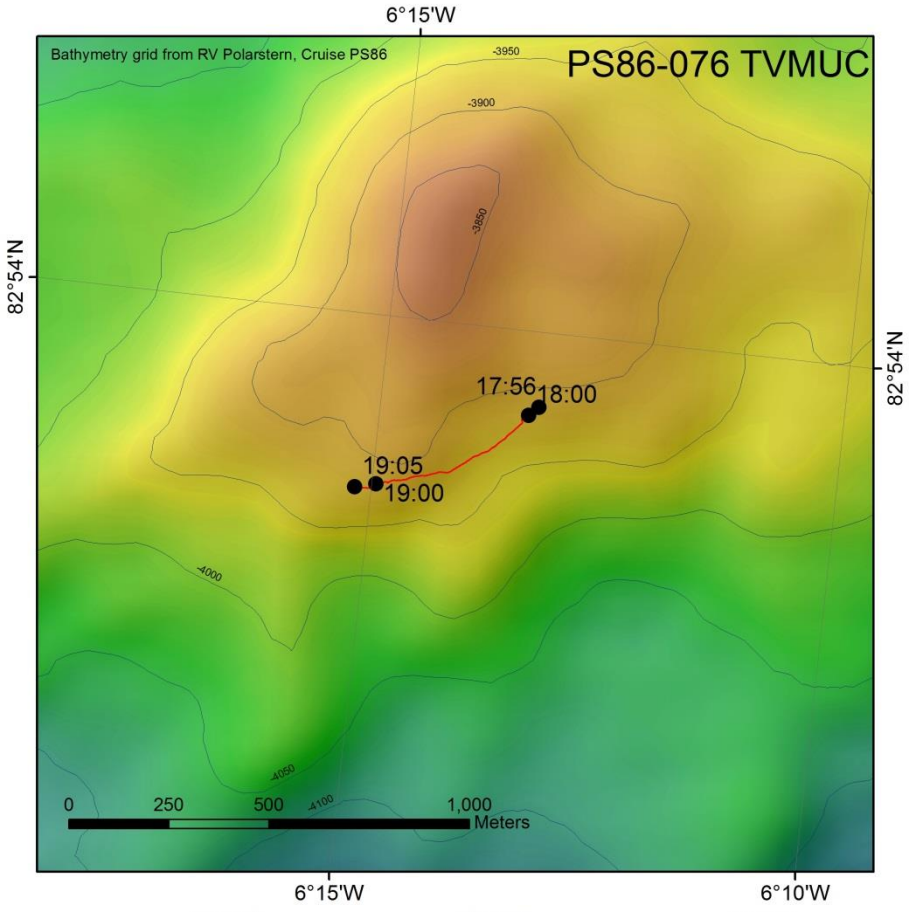

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-057 CTD
82°54'N
20:05
21:00
21:48
-4100
-4000
-3950
-3900
-3850
-4050
-4150
-4200
0 250 500 1,000
Meters

