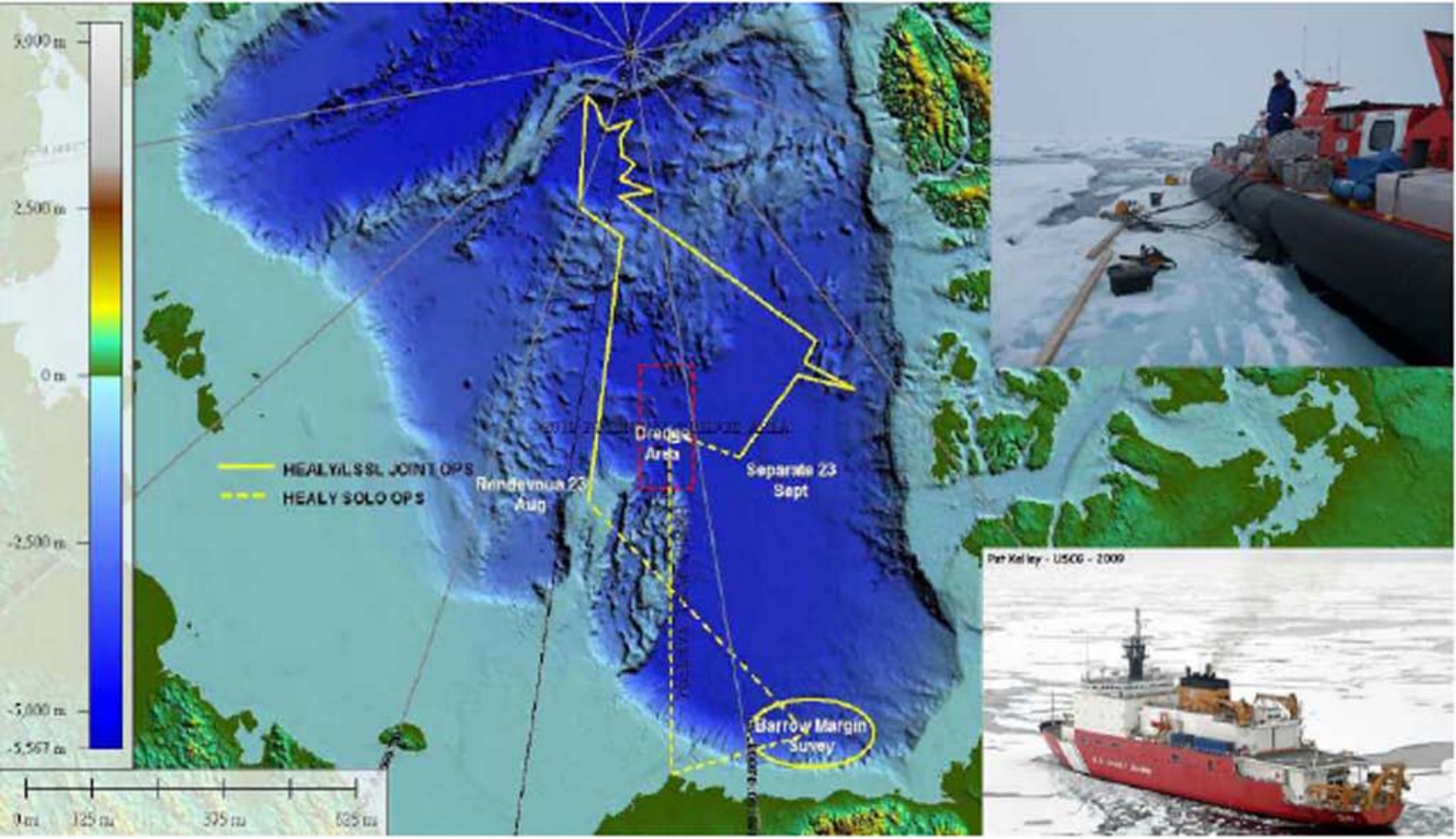


GEBCO-Related High Arctic Activities - Summer 2011

John K. Hall

Geological Survey of Israel (Retired)

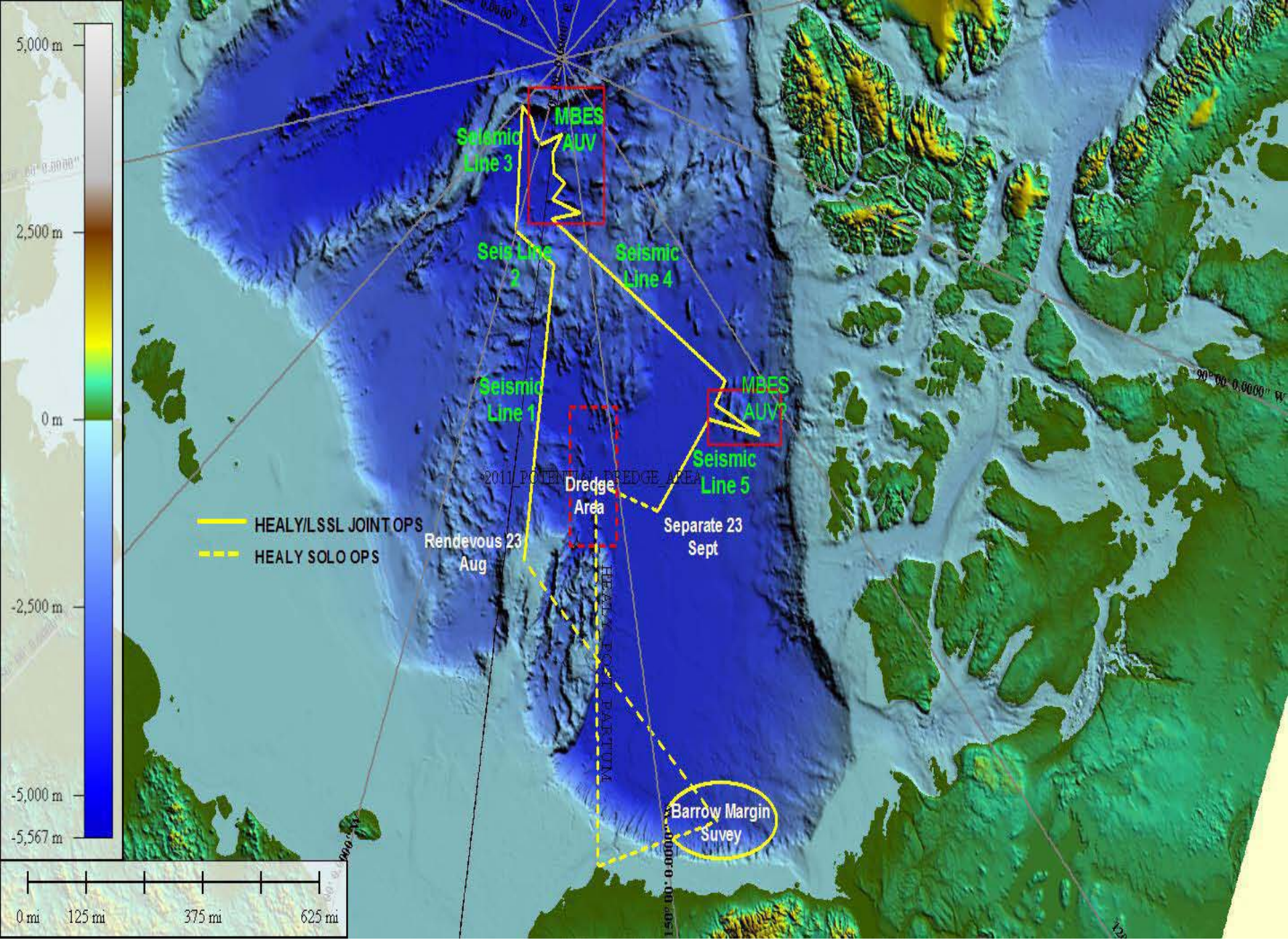
HEALY-1102

Law of the Sea

and why we are here

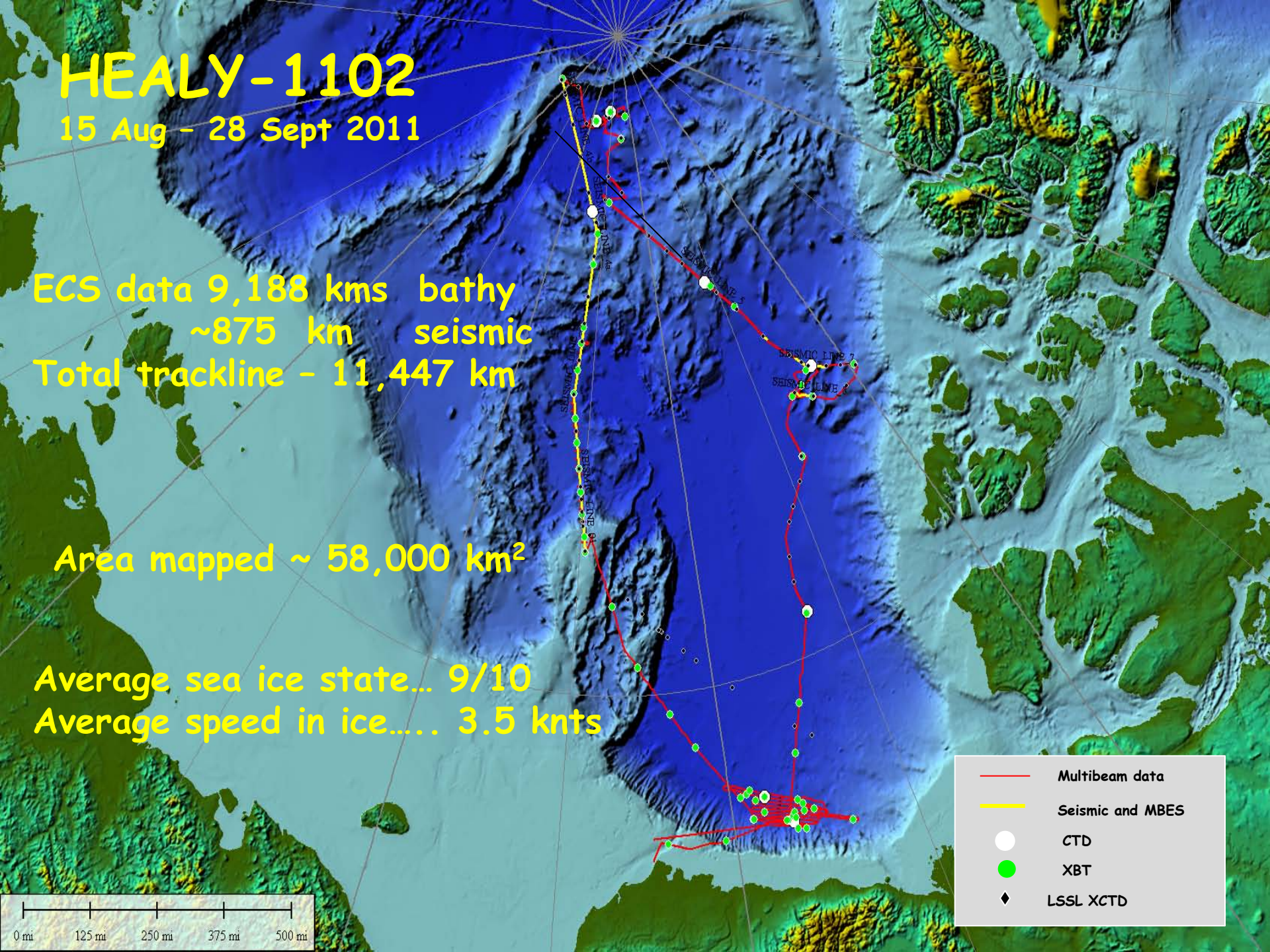
17 Aug. 2011

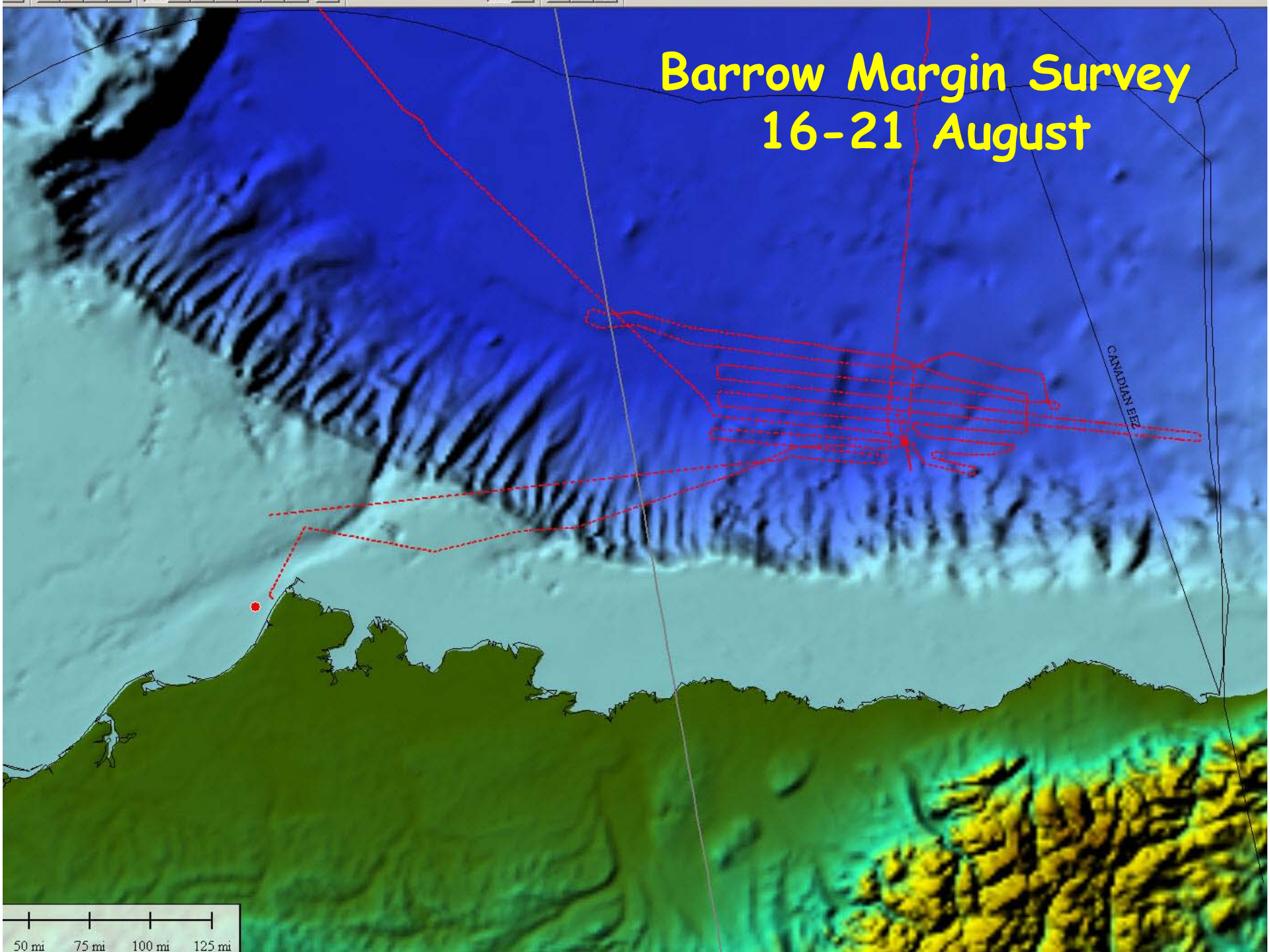

U. S. COAST GUARD
20


5,000 m
2,500 m
0 m
-2,500 m
-5,000 m
-5,567 m
0 mi
125 mi
375 mi
625 mi
MBES AUV
Seismic Line 3
Seis Line 2
Seismic Line 4
Seismic Line 1
MBES AUV?
Seismic Line 5
2011 POTENTIAL DREDGE AREA
Dredge Area
HEALY/LSSL JOINT OPS
HEALY SOLO OPS
Rendevous 23 Aug
Separate 23 Sept
HEALY EXCL PATTUM
Barrow Margin Suvey
90° 00' 0.0000" W
150° 00' 0.0000" W

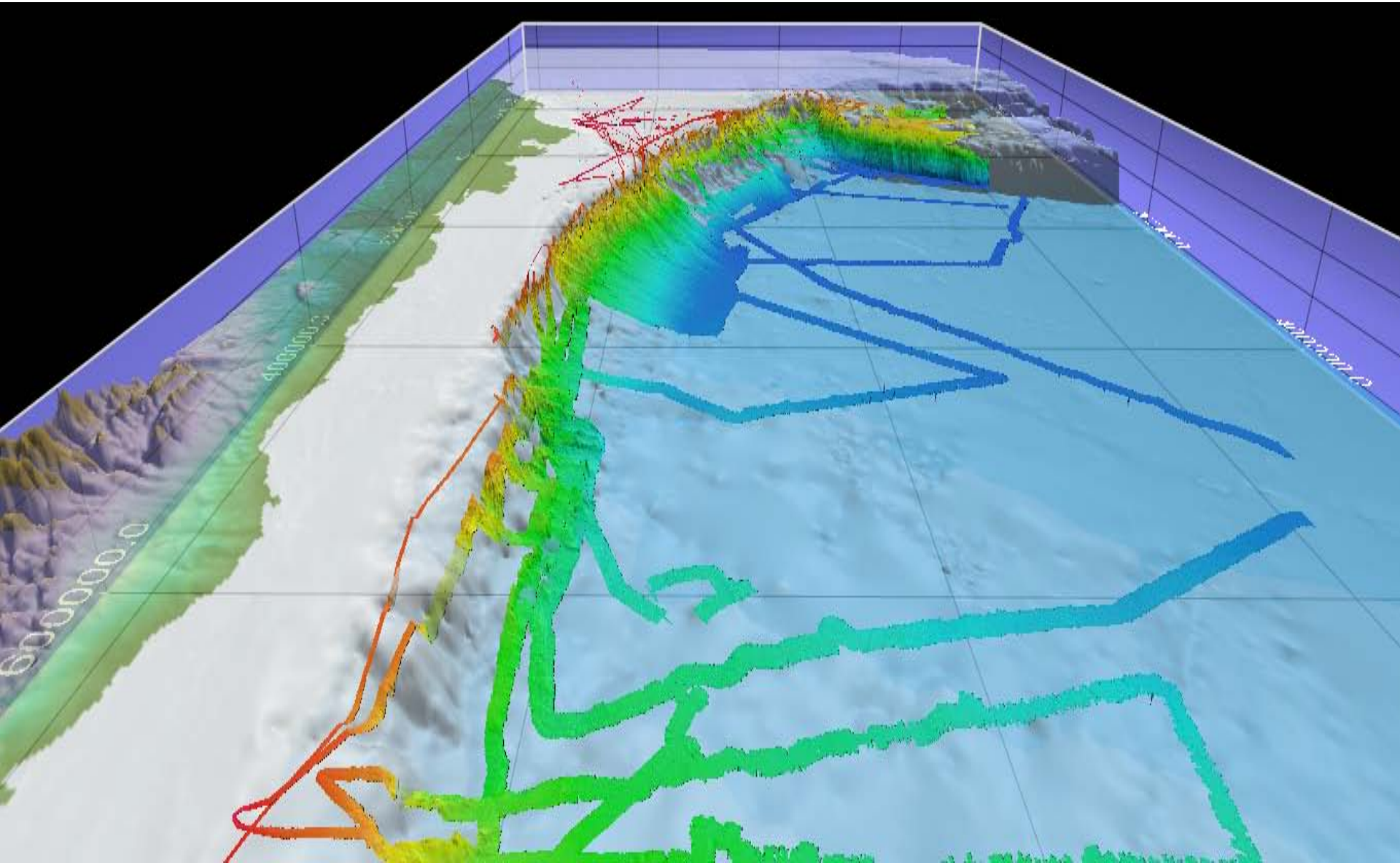
HEALY-1102
What we've done

27 Sept. 2011


HEALY-1102
15 Aug – 28 Sept 2011
ECS data 9,188 kms bathy
~875 km seismic
Total trackline – 11,447 km
Area mapped ~ 58,000 km²
Average sea ice state… 9/10
Average speed in ice….. 3.5 knts
Multibeam data
Seismic and MBES
CTD
XBT
LSSL XCTD
0 mi
125 mi
250 mi
375 mi
500 mi