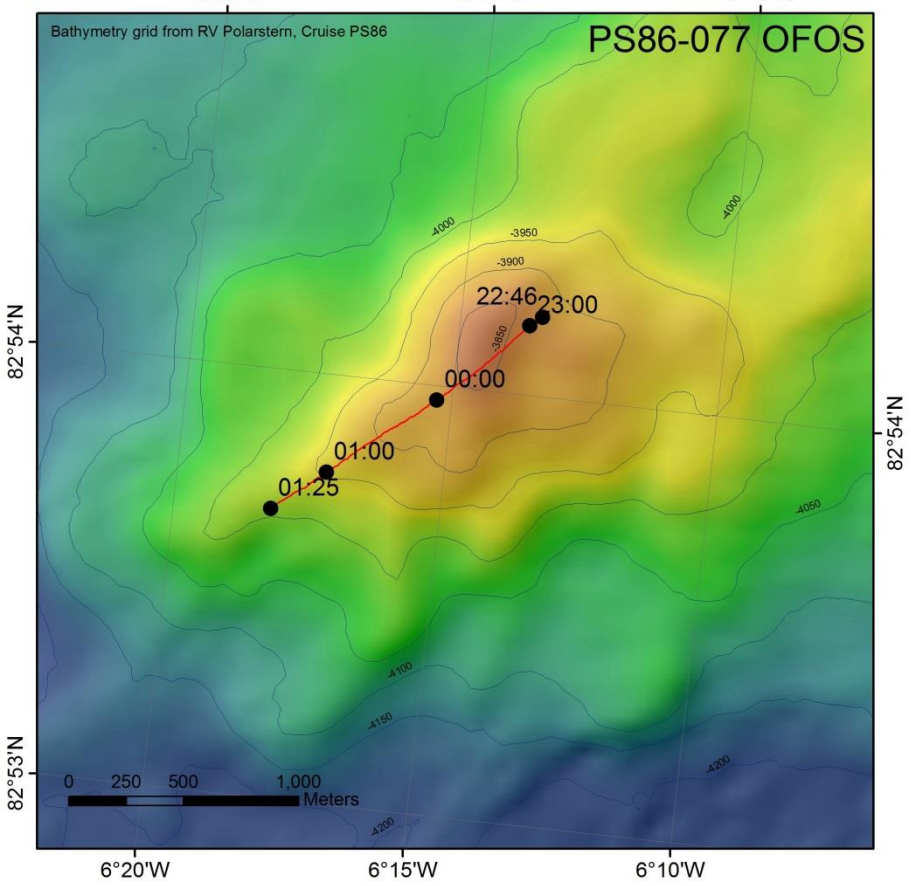

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-061 TVMUC
82°54'N
18:47
19:00
20:00
21:00
21:23
-4100
-4000
-3950
-3900
-3850
-4050
-4150
-4200
0 250 500 1,000
Meters

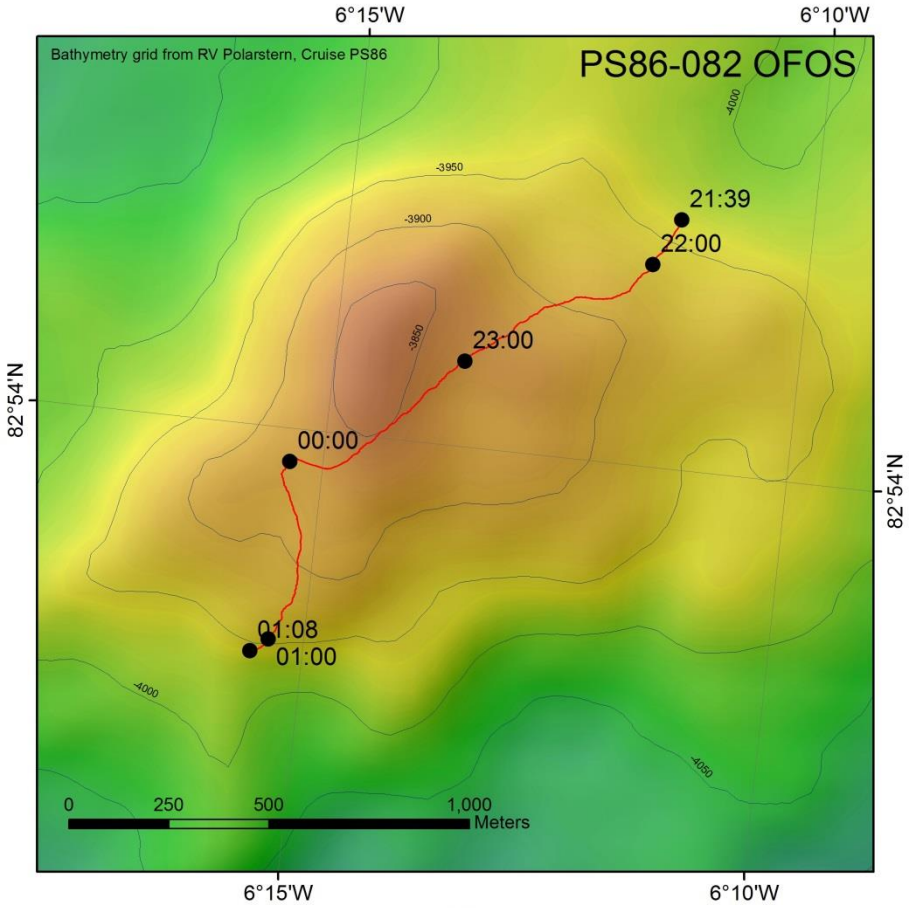

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-065 OFOS
15:11
16:00
17:00
18:00
19:00
20:00
21:00
21:09
82°55'N
82°54'N
0 250 500 1,000
Meters