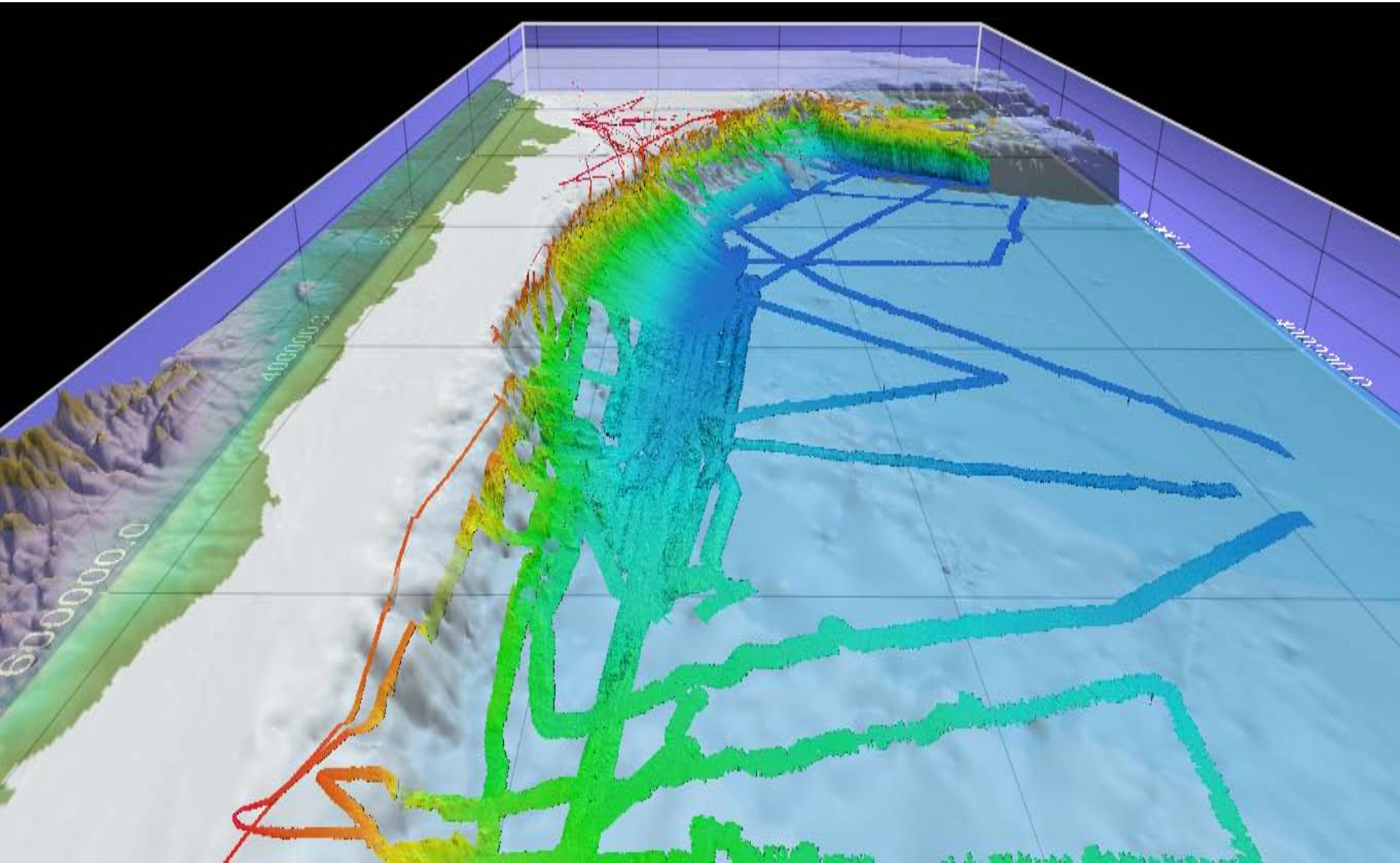

Barrow Margin Survey
16-21 August
CANADIAN EEZ
50 mi
75 mi
100 mi
125 mi

Before HLY-2011



16 – 21 August 2011

~ 7500 sq nm



Rendezvous 23 August

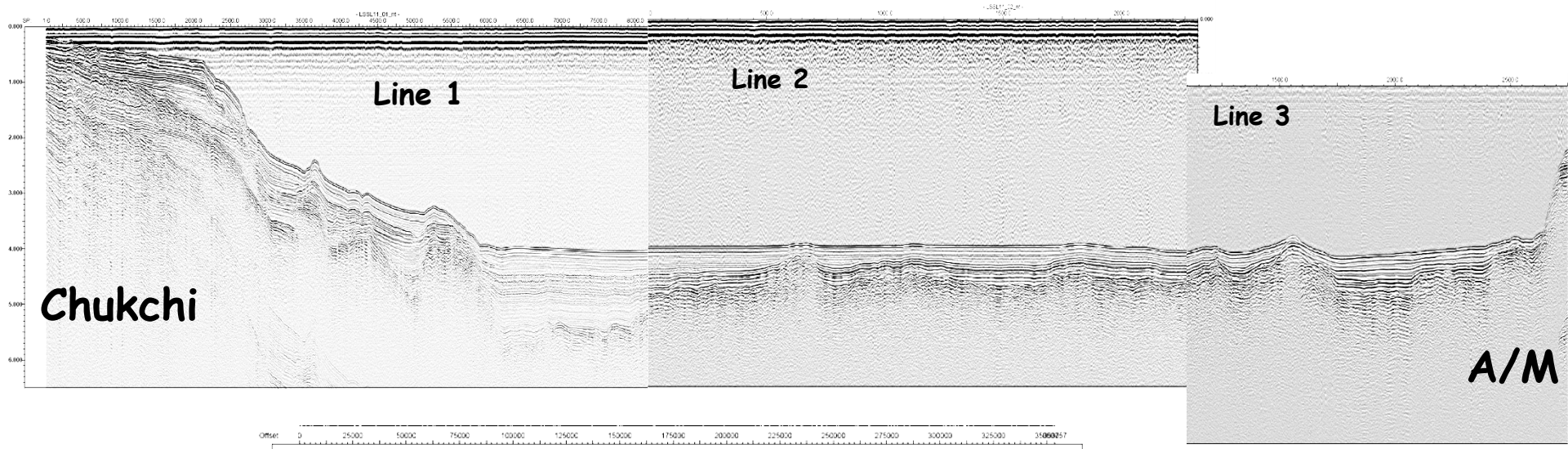
SEISMIC_LINE_7

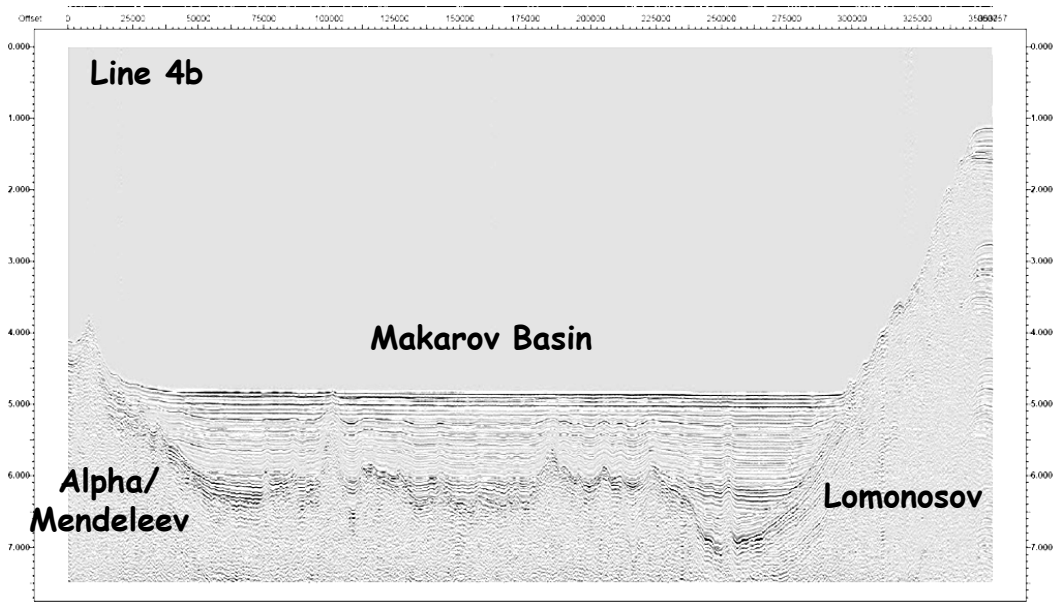
SEISMIC_LINE_8

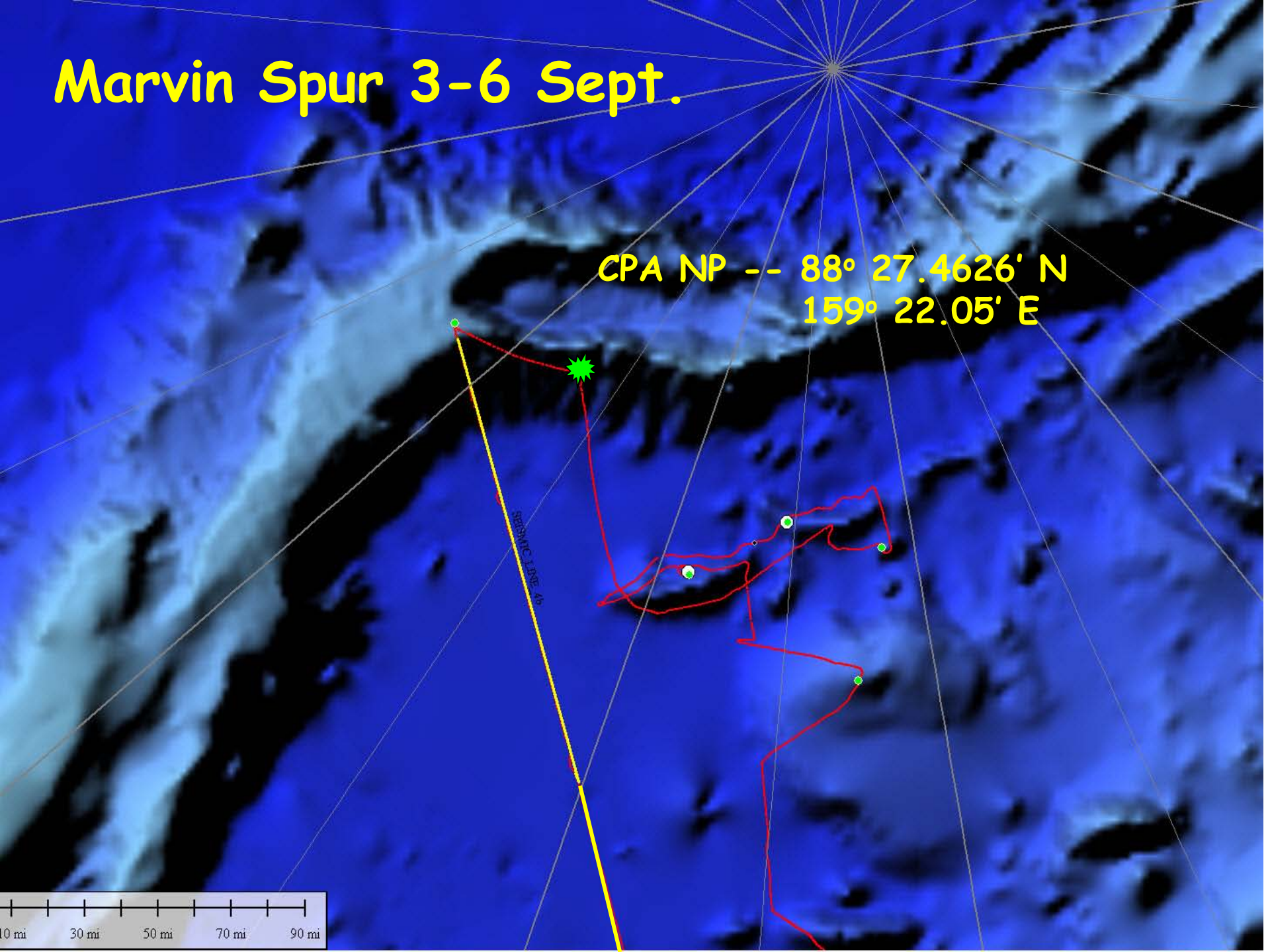
20 SEPT

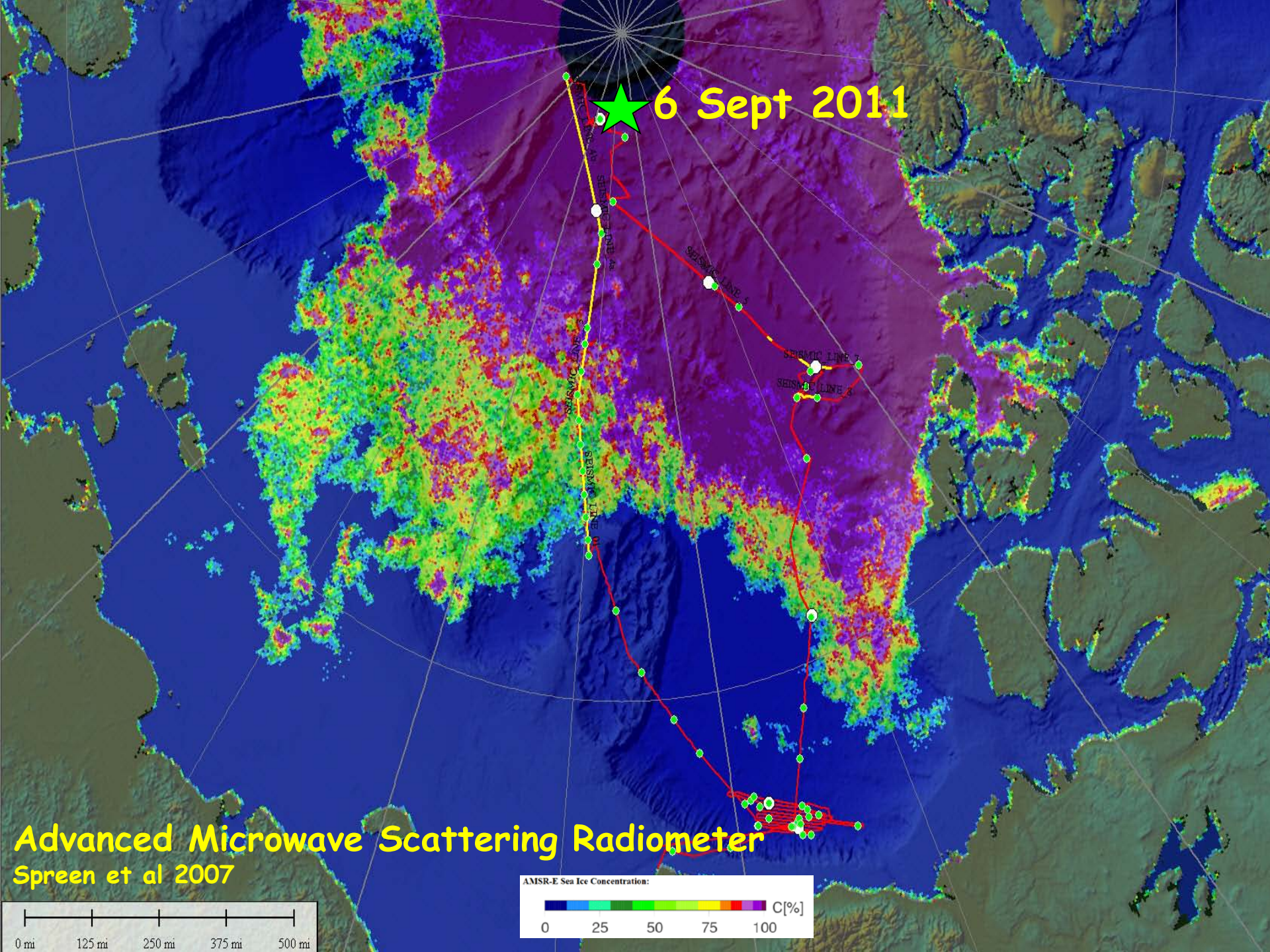
25 mi 75 mi 125 mi 175 mi

LSSL Monitor Records

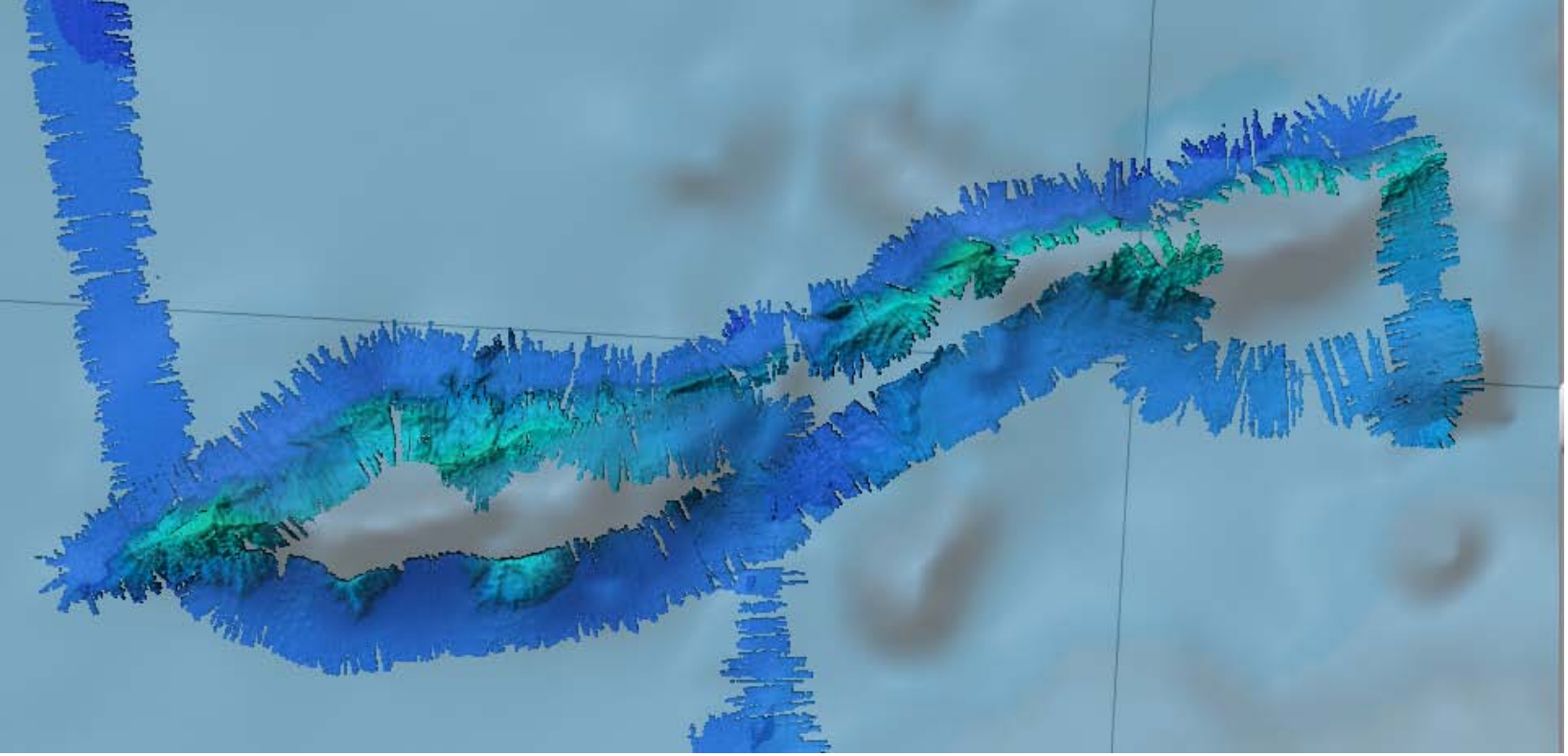


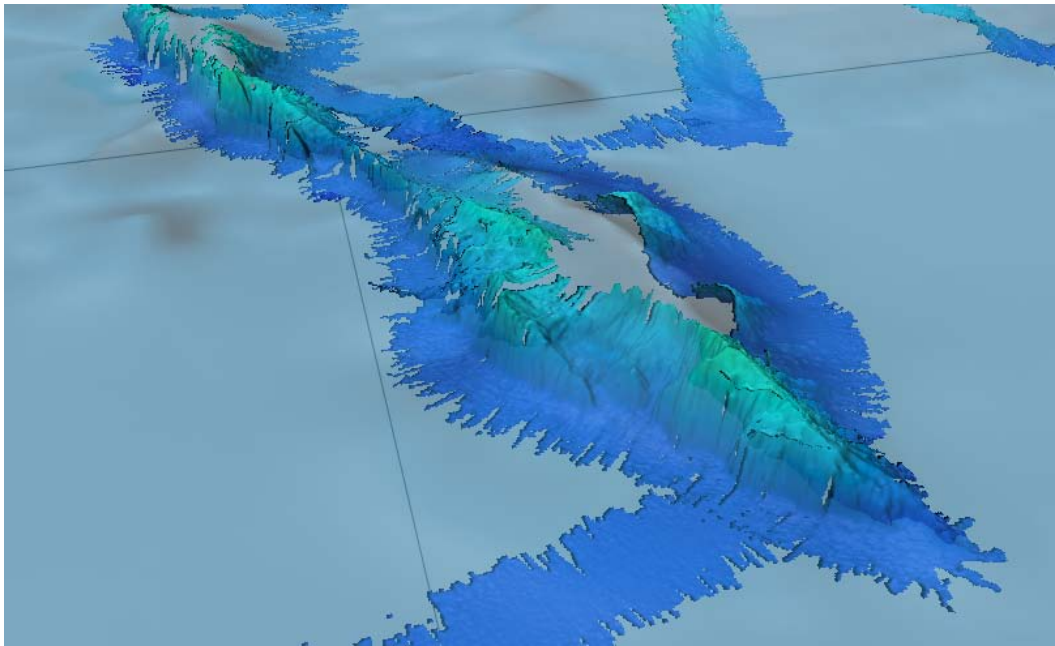



Marvin Spur 3-6 Sept.
CPA NP -- 88° 27.4626' N
159° 22.05' E
SEISMIC LINE 43
10 mi
30 mi
50 mi
70 mi
90 mi


6 Sept 2011
SEISMIC LINE 4a
SEISMIC LINE 5
SEISMIC LINE 7
SEISMIC LINE 8
SEISMIC LINE 9
SEISMIC LINE 10
Advanced Microwave Scattering Radiometer
Spreen et al 2007
AMSR-E Sea Ice Concentration:
C[%]
0
25
50
75
100
0 mi
125 mi
250 mi
375 mi
500 mi

LSSL AUV LAUNCH

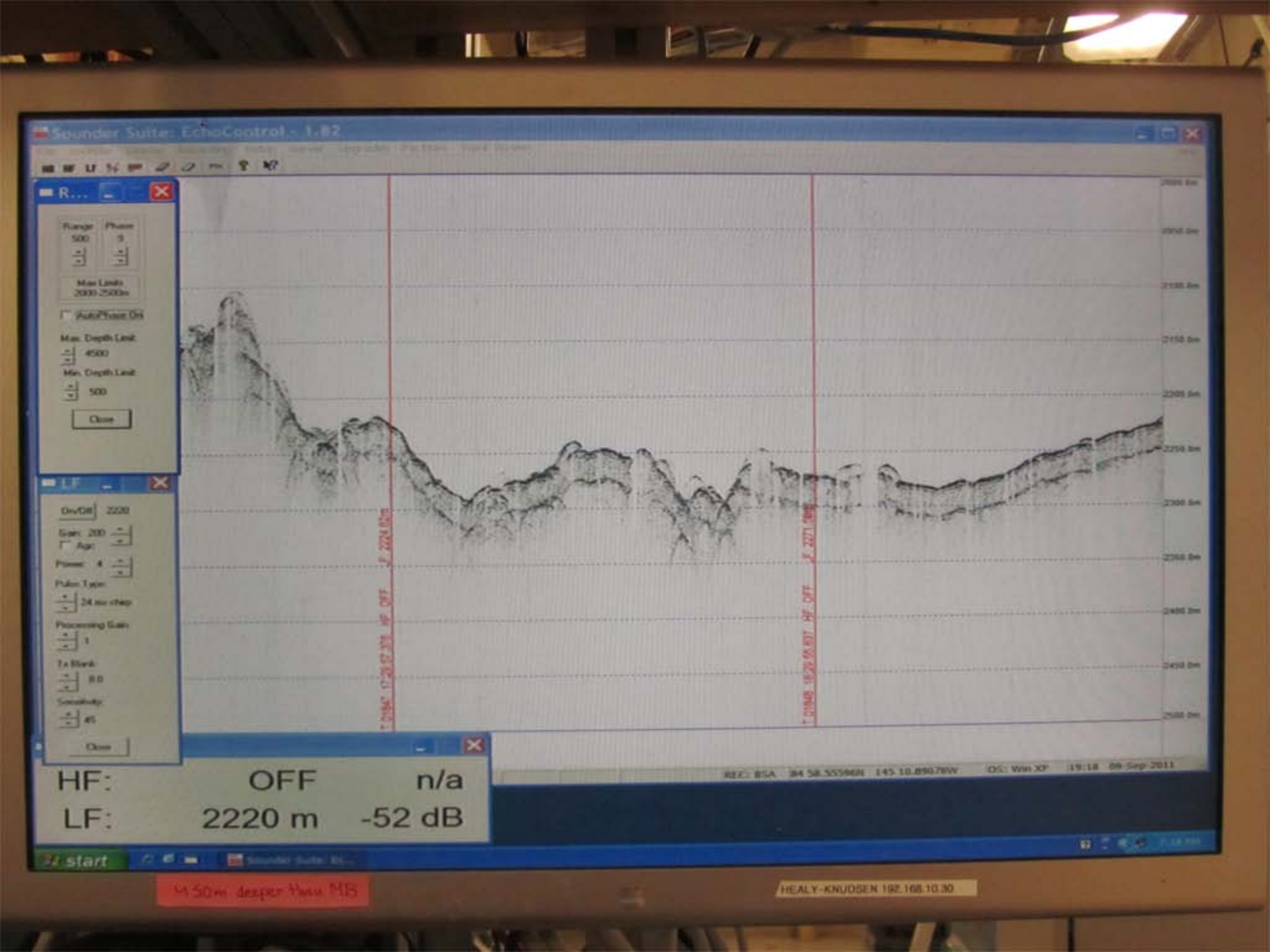




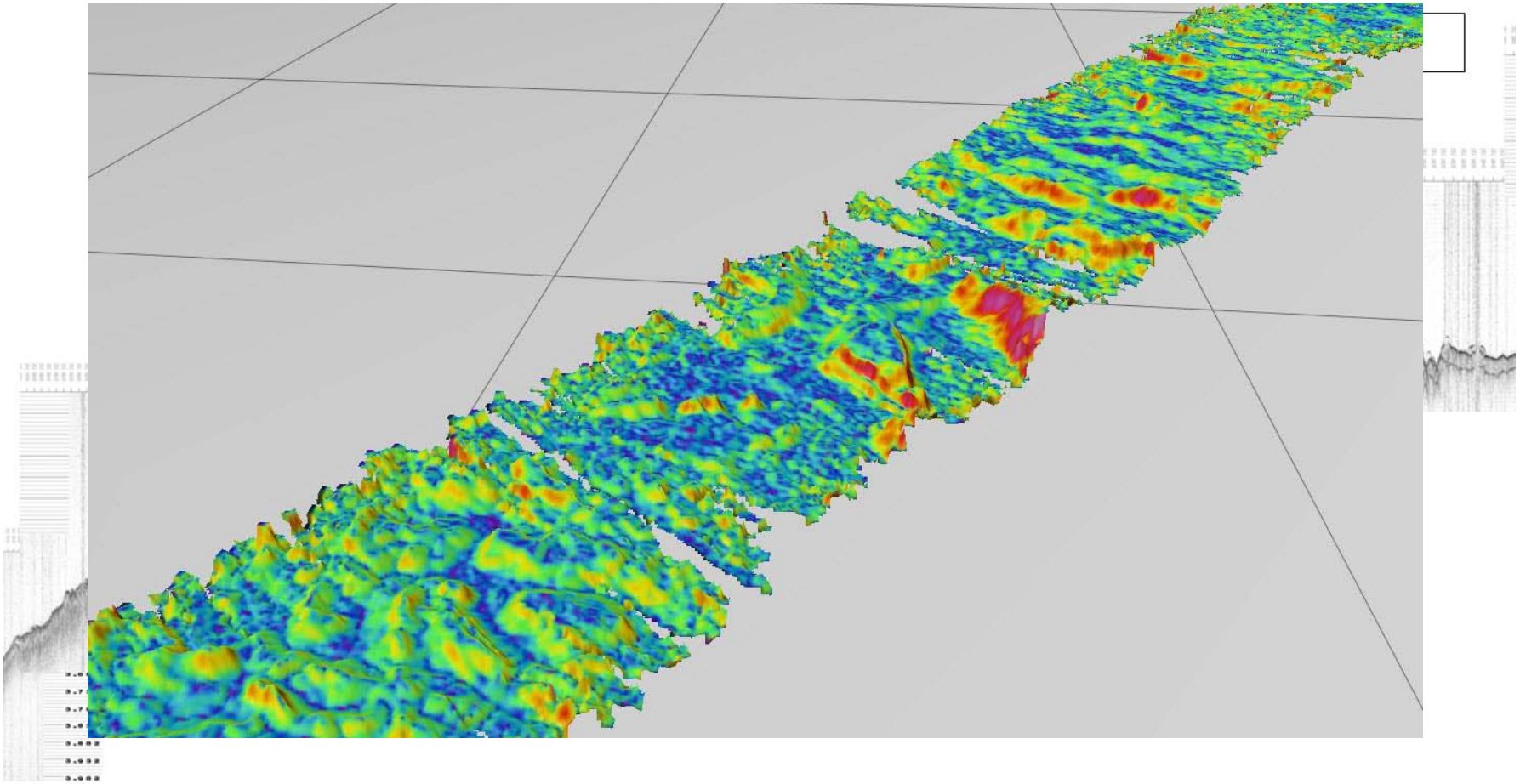
3 Sept 2011

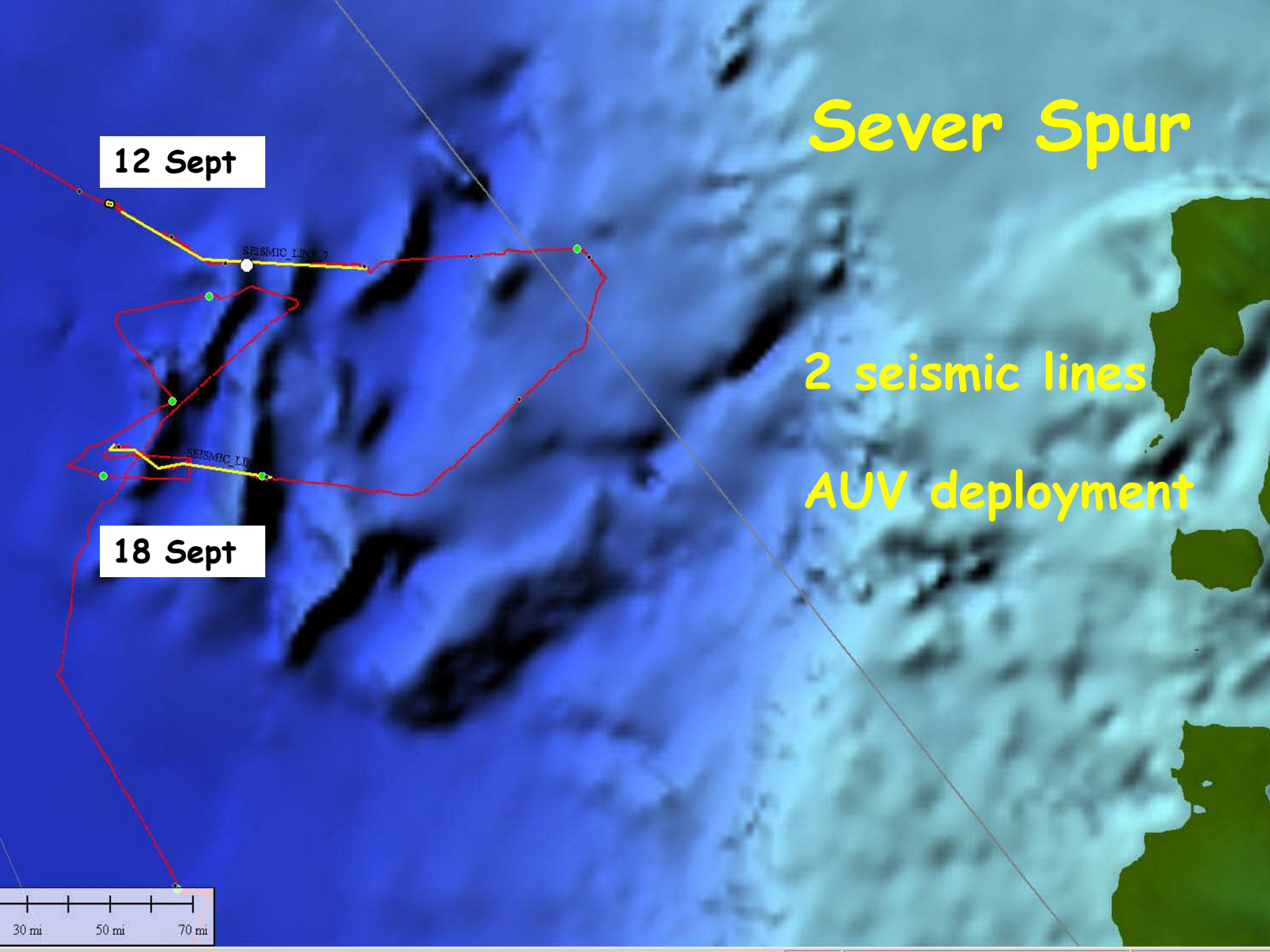

3915


watch1
Healy Map Surfer
SHOW LEGEN
Longitude: -179.99 to 179.86
Latitude: 78.98 to 86.69
Scale: 1931573
Ship Position at 2011/09/10 15:23:40 - Long: 137 9.232 W Lat: 83 53.755 N (Easting: 201176.29 Northing: -624861.80)
"IBCAO" depth: 2425 m Multibeam depths(Archive/Current/Centerbeam): NA / NA / NA m
SOG: 0.4 COG: 51.6 Heading: 84.76 Water Temp: -1.473 Sal: 27.992 Fluor: 0.17 Wireout1: NA Wireout2: NA
Almanac: 09/10 21:05Z local noon, 09/11 07:21Z Sunset, 09/11 09:05Z local midnight, 09/11 10:54Z Sunrise
WATCH2


Sounder Suite: EchoControl - 1.82
HF: OFF n/a
LF: 2220 m -52 dB
start
HEALY-KNUDSEN 192.168.10.30