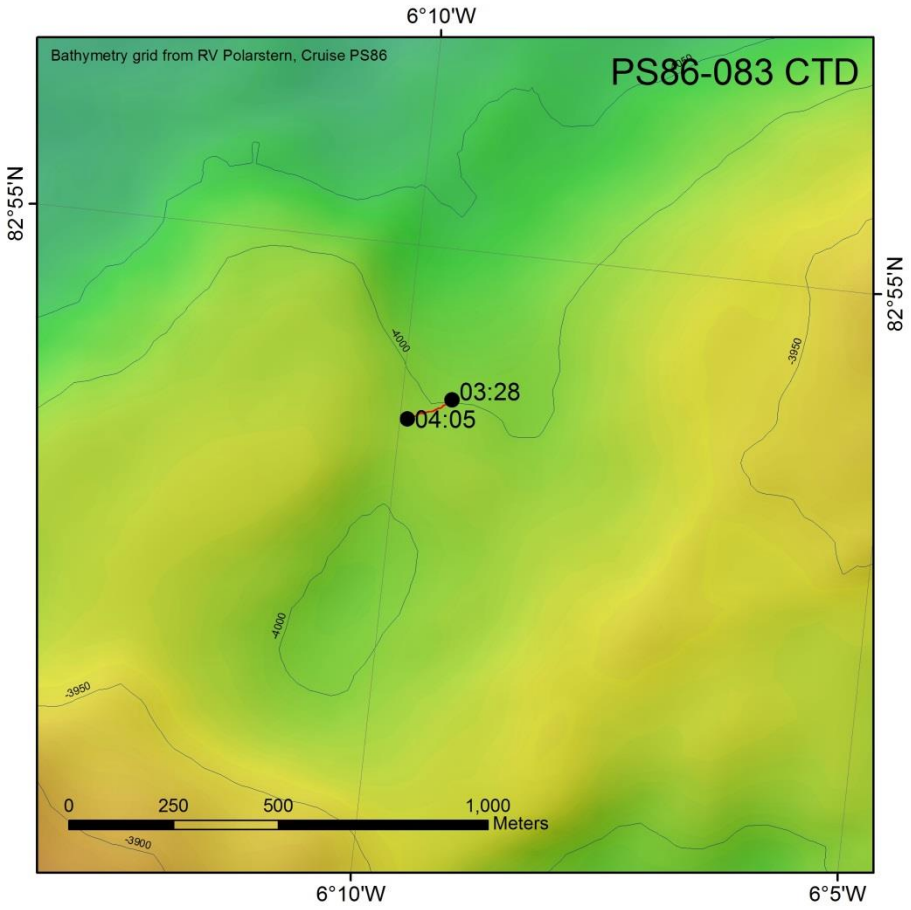

6°20'W
6°15'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-066 CTD
23:26
00:00
01:00
02:00
03:00
03:38
82°54'N
0 250 500 1,000
Meters