Hyperbolic Echoes on Alpha/Mendeleev Ridge



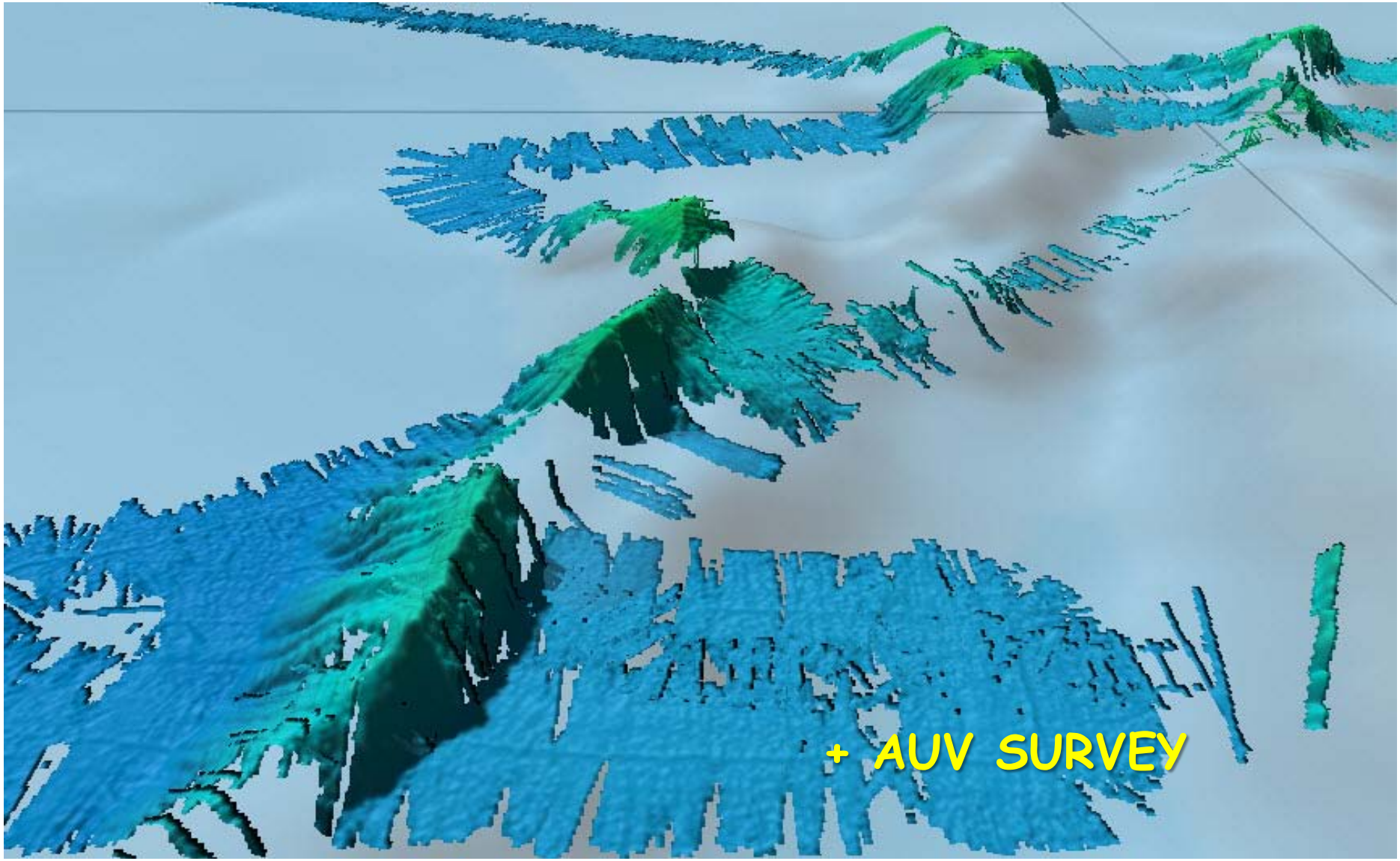


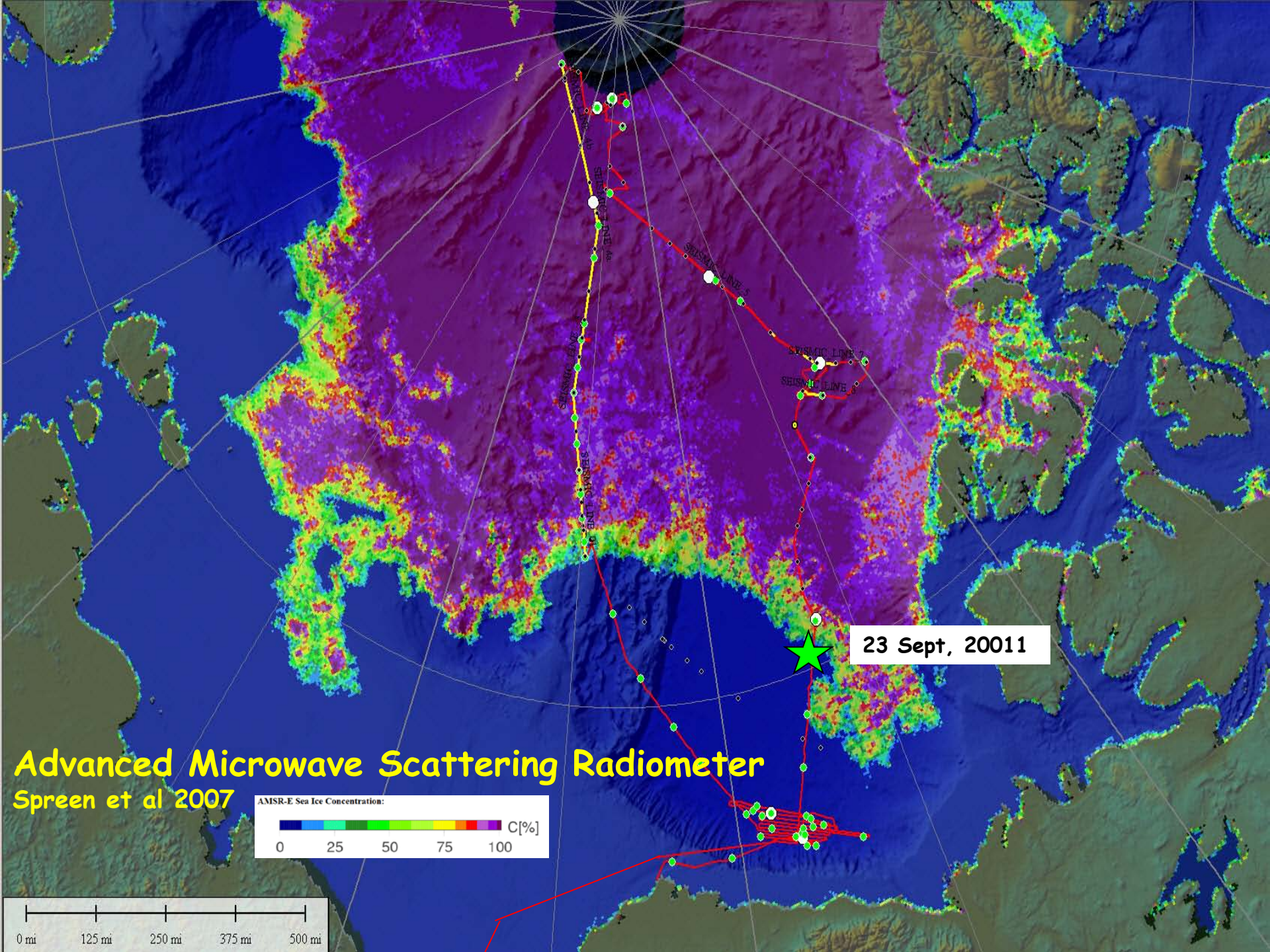
Sever Spur

2 seismic lines

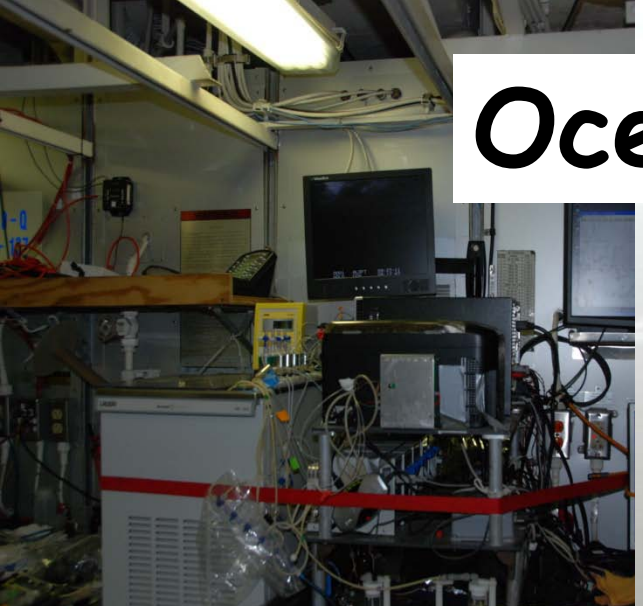
AUV deployment

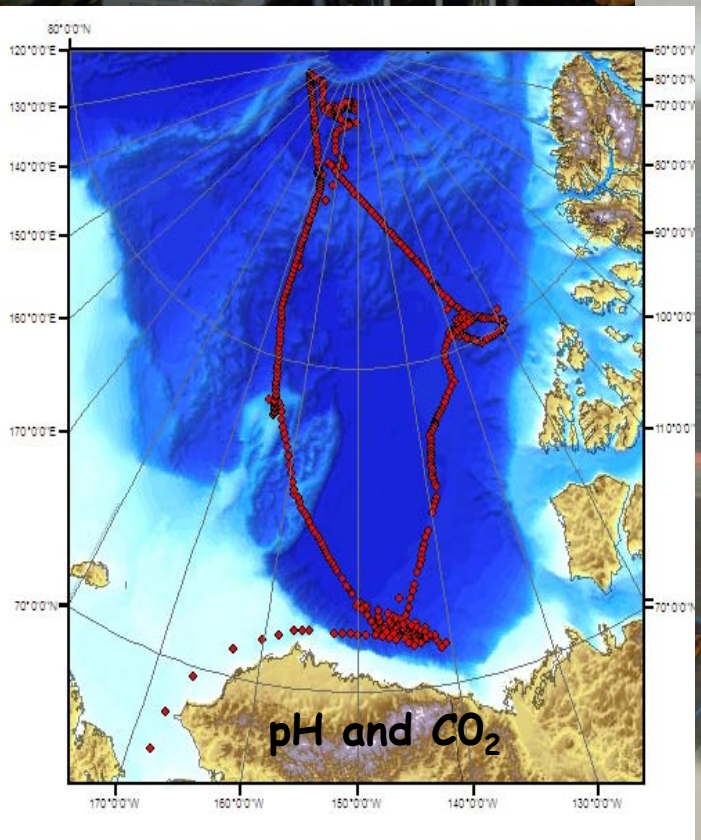
Sever Spur

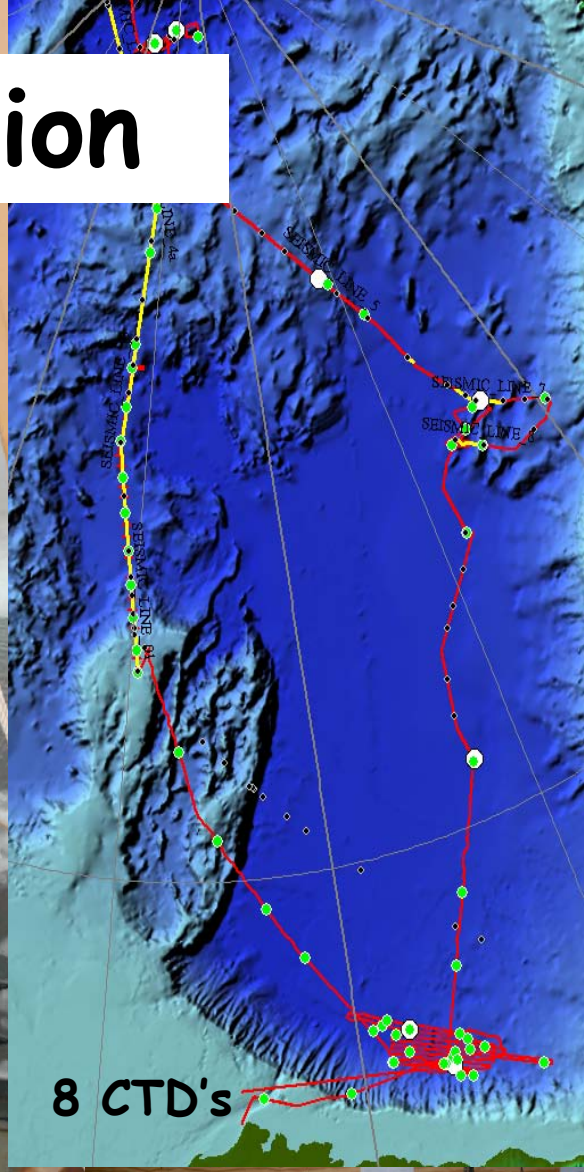



23 Sept, 20011
Advanced Microwave Scattering Radiometer
Spreen et al 2007
AMSR-E Sea Ice Concentration:
C[%]
0
25
50
75
100
0 mi
125 mi
250 mi
375 mi
500 mi

Ocean Acidification



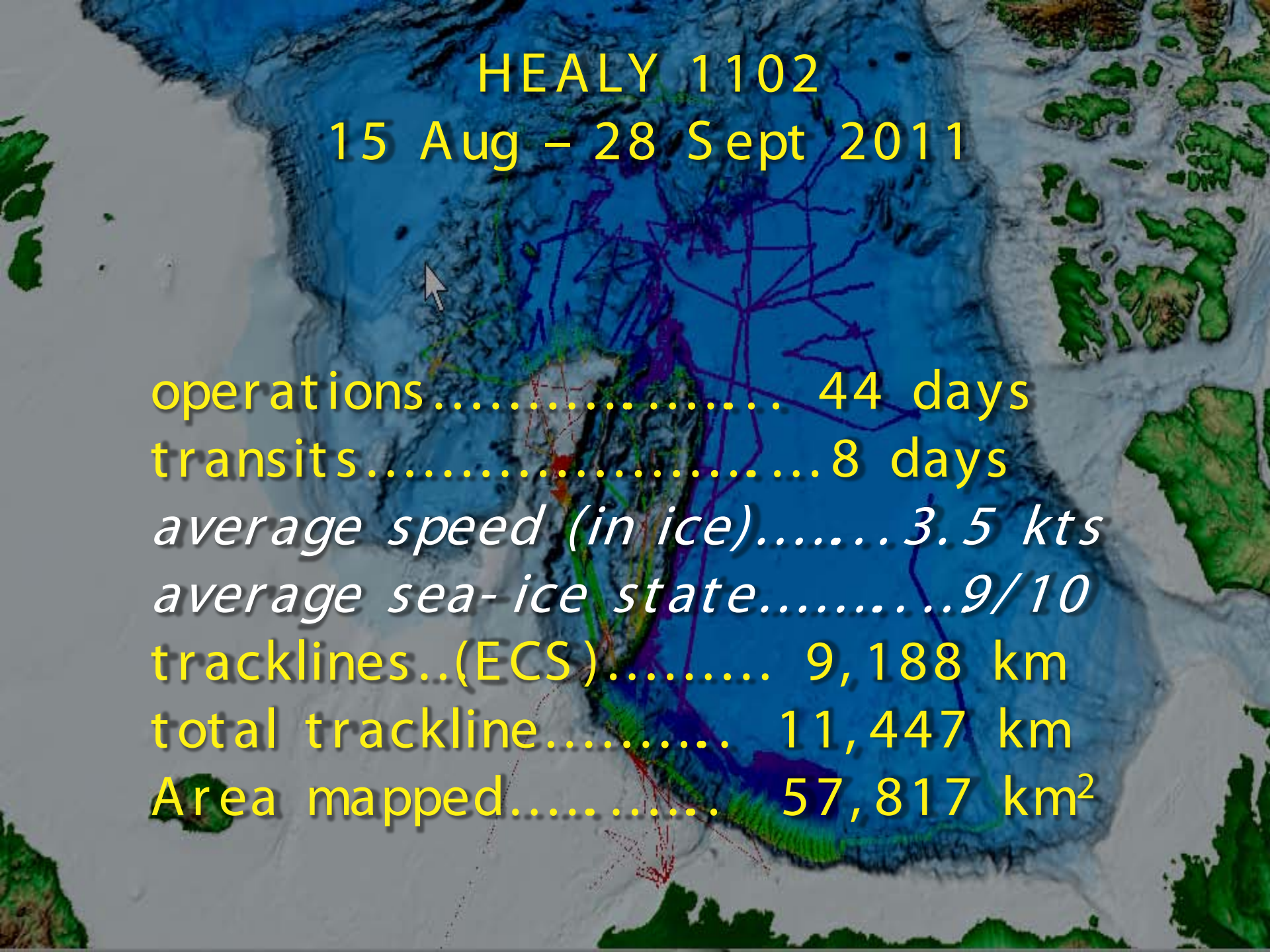


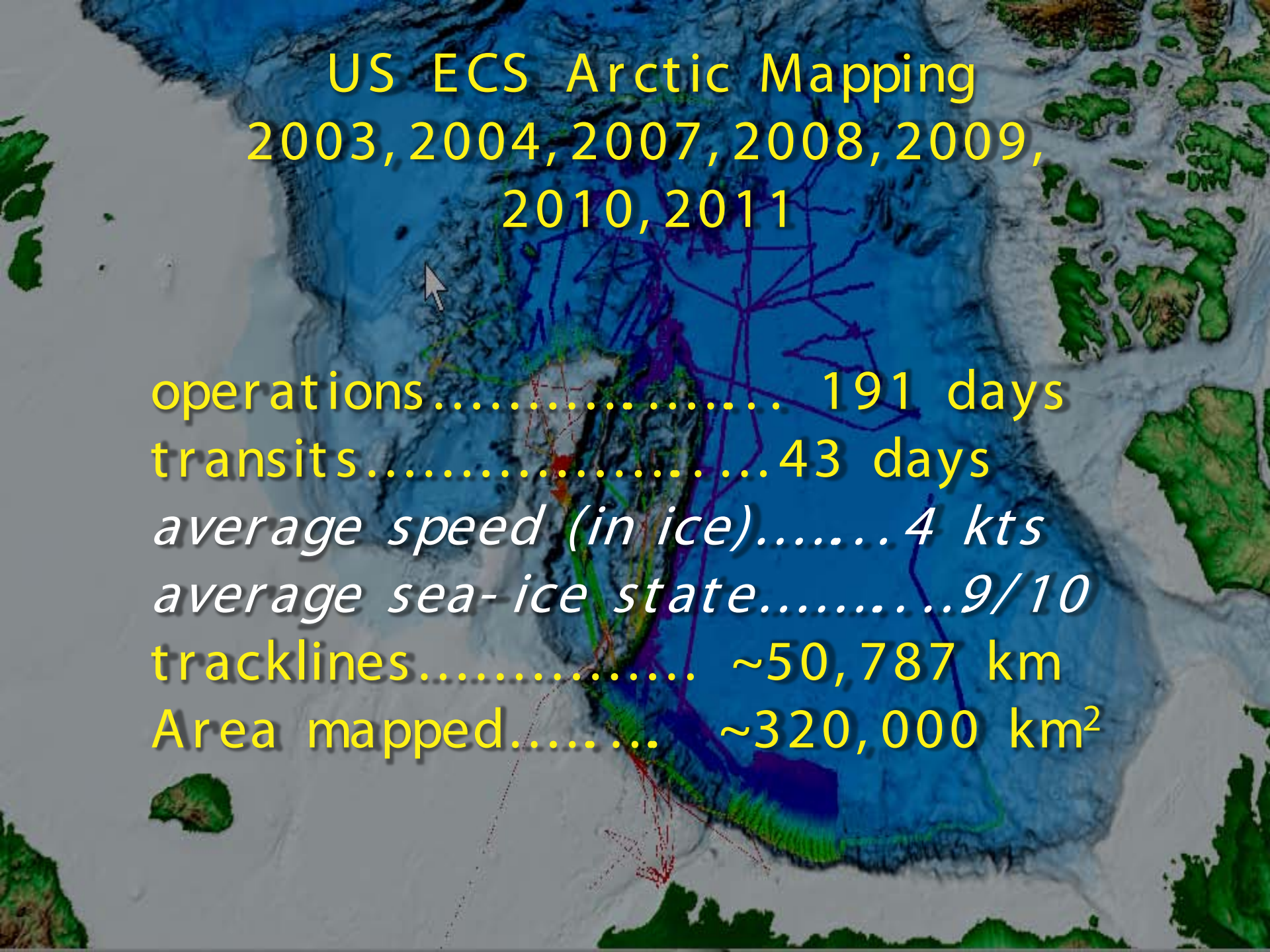


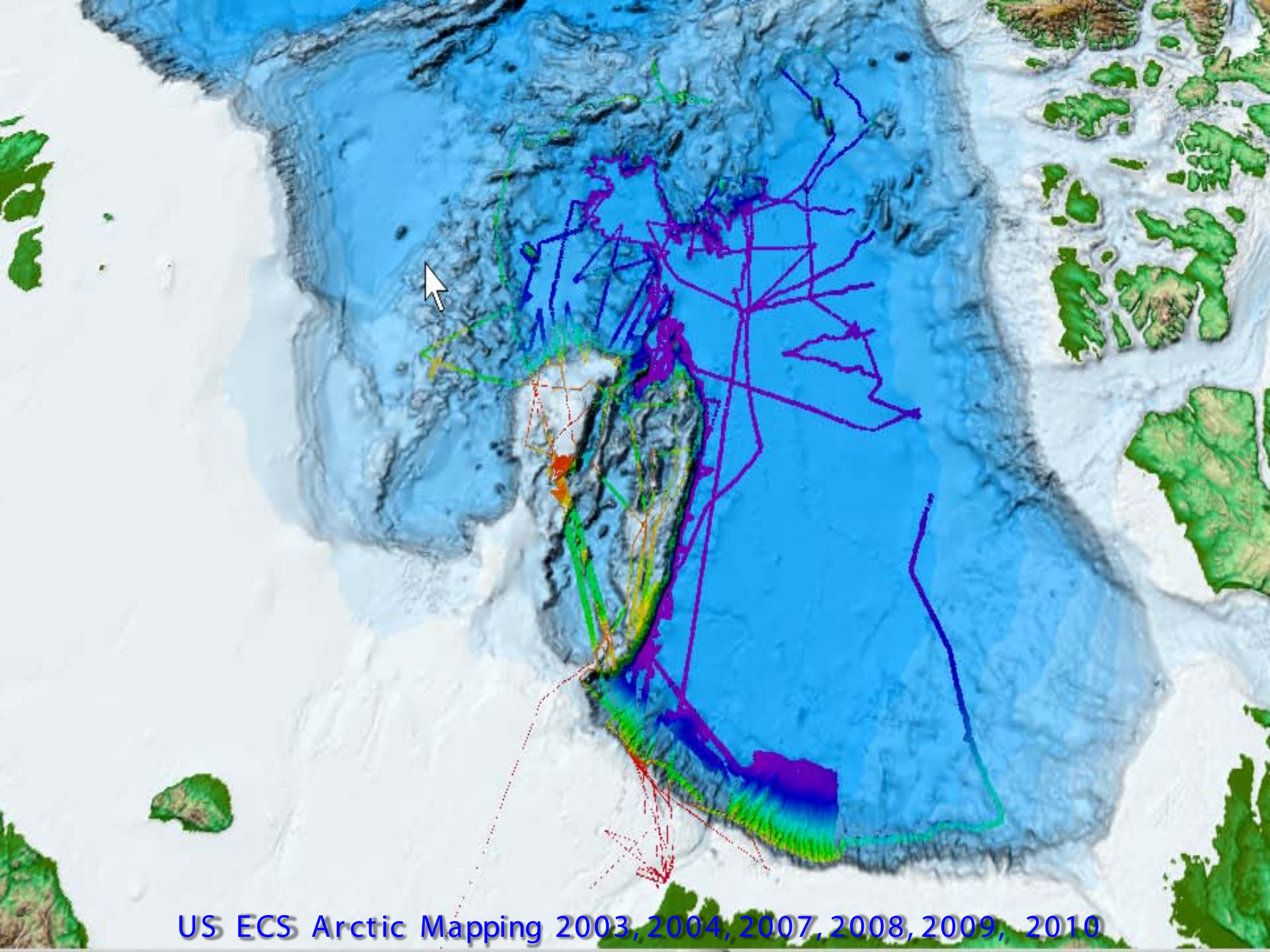
ICE OBSERVATIONS and BUOYS

1- UpTempO buoy.
8- Surface Velocity Program Drifters
2 - AXIB's

UAS OPS on LSSL

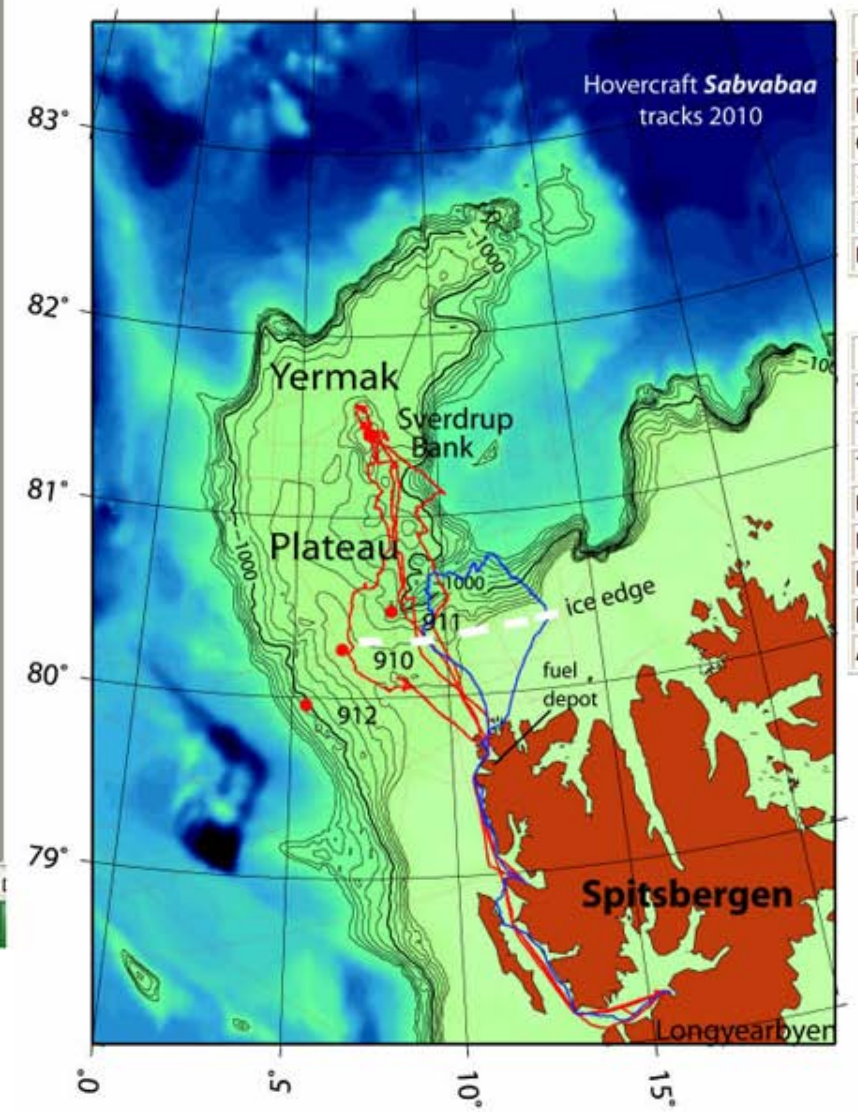

HEALY 1102
15 Aug – 28 Sept 2011
operations..... 44 days
transits.....8 days
average speed (in ice).....3.5 kts
average sea-ice state.....9/10
tracklines..(ECS)..... 9,188 km
total trackline..... 11,447 km
Area mapped..... 57,817 km²


US ECS Arctic Mapping
2003, 2004, 2007, 2008, 2009,
2010, 2011
operations..... 191 days
transits.....43 days
average speed (in ice).....4 kts
average sea-ice state.....9/10
tracklines..... ~50,787 km
Area mapped..... ~320,000 km²


US ECS Arctic Mapping 2003, 2004, 2007, 2008, 2009, 2010


Canada
Coast Garde
Guard côtière
LOUIS S. ST-LAURENT

R/H SABVABAA – In the Eastern Arctic



Scientific activities	2008	2009	2010
Ice thickness measurements	200 km	30 km	0 km
Ice cores	3	2	0
CTD stations	10	57	0
Seismic reflection (in drift mode)	10 km	35 km	35 km
Sediment cores	2	0	0
Rock dredges (successful)	0	5 (3)	11 (7)

Hovercraft operations	2008	2009	2010
Total number of trips Longyearbyen to north of 80 N	5	5	3
Total milage	3.300 nm	3.100 nm	2.075 nm
Total distance over sea ice	80 nm	80 nm	540 nm
Distance north from the ice edge	7 nm	15 nm	90 nm
Longest trip without refuelling	504 nm	724 nm	675 nm
Fuel consumption at ecomony speed	60 l/hr.	60 l/hr.	60 l/hr.
Economy speed with full payload	16-28 knop	16-28 knop	16-28 knop
Average payload at departure Longyearbyen	3.2 ton	3.2 ton	3.2 ton

2011 - 30 dredges, CSP, seismic buoys, E/S buoys tested.

By now, we have logged 1.700 n.m. driving north of the ice edge. This is equivalent to 3x the great circle distance from the ice edge north of Svalbard to the North Pole. Ice conditions. this year were the best we have had and we were able to average over 7 knots over several 10's of nautical miles. With the rocks we recovered from the sea bed earlier and now from as far as 82 N, we are able to deliver what we promised and have had support from the Norwegian Petroleum Directorate for 3 seasons now.

We are slowly getting acceptance for the notion that hovercraft is a useful alternative platform for science in the Arctic Ocean as the Germans have come and asked us to join their icebreaker expedition into the central Arctic Ocean in 2014. The craft continues to impress me with respect to traversing difficult ice. Damage to skirt segments is minimal, but safety links are regularly consumed. Have junked only 4-5 segments so far.


DL1519AR


Griffon

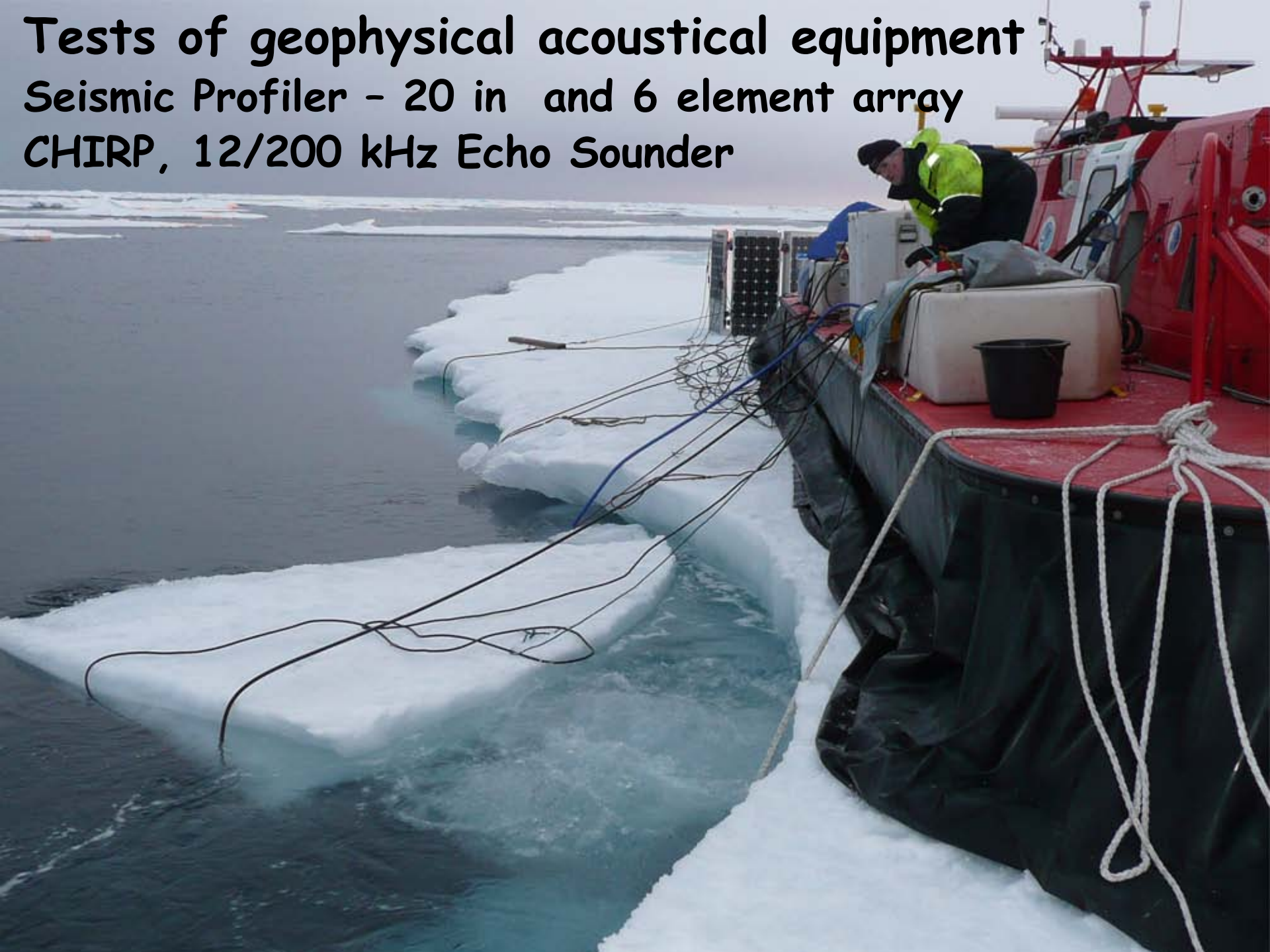

FURUNO

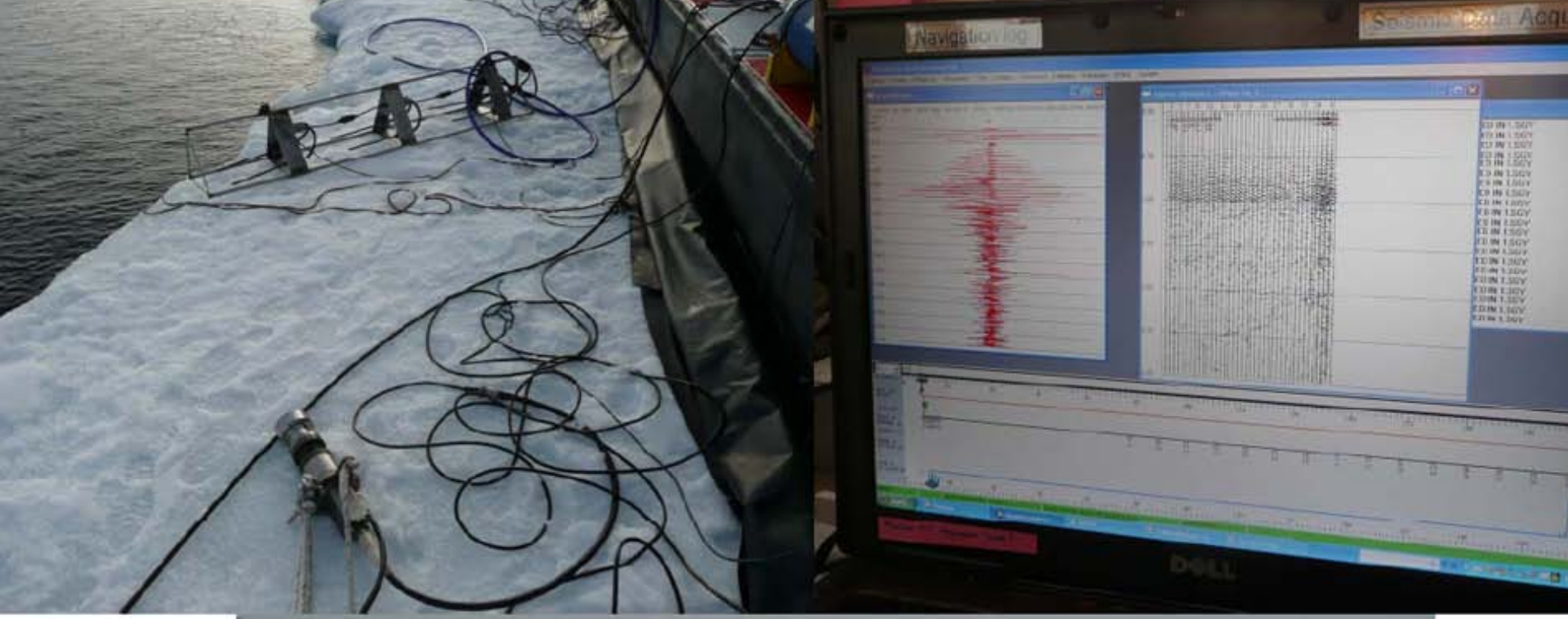

Griffon
DL1519AB

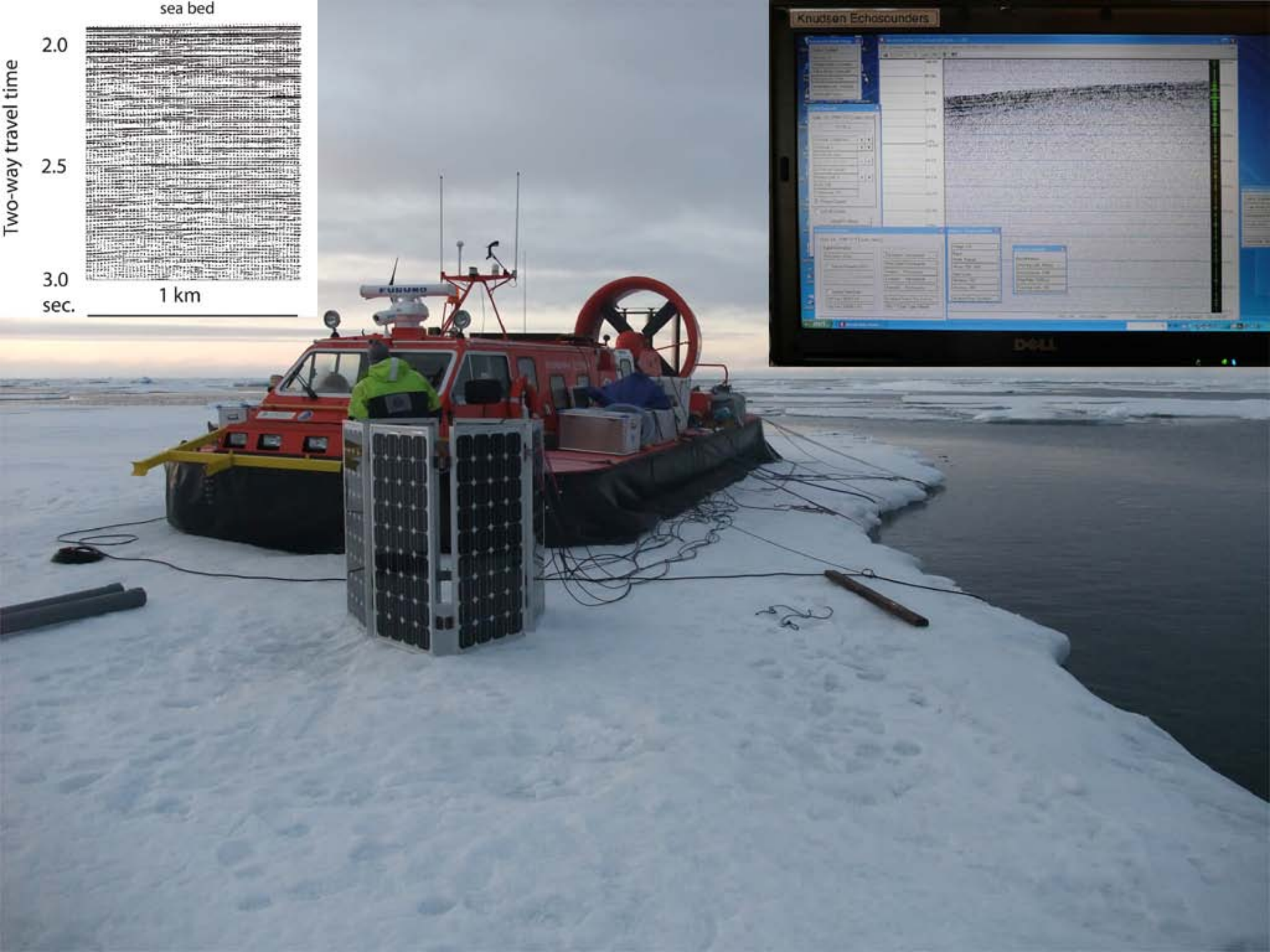
Tests of geophysical acoustical equipment