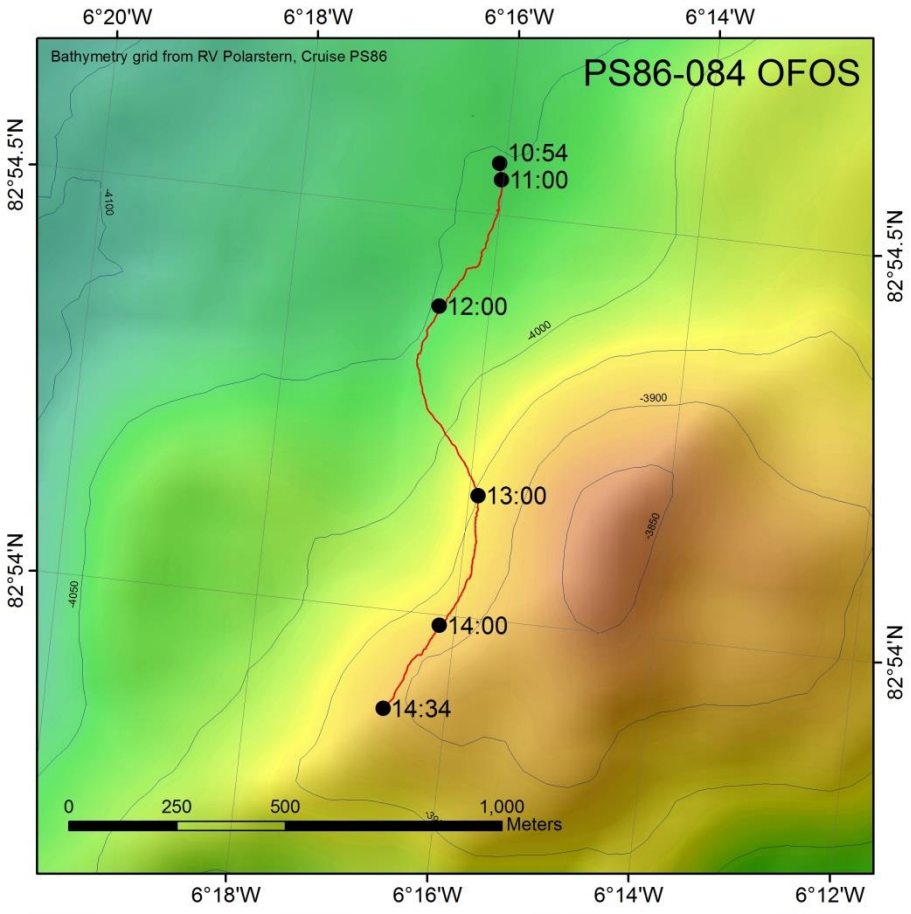

Bathymetry grid from RV Polarstern, Cruise PS86
PS86-068 OFOS
6°20'W
6°15'W
6°10'W
6°5'W
82°55'N
82°54'N
82°53'N
11:21
12:00
13:00
14:00
15:00
16:00
17:00
17:56
-3950
-4000
-3900
-3850
-4050
-4100
-4150
-4200
0 250 500 1,000
Meters
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-069 CTD
6°20'W
6°15'W
6°10'W
82°54'N
82°54'N
22:00
21:46
23:00
00:00
01:00
03:59
02:00
03:00
-4000
-3850
-3900
-4100
-3950
-4050
-4150
0 250 500 1,000
Meters

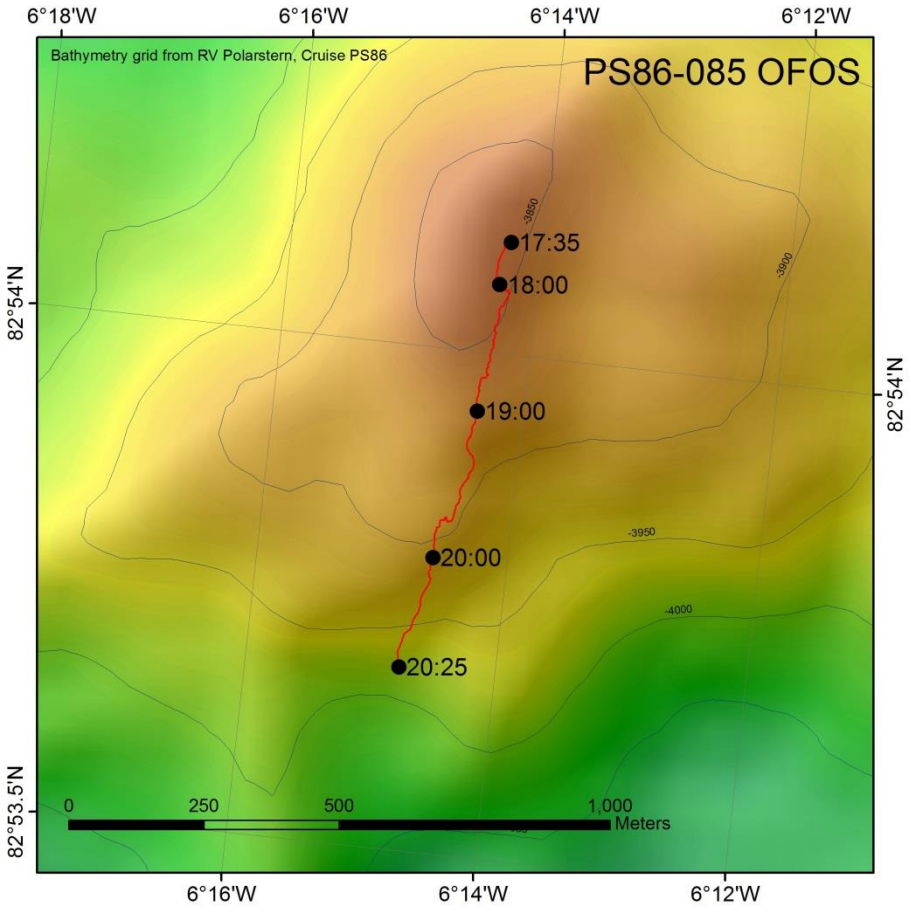

6°15'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-076 TVMUC
-3950
-3900
-3850
82°54'N
17:56
18:00
19:05
19:00
-4000
-4050
-4100
0
250
500
1,000
Meters
6°15'W
6°10'W