Seismic Profiler – 20 in and 6 element array

CHIRP, 12/200 kHz Echo Sounder




Navigation log
DELL

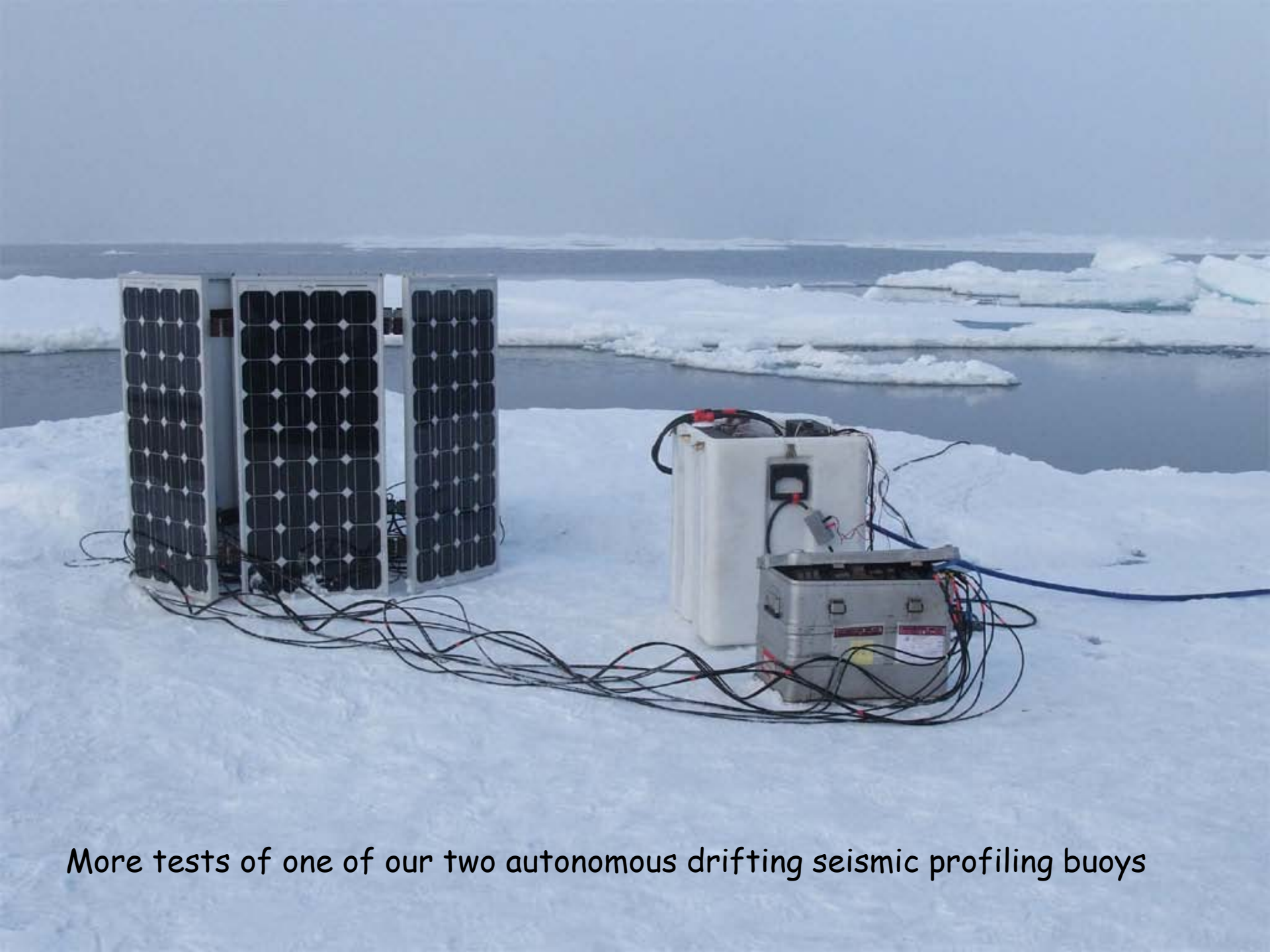

sea bed
2.0
2.5
3.0
sec.
Two-way travel time
1 km
Knudsen Echosounders
FURUNO
DELL

Some scenes from Summer 2009-2010-and-2011 activities

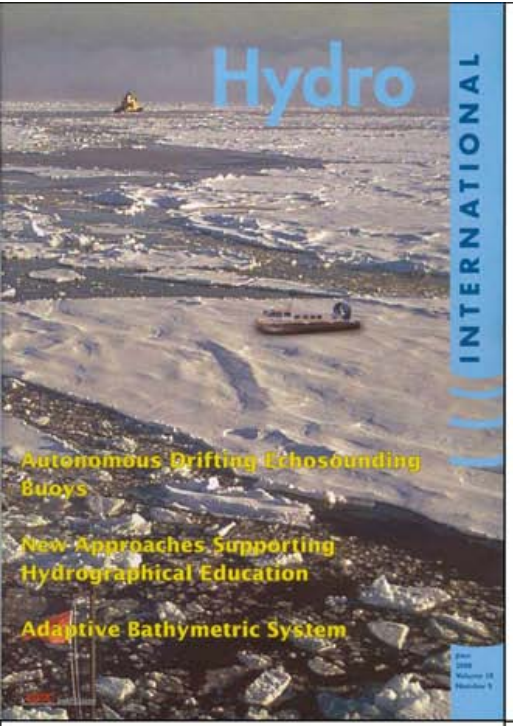
A CTD lowering through a seal's breathing hole


R/H SABVA

The Aagaard ADCP Current Profiler being set up for measurements while the crew sleeps



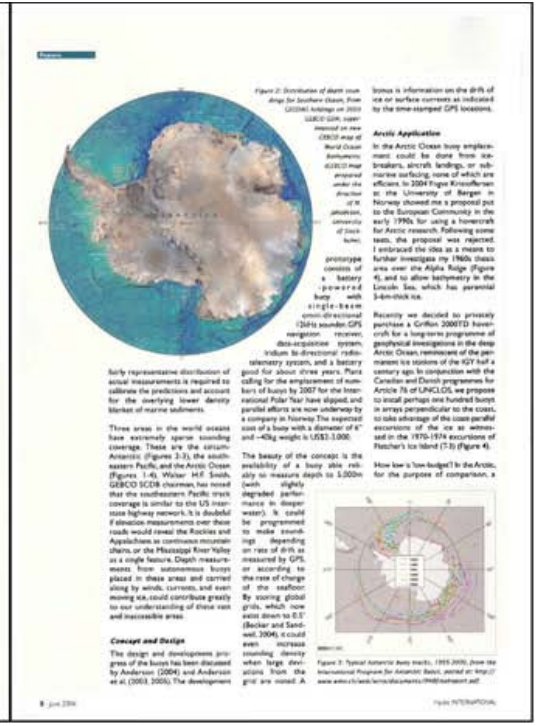
More tests of one of our two autonomous drifting seismic profiling buoys

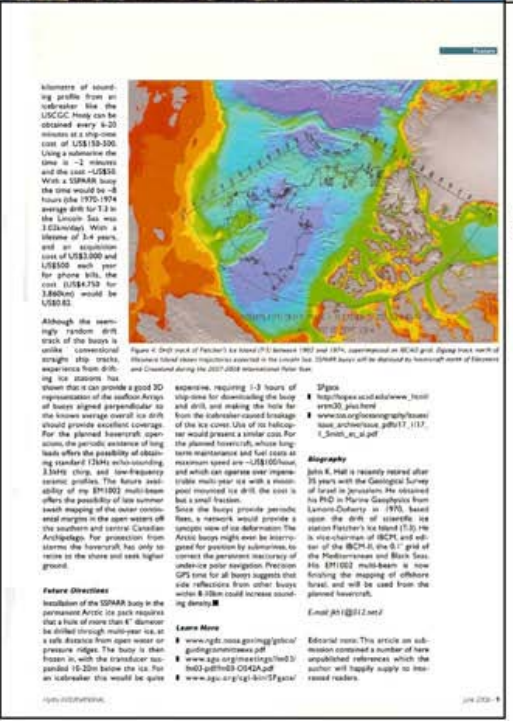


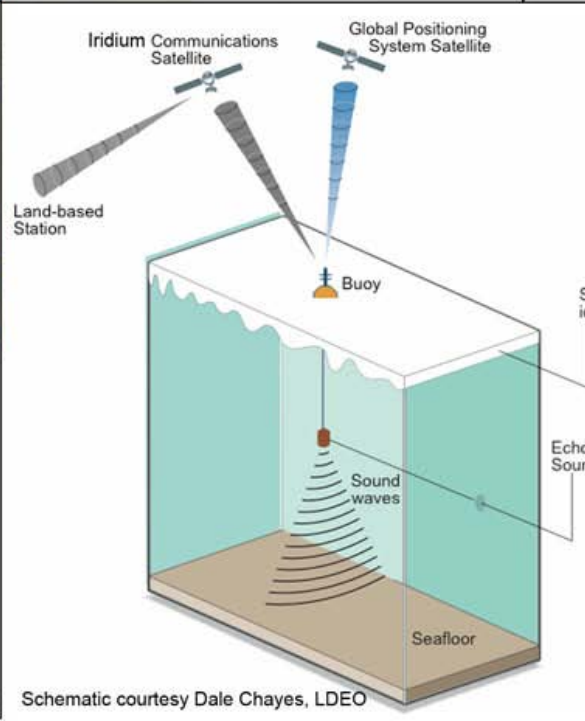
Drifting echo-sounding buoys will soon provide bathymetric control in inaccessible areas of the oceans. The SSPARR (Seafloor Soundings in Polar and Remote Regions) buoy project holds great promise for providing very low-budget bathymetry. Initial buoy implementation may be by hovercraft in the Arctic Ocean.

By Dr John K. Hall, marine geophysicist, Geological Survey of Israel (retired), Jerusalem, Israel

Autonomous Drifting Echo-sounding Buoys







Schematic courtesy Dale Chayes, LDEO

Seafloor Sounding in Polar and Remote Regions (SSPARR) Concept

Fulfills need for seafloor depth measurements in areas not visited by ships, such as:

- Arctic Ocean
- Southern Ocean
- Southern Pacific and Indian Oceans

NSF funded prototype

SSPARR buoy is an expendable device, deployable in open ocean or ice with target 5 year lifespan

Modular components can be integrated with other buoys

Expandable to use as an aid to navigation for under-ice vehicles

Details:

OD 4 inches
E/S 12 kHz
Capability 5000 m
Weight 40 kg
Lifetime: 4 years
Cost: $3,000 (?)