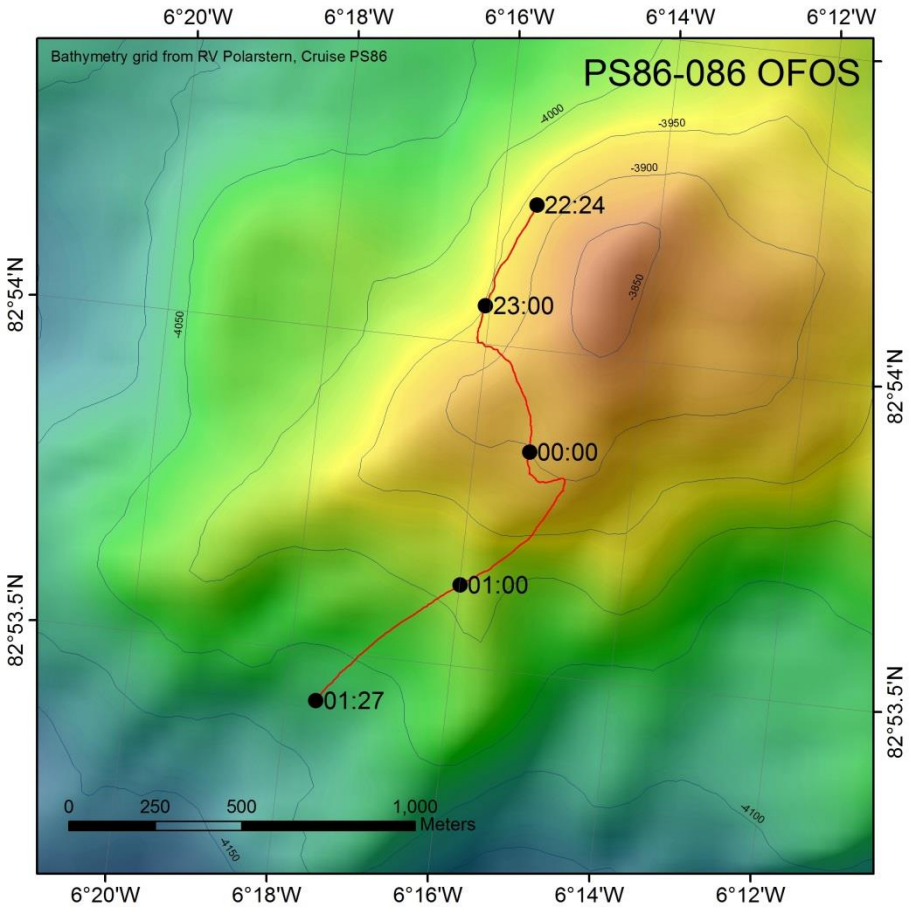

6°20'W
6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-077 OFOS
-4000
-3950
-3900
-3850
82°54'N
22:46
23:00
00:00
01:00
01:25
-4050
-4100
-4150
-4200
82°53'N
0
250
500
1,000
Meters
6°20'W
6°15'W
6°10'W


6°15'W
6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-082 OFOS
-4000
-3950
-3900
-3850
21:39
22:00
23:00
00:00
01:08
01:00
82°54'N
-4000
-4050
0
250
500
1,000
Meters
6°15'W
6°10'W
82°54'N


6°10'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-083 CTD
82°55'N
-4000
-3950
03:28
04:05
-4000
-3950
0
250
500
1,000
Meters
-3900
6°10'W
6°5'W
82°55'N


6°20'W
6°18'W
6°16'W
6°14'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-084 OFOS
82°54.5'N
82°54'N
10:54
11:00
12:00
13:00
14:00
14:34
-4100
-4000
-3900
-3850
-4050
0
250
500
1,000
Meters
6°18'W
6°16'W
6°14'W
6°12'W


6°18'W
6°16'W
6°14'W
6°12'W
Bathymetry grid from RV Polarstern, Cruise PS86
PS86-085 OFOS
82°54'N
82°53.5'N
17:35
18:00
19:00
20:00
20:25
-3850
-3900
-3950
-4000
0
250
500
1,000
Meters
6°16'W
6°14'W
6°12'W


Bathymetry grid from RV Polarstern, Cruise PS86
PS86-086 OFOS
6°20'W
6°18'W
6°16'W
6°14'W
6°12'W
82°54'N
82°53.5'N
22:24
23:00
00:00
01:00
01:27
-4000
-3950
-3900
-3850
-4050
-4100
-4150
0
250
500
1,000
Meters