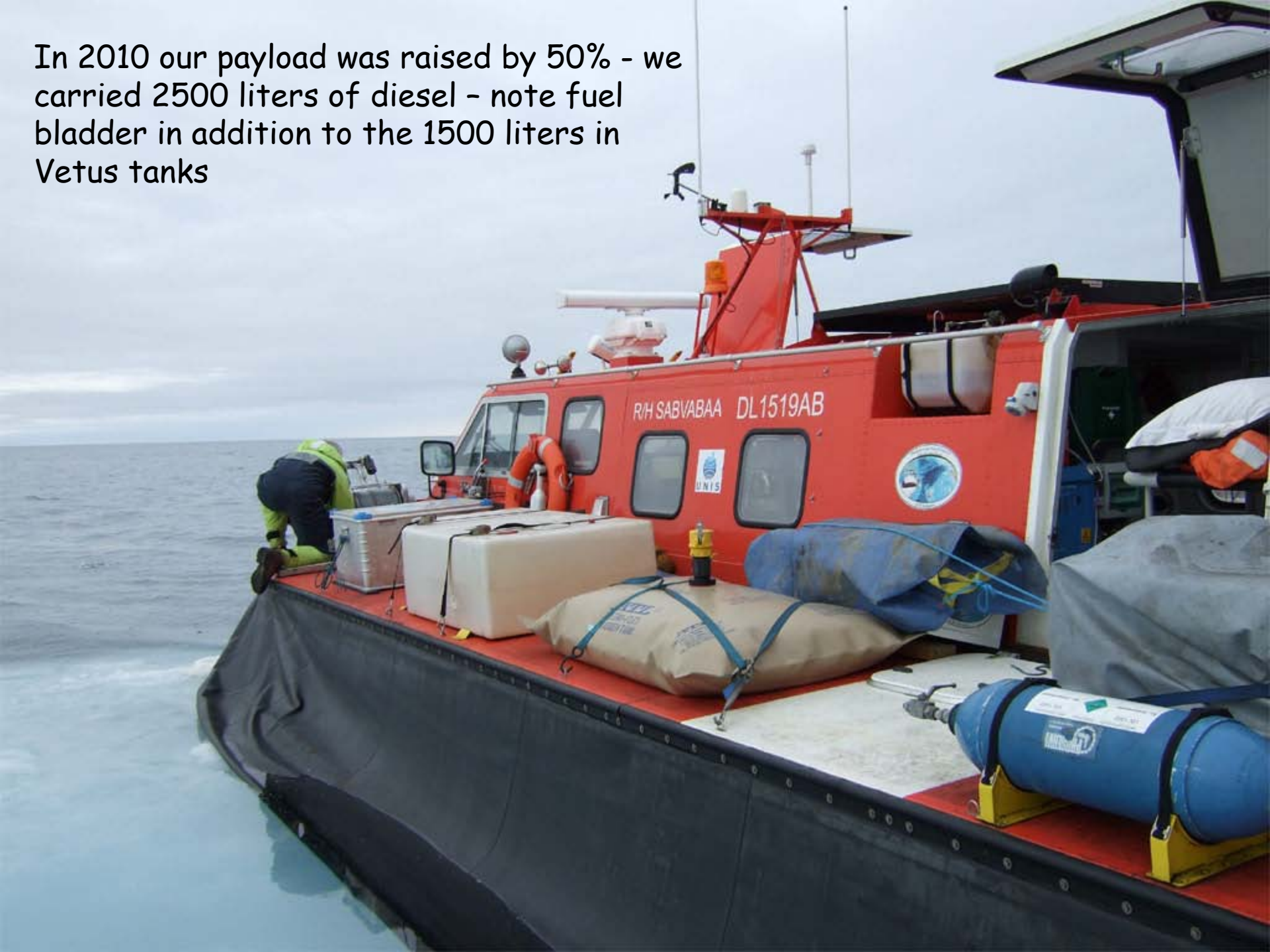
Christian Michelsen Research AS, Bergen

SyQwest, Inc.
EchoBox™ Hydrographic Echo Sounder

NAL Research Corporation

Iridium Satellite Tracker
Model A3LA-TSS

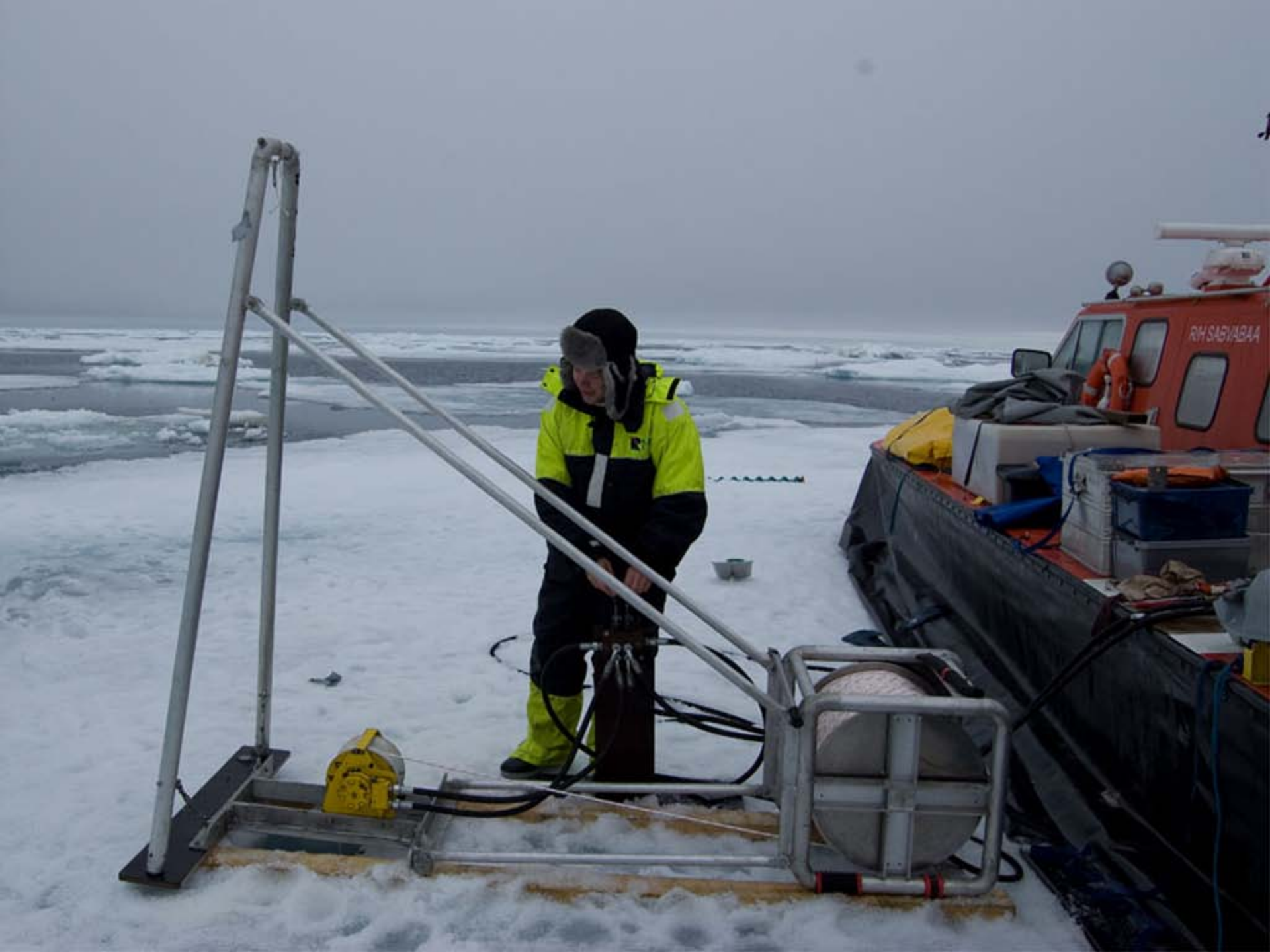
Summer 2009 tests will use a SyQwest EchoBox configured to use a 3.5 kHz transducer to obtain 4000 m bathymetry, Maybe a drifting subbottom profiler?

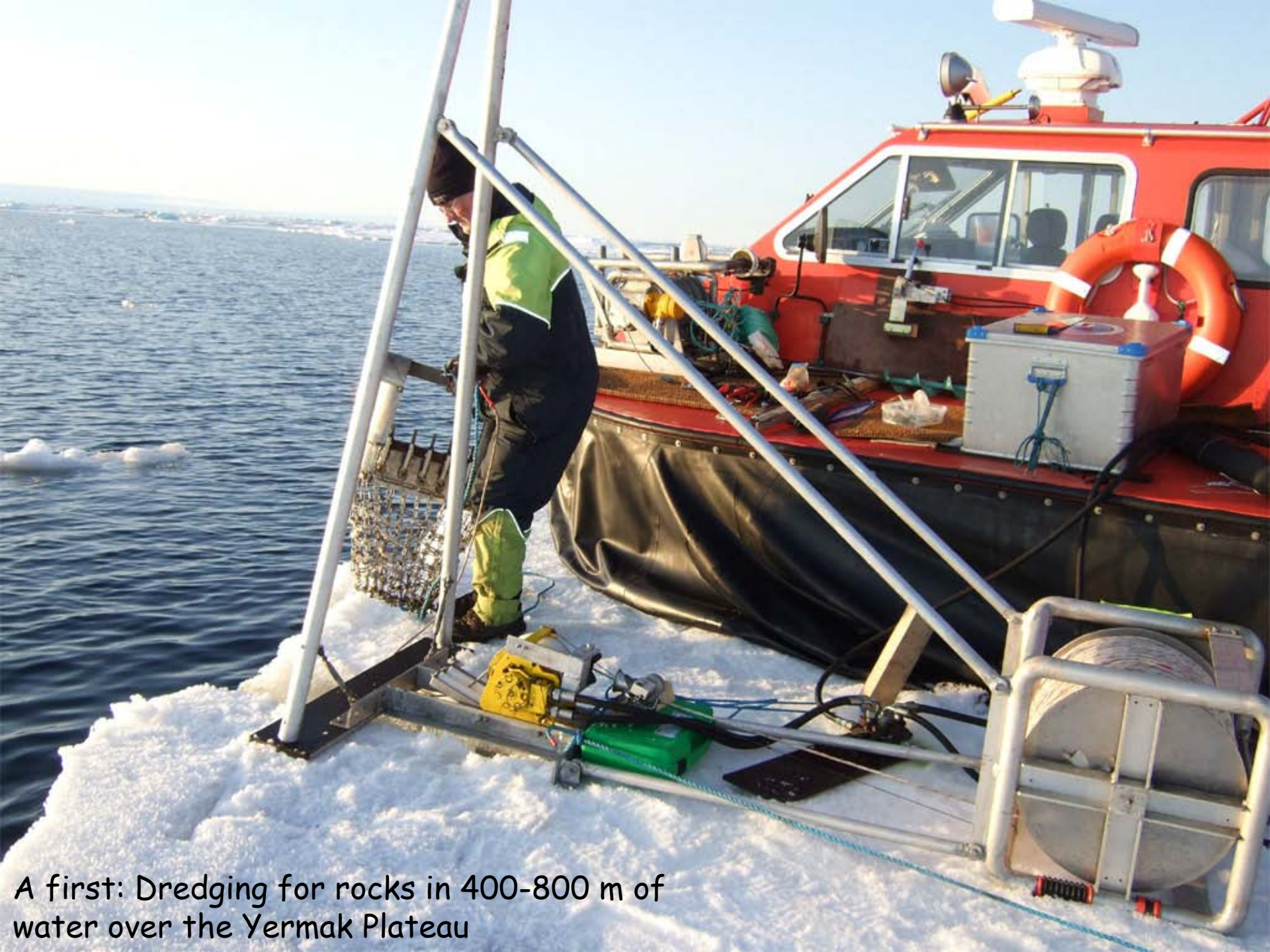


In 2010 our payload was raised by 50% - we carried 2500 liters of diesel – note fuel bladder in addition to the 1500 liters in Vetus tanks


FURUNO


SABVAABA DL1519AB
UNIS

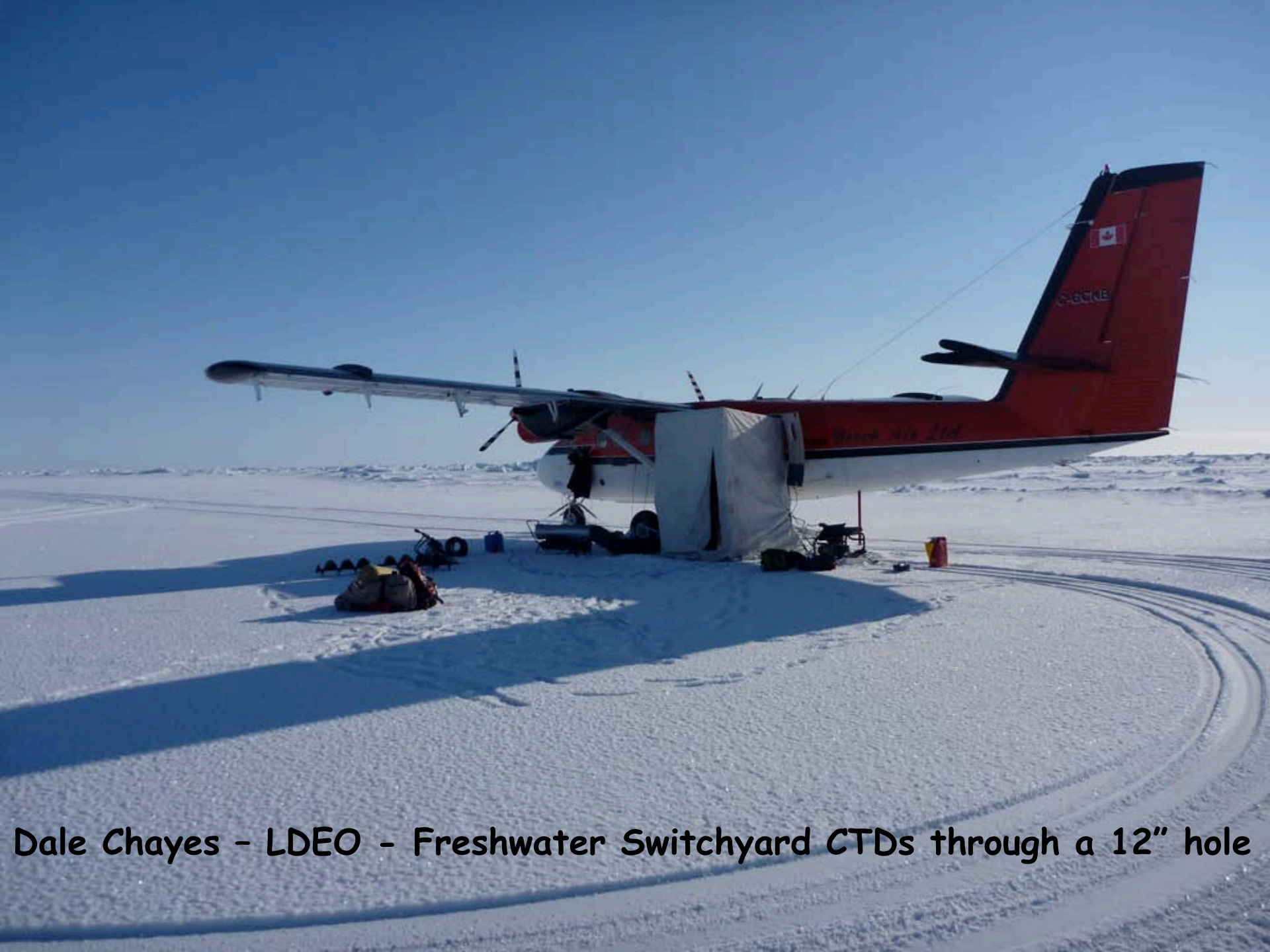

RIH SAB/ABAA



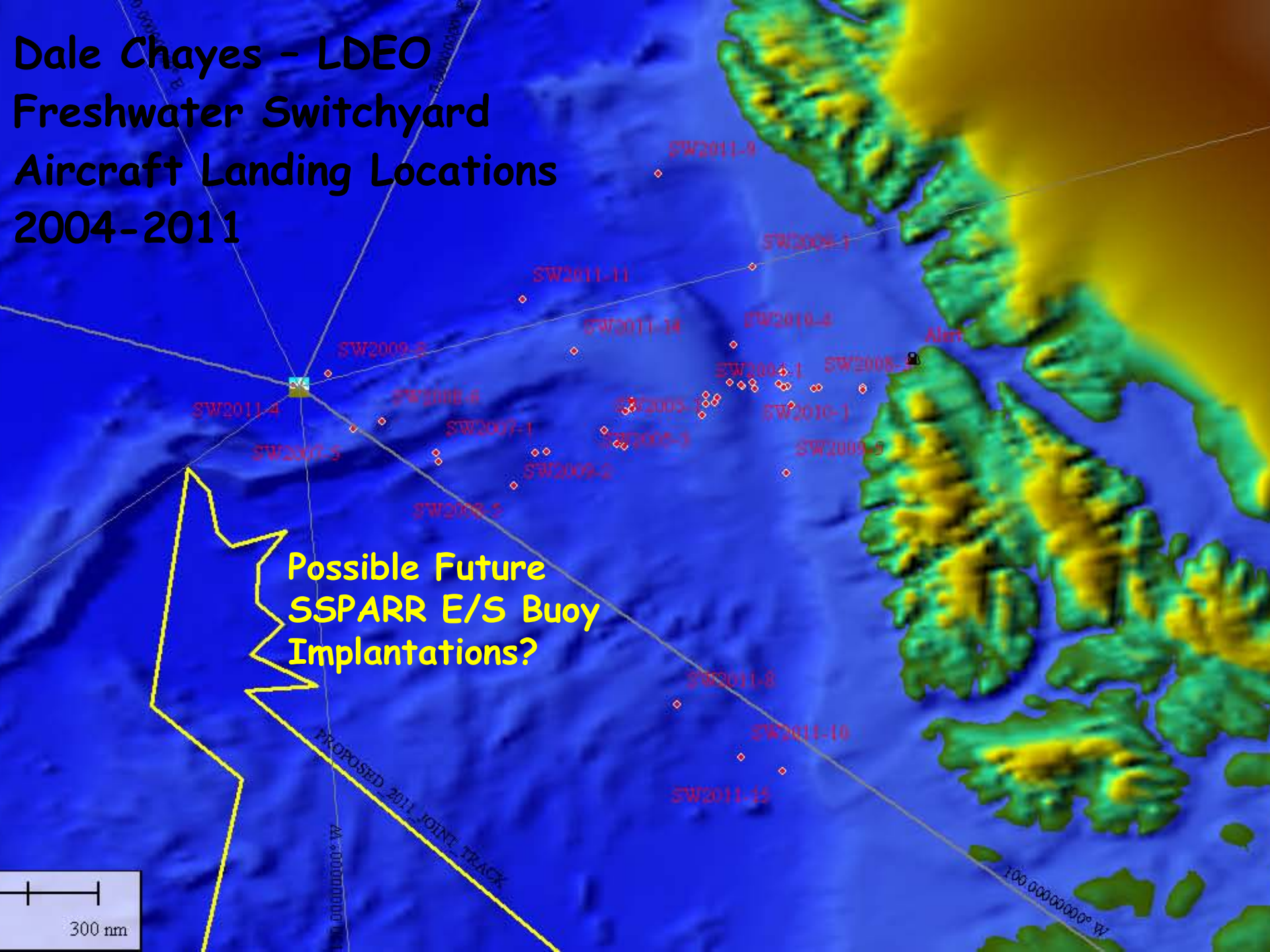
A first: Dredging for rocks in 400-800 m of water over the Yermak Plateau


Griffon
Hovercraft

The Hydraulic Winch with Capstan Drive – three turns of kevlar aramid fiber rope



Dale Chayes – LDEO - Freshwater Switchyard CTDs through a 12” hole


Dale Chayes – LDEO
Freshwater Switchyard
Aircraft Landing Locations
2004-2011
Possible Future
SSPARR E/S Buoy
Implantations?
SW2011-9
SW2011-11
SW2011-14
SW2009-5
SW2011-4
SW2007-1
SW2007-3
SW2009-2
SW2011-8
SW2011-10
SW2011-12
Alert
SW2004-1
SW2005-1
SW2010-1
SW2009-3
PROPOSED_2011_JOINT_TRACK
300 nm

Thank you for your attention

Photo courtesy Dave Monahan, UNH-CCOM-GEBCO/Nippon